

**BIG FOSSIL CREEK**  
**RELIEF SEWER PLANNING REPORT**

**TWDB CONTRACT NO. 99-483-308**  
**BIG FOSSIL CREEK**  
**REGIONAL WASTEWATER PLANNING GRANT**

*Prepared for the*

**CITY OF NORTH RICHLAND HILLS**  
**PUBLIC WORKS DEPARTMENT**  
**7301 N.E. LOOP 820**  
**NORTH RICHLAND HILLS, TEXAS**  
**76180 (817) 581-5521**

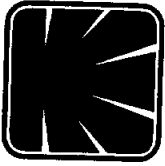
*and*

**The City of Fort Worth**  
**The City of Richland Hills**  
**The City of Haltom City**

*Prepared by*

**Knowlton-English-Flowers, Inc.**  
**Consulting Engineers**  
**1901 Central Drive, Suite 550**  
**Bedford, Texas 76021**  
**(817) 283-6211**

**December, 1999**  
**Revised March, 2000**



**KNOWLTON-ENGLISH-FLOWERS, INC.**  
CONSULTING ENGINEERS / Fort Worth-Dallas

December 31, 1999

Mr. Gregory W. Dickens, P.E.  
Public Works Director  
City of North Richland Hills  
7301 N.E. Loop 820  
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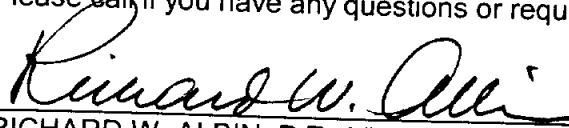
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Re: **3-436, CITY OF NORTH RICHLAND HILLS,  
TWDB CONTRACT NO. 99-483-308, BIG FOSSIL CREEK  
REGIONAL WASTEWATER PLANNING GRANT,  
TRANSMITTAL OF PRELIMINARY REPORT**

In accordance with the provisions of our Authorization for Professional Engineering Services agreement dated July 15, 1997, we are furnishing you with copies of the Preliminary Report for the "North Richland Hills Big Fossil Relief Sewer Planning" study, for your review and transmittal to the primary funding agency, the Texas Water Development Board. Copies of the report are also provided for the other city participants which include the City of Fort Worth, Haltom City, and Richland Hills.

We would like to thank the Texas Water Development Board for providing the grant funds for half of this project, along with the other funding participants which include administrative and public works staffs of the participating cities who furnished us with the engineering data and other planning materials required to conduct this study, whose names are included in the list below. We would also like to thank our sub-consultants, Shaun Spooner, of Spooner & Associates, Inc., Surveyors, and Mark Bradley, R.O.W. Agent with Universal Field Services, Inc., for their help with this assignment.

Please call if you have any questions or require any additional information concerning this study.

  
RICHARD W. ALBIN, P.E., Vice President

RWA/ra/Report Transmittal.doc

CC: Mr. Steve Norwood, Assistant City Manager  
Mr. Kevin B. Miller, P.E., C.F.M., Assistant Director of Public Works/Utilities  
Mr. Frank Crumb, P.E., Fort Worth Engineering Services Coordinator  
Mr. Peter Fu, P.E., Fort Worth Wastewater Facilities Engineer  
Mr. Greg Van Nieuwenhuize, P.E., Haltom City Engineer  
Mr. John Cherry, P.E., Richland Hills Director of Public Works  
Mr. Shaun Spooner, R.P.L.S., Spooner & Associates.  
Mr. Mark Bradley, R.O.W. Agent, Universal Field Services

**TWDB CONTRACT NO. 99-483-308**  
**BIG FOSSIL CREEK**  
**REGIONAL WASTEWATER PLANNING GRANT STUDY**  
**December, 1999**

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**TAB 1**

**BIG FOSSIL SEWER STUDY**

**REPORT TEXT**

## **Executive Summary**

The Big Fossil Creek Wastewater Outfall System affects four main communities which include Fort Worth, Haltom City, North Richland Hills and Richland Hills. The City of Richland Hills has a 36-inch Wastewater Outfall that was installed in the 1950's by the Tarrant County Water Supply Corporation, which was the previous owner of the systems which serve Richland Hills and North Richland Hills. This sewer line is designated as the T.C.W.S.C. Outfall Main, and transports wastewater from portions of both cities of Richland Hills and North Richland Hills to the City of Fort Worth 96-inch West Fork Outfall Sewer. The City of Fort Worth has a 48-inch wastewater Outfall main which is located in close proximity to the T.C.W.S.C. line and runs along the same creek bottom. This line is designated as the C.O.F.W. Outfall Main and serves a large watershed area which includes customers in Haltom City, Fort Worth, and portions of other smaller communities such as Watauga, Saginaw, and Haslet, plus some unincorporated Tarrant County areas. TAB 2 includes maps which show the Big Fossil watershed area and the location of the C.O.F.W. and T.C.W.S.C. Outfall mains. The recommendations included in this study for improvements to the Big Fossil Outfall System include only the portion from the Fort Worth West Fork Outfall to Broadway Drive. See Exhibit 1, at the end of this section, which is a map showing the location of the Outfall Sewers studied in detail in this report.

All four of the cities participating in this study, which include North Richland Hills, Richland Hills, Haltom City, and Fort Worth, have received Administrative Orders (AO) from the United States Environmental Protection Agency (EPA) with this Big Fossil Creek Wastewater Outfall System being recognized as needing to be studied in detail to determine the best plan for increasing the capacity to meet future demands. The Big Fossil Creek area is currently only partially developed, with full service of the watershed area expected to occur by the year 2020. The Big Fossil Creek system is also expected to provide service to the Marine Creek Watershed area which is located west of the natural Big Fossil Creek watershed area. Wastewater from the Marine Creek area is currently planned to be pumped by lift station to the Big Fossil area. The Big Fossil wastewater system is also expected to serve an Intel Facilities Plant located north of Big Fossil in the TRA Denton Creek Watershed area. A constant flow of 6.0 MGD was assumed for this facility based on a report prepared by Carter & Burgess, Inc.

Three primary alternatives have been identified for providing increased capacity to the Big Fossil Outfall System. These three alternatives are evaluated in this study. Several combinations of flow capacity sharing "Options" were modeled as required for the selection of the best alternative for each of the participating cities. A ranking matrix was developed for determining the best alternative, and a detailed discussion of the ranking procedure is presented at the end of this section of the report.

1. The first alternative includes construction of a single parallel Outfall Line in the vicinity of the existing City of Fort Worth Outfall Sewer which would increase the capacity of the Big Fossil system as required to serve all of the communities including Haltom City, North Richland Hills, Richland Hills, and the City of Fort Worth, and its other customer cities which are served by the Big Fossil system. The T.C.W.S.C. line would be abandoned as a major Outfall Line under this scenario, although a portion of it could be used by Richland Hills as a minor collector.
2. The second alternative includes construction of a parallel Big Fossil Outfall Sewer which would have sufficient capacity to serve all of the communities except for Richland Hills, which would continue to be served by the TCWSC line alone. The TCWSC line has sufficient capacity to serve Richland Hills for the foreseeable future, without future paralleling, but it will require extensive rehabilitation or replacement.
3. The third alternative includes separate parallel pipes for both the C.O.F.W. Outfall sewer, and the T.C.W.S.C. Outfall Sewer as proposed in the City of Fort Worth Sanitary Sewer Master Plan. This alternative assumes that North Richland Hills and Richland Hills will both continue to be served jointly by the T.C.W.S.C. Outfall System, and that the C.O.F.W. line will be paralleled as required to provide capacity for Haltom City, Fort Worth and the remainder of the Big Fossil service area, including the designated Marine Creek area and the Intel Facility.

The results of this comprehensive study indicate that the best interests of each of the four participating cities is served by a single parallel Outfall Sewer line which should be designed to have sufficient capacity to provide joint service for the entire Big Fossil service area. Cost comparisons of all the scenarios considered are discussed in detail in this report along with the methodology used in the evaluations and recommendations.

The table on the following page is a summary of the total preliminary estimated project cost allocations for each city for the design year of 2070 required to construct the Big Fossil Parallel Sanitary sewer line which has sufficient capacity to provide service for North Richland Hills, Richland Hills, the Haltom City Big Fossil watershed area plus a portion of the Little Fossil area, and for the City of Fort Worth and other customer cities in the Big Fossil watershed plus a portion of the Marine Creek watershed, and the Intel Facility Plant located in the TRA Denton Creek Watershed area.

The following sections include discussions regarding the methodology used in this study to develop the peak discharges, size the relief Outfall Lines, and develop the preliminary cost estimates for evaluating various alternatives and flow scenarios.

| PARTICIPATING COMMUNITY   | PEAK FLOW (MGD) | % COST SHARE | TOTAL ESTIM. COST |
|---|-----------------|--------------|-------------------|
| FORT WORTH  | 125.69          | 83.98%       | \$13,461,687      |
| HALTOM CITY   | 15.38           | 10.28%       | \$1,647,233       |
| NORTH RICHLAND HILLS  | 7.36            | 4.92%        | \$788,273         |
| RICHLAND HILLS  | 1.24            | 0.83%        | \$132,807         |
| TOTAL   | 149.67          | 100.00%      | \$16,030,000      |
| NOTE: Cost Participation Share based on estimated peak flows calculated using a calibration formula developed from the City of Fort WorthHydroworks computer model of the Big Fossil watershed area which relates future estimated Equivalent Populations and Sewered Areas for each community. |                 |              |                   |

### Service Area

The Big Fossil Creek Watershed area is shown on the exhibit titled "Watershed Areas" under TAB 2. The total natural watershed area includes 34,989 acres. Currently, service is provided to 21,851 acres. The limits of the current service area are shown on the Watershed Area map and is labeled "Year 2000 Service Area". This area within the natural Big Fossil Creek watershed, but outside the current service area limits is referred to as area "BFX" throughout this report.

The City of Fort Worth Master Plan proposes to serve a portion of an additional area outside the Big Fossil Creek Watershed designated as the "Marine Creek Watershed" area. This area will be served by pumping wastewater by lift station to the Big Fossil System. The Marine Creek area to be served by the Big Fossil Creek System totals 23,717 acres.

A plant designated as the "Intel Facility" is shown on the Watershed Area map, and is located in the TRA Denton Creek Watershed area north of the Big Fossil Watershed. A lift station and force main are proposed which would provide service to this facility by the Big Fossil system. A constant flow of 6.0 MGD is assumed in the flow models included in this report as proposed in a "Hydraulic Analysis Intel Wastewater Project" report prepared by Carter and Burgess, Inc., dated November, 1997. Flow option calculations are provided which show the effect of the 6.0 MGD Intel flow on the capacity requirements of the Big Fossil Creek Outfall Sewer, and with the flow omitted from the model for comparison.

Three additional detailed watershed area exhibits are included under TAB 2 which show the "Lower Big Fossil Watershed" area, the "Upper Big Fossil Watershed" area, and the "Marine Creek Watershed" areas. Sub-areas are shown on each of these exhibits which are included in the tables and computer models used for population projections and sewer discharge calculations throughout this report. These sub-areas correspond to the area designations included in the City of Fort Worth Land Use Plan and Sanitary Sewer Master Plan. The size in acres of each sub-area, along with the land use characteristics and population projections is presented in the table labeled "Base Table Query, Dec.99.xls", which is included under TAB 5. Additional population projections are shown for each sub-area and grouped into the basin areas included in this study, and this data is also included under TAB 5. The data included in these tables was provided by the City of Fort Worth Water Department for our use in this study. Areas discharging into the Big Fossil system were extracted from the database and grouped by categories used in the flow "Options" scenarios considered in this study.

An additional area is included in this study located within Haltom City which could also be served by the proposed Big Fossil Outfall Sewer. This extra area includes portions of the Little Fossil Creek and West Fork watershed areas. The existing sewer line which currently serves this area is labeled "Existing Haltom City West Fork Outfall Sanitary Sewer". The area served is designated as the "Little Fossil Creek" watershed area as shown on Exhibit 1, and sheet 2 of 4, "Lower Big Fossil Watershed" in the TAB 2 section.

### **Population Projections**

Detailed population projections and methodologies used for this study are presented under TAB 5 for each of the participating communities and other cities located within the Big Fossil watershed area. These projections were performed to provide a check against the population data and projections provided by the City of Fort Worth. The results of our population projections agree favorably with the projections provided by the City of Fort Worth. A detailed discussion of the population projection methods used in this study, along with exhibits showing the North Central Texas Council of Governments (N.C.T.C.O.G.) Census Tracts and Forecast Districts used in the projections, are presented in this section of the report for reference.

### **Sanitary Sewer Plans and Right-Of-Way Documents**

As-built construction plans of the City of Fort Worth (C.O.F.W.) Big Fossil Creek Outfall Sewer Line and the Tarrant County Water Supply Corporation (T.C.W.S.C.) Outfall Sewer Line were provided by the City of Fort Worth Water Department. A detailed on-the-ground field survey was conducted to verify the location of the existing sewer lines and confirm the stations and elevations of the

manholes and manhole rims. The field survey data agree favorably with the as-built construction plans, and the as-built plan data is sufficiently accurate for the planning purposes included in this study.

The plan location and alignment of the C.O.F.W. and T.C.W.S.C. lines are shown on the plan sheets included under TAB 3 of this report. A proposed route for the Big Fossil Creek Parallel Outfall Line is shown on these drawings. An alternate route proposed by the City of Fort Worth Water Department is also shown in this section of the report for reference. The preliminary location of the proposed Haltom City West Fork Parallel Sanitary Sewer line which would serve the extra Little Fossil Creek area is also shown on this drawing.

The location and number of each sanitary sewer easement parcel are noted on the plan sheets. Spreadsheets are also included in this section of the report which list the available easement parcel ownership data associated with the C.O.F. W. and T.C.W.S.C. sewer mains. Profile sheets are also provided in this section of the report, and the beginning and ending locations of each right-of-way or easement parcel are shown in the profile drawings. Hydraulic information and other data is provided in the profile sheets as well. Profile data sheets are included under TAB 4 of this report.

A tabulation of the ownership data for the easements and properties on which the sewer lines are located is presented under TAB 3, as noted above. Not all of the ownership records for the sewer mains have been located. We are continuing to research the records to determine if any additional easement ownership data is available. All known property ownership information will be included in the final report.

### **Calculation of Flow Data**

The basis for the preliminary sizing of the proposed Big Fossil Creek and TCWSC Outfall Relief Sewer Lines is discharge flow rate plus other hydraulic flow parameters used to determine pipe capacity. The sanitary sewer discharge consists of three basic components. The first is the *base flow*, which is a function of the equivalent population. The equivalent population is equal to the residential population plus one-half the employment population. Projections of these data are presented for each sub-area in TAB 5 of the report. The Fort Worth Master Plan recommends using a base flow rate of 80 gallons per capita per day (gpcd) for the design base flow rate. The second component of the flow is *ground water infiltration* (GWI). The Fort Worth Master Plan recommends 14 gpcd times the equivalent population as an approximation of this flow. The third component of the discharge is *rain-dependent infiltration/inflow* (RDII). This quantity of flow is determined by correlating rainfall events to excesses in sewer system flow rates through a comprehensive flow metering and monitoring program. RDII flows are a function of the size and runoff characteristics of the portion of the watershed area which is sewered. Hydrographs showing the shapes of various land use



types are presented under TAB 6 of this report. Existing and projected sewer areas in acres are presented in the Population Projections table under TAB 5.

For purposes of this preliminary planning report, approximations in peak flow rates have been calculated by developing formulas which "calibrate" the discharges to the Fort Worth "HydroWorks" sanitary sewer model. Design discharges for the years 2000 and 2020 from the Master Plan data for the Big Fossil Watershed were used to develop these formulas. An outline of the procedure used to develop these flow calibration formulas is presented under TAB 6 in Table "CALIB-1" of the report. Peak discharge flow rates for various flow "scenarios" are tabulated under TAB 7 also. We would caution that these approximate peak flows should only be used for purposes of comparing various sizing alternatives, and not used for final design. We would recommend that a *HydroWorks* model update be performed by the City of Fort Worth, based on the parameters presented in this report, for the best design scenario selected in order to determine the final pipe design and hydraulic gradients.

### **Pipe Sizing and Cost Estimates**

After development of flow data tables (TAB 7) for various flow "scenarios" for the design years of 2000, 2005, 2010, 2015, 2020, 2050, and 2070, the proposed C.O.F.W. and T.C.W.S.C. parallel sewers were sized based on hydraulic calculations calibrated to the City of Fort Worth hydraulic tables from the Master Plan CIP project spreadsheets. Peak discharges for each line segment for various conditions of equivalent population, sewer acreages, and design year were calculated based on calibration formulas developed from the Master Plan year 2000 and 2020 HydroWorks computer models. These formulas were used to develop discharge estimates for design years other than 2000 and 2020 by interpolation and extrapolation of the data based on these two design periods. Baseline calibration tables showing the existing year 2000 conditions and projected year 2020 conditions for the C.O.F.W. Line, along with a discussion of the methodology used are included under TAB 7.

Flow scenario calculations for each of the design years noted were performed for the following conditions:

1. City of Fort Worth Outfall flows based on the Master Plan conditions for the Big Fossil Creek watershed, not including Intel Flows, the BFX or Marine Creek areas until design year 2020.
2. City of Fort Worth Outfall flows, including BFX flows, but not Marine Creek or Intel.
3. City of Fort worth Outfall flows, including BFX area, and Marine Creek areas, but not Intel.

4. Same as Scenario 3 plus Intel flows.
5. Tarrant County Water Supply Corporation Outfall flows, based on the City of Fort Worth Master Plan, including flows from Richland Hills and North Richland Hills.
6. Tarrant County Water Supply Corporation Outfall flows revised to account for additional area in North Richland Hills which is served by the T.C.W.S.C. line, but not included in the Fort Worth Model.
7. North Richland Hills total flows to the Big Fossil Creek system based on calibration with the T.C.W.S.C. Fort Worth Master Plan model. These flow rates are higher than the C.O.F.W. model flows because the time to peak is shorter. These peak rates are used to determine the proposed cost split between NRH and Richland Hills for improvements to the T.C.W.S.C. system.
8. Richland Hills total flows to the Big Fossil Creek system based on calibration with the T.C.W.S.C. Fort Worth Master Plan model. These flow rates are higher than then C.O.F.W. model flows because the time to peak is shorter. These peak rates are used to determine the proposed cost split between NRH and Richland Hills for improvements to the T.C.W.S.C. system.
9. North Richland Hills flows to the Big Fossil Creek system based on calibration with the C.O.F.W. Master Plan model. These flows are used for determining the cost split with the other cities for improvements to the C.O.F.W. Big Fossil Outfall Sewer. These peak flows are less than the T.C.W.S.C. model flows due to the longer time to peak for the Big Fossil watershed.
10. Richland Hills flows to the Big Fossil Creek system based on calibration with the C.O.F.W. Master Plan model. These flows are used for determining the cost split with the other cities for improvements to the C.O.F.W. Big Fossil Outfall Sewer. These peak flows are less than the T.C.W.S.C. model flows due to the longer time to peak for the Big Fossil Creek watershed.
11. Haltom City total flows from the area of the city within the Big Fossil Creek watershed which sewer to the C.O.F.W. Outfall, based on calibration with the C.O.F.W. Outfall Master Plan.
12. Haltom City total flows from the area of the city within the "Little" Fossil Creek watershed which sewer to the C.O.F.W. Outfall, based on calibration with the C.O.F.W. Outfall Master Plan. This area is designated as "LF000570" as shown on the "Lower Big Fossil Creek Watershed" area

map under TAB 1. This additional area is being considered for service to the C.O.F.W. line because the current Little Fossil Creek Outfall Main requires extensive rehabilitation, and diversion of the Little Fossil area to the Big Fossil line is an alternative which would eliminate the need for rehabilitation or reconstruction of a major portion of the Little Fossil Creek Outfall.

13. Combined Haltom City flows from the Big Fossil area and the Little Fossil area into the C.O.F.W. Outfall Sewer, (11.+12.).

A tabulation titled "Flow Scenario Calculations" of the 13 flow scenarios listed above is presented under TAB 6 of the report. Included in the table are the calculated flow model calibration coefficients "A" and "B" used to develop the peak flow rates, along with the equivalent populations, sewer acres, base flow calculations, *Harmon's Peaking Factor*, *Peak Base Flow* calculations, GWI and RDII flows, total Flows and *Base Flow* peaking factor check. These parameters are provided for the design years 2000, 2005, 2010, 2015, 2020, 2050, and 2070. For purposes of this study, projections to the year 2070 are considered to represent ultimate development of the watershed areas served by the Big Fossil Creek Outfall System. A summary of the calculated peak discharges for each of these 13 scenarios is listed in Table "PEAKS-1" titled "Peak discharge Summary" included under TAB 6.

Hydraulic calculation tables were developed based on the City of Fort Worth *HydroWorks* calibrated model which are used for sizing the proposed replacement pipes and parallel pipes for each flow scenario and design option considered. Cost estimates of replacement and parallel sanitary sewer lines are based on pipeline costs developed from the City of Fort Worth Master Plan, dated December, 1997, and increased by a factor of about 1.06 times 1997 values based on the Engineering News Record (ENR) cost index increase since 1997. Estimated construction costs are increased by a factor of 1.5 to include engineering, financing, right-of-way acquisition costs, and contingencies. Table "COST-1" showing these unit prices is included at the end of TAB 7 of the report. These preliminary costs should not be used for final design estimates, but rather for purposes of comparing various alternative designs and preliminary planning only. Hydraulic tables for each design option are presented under TAB 7 of the report.

Using the various flow scenarios listed above, three main design "Options" are considered, including several "sub-options" in order to determine the sewer system improvement that is most advantageous from an economic standpoint to each participating city. Summary tables of the results of these comparisons follow this section. The following is a brief summary of each main Option and the associated "sub-options". A detailed discussion of the results of each Option is included herein.

**Option 1 -- Construct a single parallel relief line to serve all Cities**

Option 1a -- All areas considered in the service area including Haltom City Little Fossil, BFX area, Marine Creek and Intel site.

Option 1b -- Same as Option 1a less the Marine Creek area

Option 1c -- Same as Option 1b less the Intel Site flow

Option 1d -- Same as Option 1c less the Haltom City Little Fossil area

**Option 2 -- Construct a single parallel relief line to serve all Cities except Richland Hills**

Option 2a -- C.O.F.W. parallel line to serve only Fort Worth, Haltom City (with Little Fossil), and North Richland Hills, including BFX, Marine Creek and Intel site

Option 2b -- T.C.W.S.C. existing line with rehab serving Richland Hills only

**Option 3 -- Construct two parallel lines, one adjacent to existing C.O.F.W. line and another adjacent to existing T.C.W.S.C. line.**

Option 3a -- C.O.F.W. parallel line to serve only Fort Worth and Haltom City (with Little Fossil), including BFX, Marine Creek and Intel site

Option 3b -- New parallel T.C.W.S.C. line constructed to serve both NRH and Richland Hills

**Option 1a -- All Cities Served by Proposed C.O.F.W. Parallel Outfall**

This option includes flows from each city to the Big Fossil Creek Outfall including Fort Worth Big Fossil watershed area, North Richland Hills, Richland Hills, Haltom City (Big Fossil and Little Fossil Areas), plus areas outside the Big Fossil Creek watershed including the Marine Creek watershed area and the Intel Facility site.

Table FWOPT-1 shows an estimate of Fort Worth's share of the costs for this option for the design years 2000 through 2070. Fort Worth's share of the estimated cost for the proposed C.O.F.W. parallel Outfall sized to meet the demands of the year 2020 is about \$12.16 million. The cost to construct this parallel line to meet projected 2070 demands is \$13.46. Haltom City's share of

the costs for capacity in this line based on calculated peak flows is \$1.59 million in 2020 or \$1.65 million in 2070. Haltom City's share includes capacity for both the Big and Little Fossil Creek service areas.

North Richland Hills' share of the estimated cost of this Option is \$0.96 for the 2020 design, or \$0.79 for the 2070 design year. NRH costs are less in 2070 because NRH's proportion of the peak flow in 2020 is higher than its portion in 2070 relative to the demands of Fort Worth. Therefore, it is more advantageous for NRH to have the C.O.F.W. Outfall design based on 2070 demand conditions rather than the year 2020 conditions.

Richland Hills' share of the estimated cost of this Option is \$0.18 for the 2020 design, or \$0.13 for the 2070 design year. Richland Hills' costs are less in 2070 because RH's proportion of the peak flow in 2020 is higher than its portion in 2070 relative to the demands of Fort Worth. Therefore, like NRH, it is more advantageous for RH to have the C.O.F.W. Outfall design based on 2070 demand conditions rather than the year 2020 conditions.

**Option 1b -- All Cities Served by Proposed C.O.F.W. Parallel Outfall  
(less the Marine Creek Area)**

This option is similar to Option 1a, and includes flows from each city to the Big Fossil Outfall including Fort Worth Big Fossil watershed area, North Richland Hills, Richland Hills, Haltom City (Big Fossil and Little Fossil Areas), plus the Intel Facility site. However, the Marine Creek area is omitted from the model to help Fort Worth determine what the cost difference would be to provide sewer service for the Marine Creek area to some other watershed area or system.

Fort Worth's share of the estimated cost for the proposed C.O.F.W. parallel Outfall sized to meet the demands of the year 2020 is about \$12.16 million with the Marine Creek area included, and \$11.04 million with Marine Creek not included in the capacity of the parallel Outfall sewer. This is a cost difference of about \$1.12 million. The cost to construct this parallel line to meet projected 2070 demands is \$13.2146 including Marine Creek, and \$11.95 with Marine Creek not included. This is a cost difference of about \$1.51 million. Therefore, if Marine Creek is to be served by the Big Fossil parallel Outfall, it is more cost effective to base the design on Year 2070 conditions than 2020 conditions. These cost differences should be compared with the cost to provide sewer service to the Marine Creek area to some other watershed other than Big Fossil before a final decision can be made in this regard.

Haltom City's share of the costs for capacity in this line based on calculated peak flows is \$1.59 million in 2020 with the Marine Creek area included, and \$1.68 with Marine Creek not included. Haltom City's 2070 costs are \$1.65 million with the Marine Creek area included, and \$1.76 million with Marine Creek not included. Therefore, it is more advantageous to have the Marine Creek area

served by Big Fossil if that Option is selected for the design. We would note that Haltom City's share includes capacity for both the Big and Little Fossil Creek service areas in this design Option.

North Richland Hills' share of the estimated cost of this Option is \$0.96 with Marine Creek included, and \$1.01 with Marine Creek not included for the 2020 design; or \$0.79 with Marine Creek in the 2070 design year, and \$0.84 without Marine Creek. Therefore, it is more advantageous for NRH to have the C.O.F.W. Outfall design based on Marine Creek included in the capacity design for either the 2020 or the 2070 demand conditions.

Richland Hills' share of the estimated cost of this Option is \$0.18 for the 2020 design with Marine Creek included, and \$0.16 with Marine Creek not included; or \$0.13 for the 2070 design year with Marine Creek, and \$0.14 without Marine Creek. Therefore, like NRH, it is more advantageous for RH to have the C.O.F.W. Outfall design based on Marine Creek included in the capacity design for either the 2020 or the 2070 demand conditions.

**Option 1c -- All Cities Served by Proposed C.O.F.W. Parallel Outfall  
(less the Marine Creek Area and the Intel Flow)**

This option is similar to Option 1b, and includes flows from each city to the Big Fossil Creek Outfall including Fort Worth Big Fossil Creek watershed area, North Richland Hills, Richland Hills, Haltom City (Big Fossil and Little Fossil Areas). However, the Marine Creek area and the Intel Facility flow are omitted from the model to help Fort Worth determine what the cost differences would be to provide sewer service for the Marine Creek area and the Intel site to some other watershed or system.

The 2020 design year cost difference for Fort Worth between Options 1b and 1c with the 6.0 MGD Intel site flow omitted from the C.O.F.W. parallel line capacity sizing is  $\$11.04 - \$9.45 = \$1.59$  million. The year 2070 design cost difference is  $\$11.95 - 10.67 = \$1.28$  million. Therefore, it is more advantageous to Fort Worth for the C.O.F.W. parallel line to be designed to the 2070 conditions if the Intel site is served by the Big Fossil system.

For the 2020 design year, the cost savings to Haltom City is  $\$1.68 - \$1.55 = \$130,000$  without the Intel Flow capacity, and  $\$1.76 - \$1.66 = \$100,000$  less for the 2070 design year. It is more advantageous to Haltom City if capacity for the Intel site is not included in the C.O.F.W. sewer design.

For the 2020 design year, the cost savings to NRH is  $\$1.01 - \$0.94 = \$70,000$  without the Intel Flow capacity, and  $\$0.84 - \$0.80 = \$40,000$  less for the 2070 design year. It is more advantageous to NRH if capacity for the Intel site is not included in the C.O.F.W. sewer design.

For the 2020 design year, the cost savings to RH is  $\$0.16 - \$0.14 = \$20,000$  without the Intel Flow capacity, and  $\$0.14 - \$0.12 = \$20,000$  less for the 2070 design year. It is more advantageous to RH if capacity for the Intel site is not included in the C.O.F.W. sewer design.

If the Intel Site is added to the capacity requirements of the Big Fossil Creek Sewer, then we would recommend that the extra costs to Haltom City, NRH, and Richland Hills be borne by Intel and/or the City of Fort Worth. For the 2020 Design year, this total extra cost would be  $\$1.59 + \$0.13 + \$0.07 + \$0.02 = \$1.81$  million to provide the additional 6.0 MGD capacity to serve the Intel site. The cost shares for Haltom City, NRH, and Richland Hills should be reduced accordingly. The extra year 2070 costs would be  $\$1.28 + \$0.10 + \$0.04 + \$0.02 = \$1.44$  million.

**Option 1d -- All Cities Served by Proposed C.O.F.W. Parallel Outfall  
(less Haltom City Little Fossil watershed area)**

This option includes flows from each city to the Big Fossil Creek Outfall including Fort Worth Big Fossil Creek watershed area, North Richland Hills, Richland Hills, Haltom City (Big Fossil area only), plus areas outside the Big Fossil watershed including Marine Creek and the Intel Facility site. The Haltom City Little Fossil Creek watershed area is not included.

Fort Worth's share of the C.O.F.W. parallel Outfall cost, for design year 2020, would increase from \$12.16 million to \$12.81 million if the Little Fossil area is omitted from the capacity design, because Haltom City's total share would go down. For design year 2070, Fort Worth's share of the cost would go up from \$13.46 million to \$14.02 without Little Fossil included. Therefore, it is more advantageous for Fort Worth to have the Little Fossil area included in the design capacity.

Haltom City's share of the cost would go down from \$1.59 million to \$0.85 million, in design year 2020, if the Little Fossil area is not included in the capacity calculations. However, Haltom City should compare the cost difference of \$740,000 for the Little Fossil capacity in the Big Fossil parallel Outfall, versus the cost to rehabilitate or reconstruct a new Little Fossil Outfall line. Assuming that the required capacity of the Little Fossil Outfall is about 7.5 MGD, and the grade of the line is the same as the C.O.F.W. Outfall, which is 0.08%, then the approximate size of the Little Fossil line would be about 36" in diameter, based on a Manning's n factor of 0.0145. Assuming the length of the Little Fossil Line is about 5,200 feet, and the cost of the 36 inch line is about \$230 per foot, then the total estimated cost of the Little Fossil line would be about \$1.20 million. Therefore, Haltom City would save  $\$1.20 - \$0.74 = \$460,000$  by purchasing capacity in the proposed C.O.F.W. parallel Outfall sewer rather than building a new Little Fossil line.

North Richland Hills' share of the 2020 project cost would increase from \$0.96 to \$1.04 if the Little Fossil capacity is not included in the design. For the 2070 design year, NRH costs would increase from \$0.79 to \$0.84 without the Little Fossil capacity. Therefore, it is more advantageous to NRH for Haltom City to include the Little Fossil Creek area in its share of the C.O.F.W. parallel line capacity purchase.

Similarly, Richland Hills' share of the 2020 project cost would increase from \$0.18 to \$0.20 if the Little Fossil capacity is not included in the design. For the 2070 design year, RH costs would increase from \$0.13 to \$0.14 without the Little Fossil capacity. Therefore, it is more advantageous to RH for Haltom City to include the Little Fossil area in its share of the C.O.F.W. parallel line capacity purchase.

**Options 2a and 2b -- All Cities Served by Proposed C.O.F.W. Parallel Outfall except Richland Hills which would be served by the TCWSC line**

This option includes flows from each city to the Big Fossil Outfall including Fort Worth Big Fossil Creek watershed area, North Richland Hills, and Haltom City (Big Fossil and Little Fossil Creek Areas), plus areas outside the Big Fossil watershed including Marine Creek and the Intel Facility site. Richland Hills would continue to be served by the existing Tarrant County Water Supply Corporation Outfall Line, but NRH would transfer service to the proposed new C.O.F.W. parallel Outfall.

For this Option, Fort Worth's share of the costs would increase from \$12.16 million to \$12.40 million, in the 2020 design year, without Richland Hills participation. In the 2070 design year, Fort Worth's cost would increase from \$13.46 to \$13.53 without Richland Hills' participation.

For this Option, Haltom City's share of the costs would increase from \$1.59 million to \$1.65 million, in the 2020 design year, without Richland Hills participation. In the 2070 design year, Haltom City's cost would increase from \$1.65 to \$1.69 without Richland Hills' participation.

For this Option, North Richland Hills' share of the costs would increase from \$0.96 million to \$1.00 million, in the 2020 design year, without Richland Hills participation. In the 2070 design year, NRH's cost would increase from \$0.79 to \$0.81 without Richland Hills' participation.

Assuming that Richland Hills rehabilitation costs of the existing Tarrant County Water Supply Corporation are about 1/3 of the costs to replace that existing line, then the estimated rehabilitation costs to Richland Hills would be about \$720,000. This cost is higher for Richland Hills than all the other Option costs which include Richland Hills purchasing capacity in the proposed C.O.F.W. parallel Outfall sewer. Therefore, based on this scenario, it is more



advantageous for Richland Hills to participate in the cost of a new C.O.F.W. parallel Outfall sewer than it would be to assume maintenance responsibility for the T.C.W.S.C. line and pay for the rehab costs. This also assumes that someone will pay for the connections.

**Options 3a and 3b -- Cities Served by Proposed C.O.F.W. Parallel Outfall include only Fort Worth and Haltom City, with NRH and Richland Hills being served by the T.C.W.S.C. line**

This option includes flows from Fort Worth and Haltom City (with Little Fossil Creek area) to the Big Fossil Creek Outfall including Marine Creek and the Intel Facility site. Richland Hills and North Richland Hills would continue to be served by the Tarrant County Water Supply Corporation line, and Richland Hills and NRH would share in the cost of a new parallel T.C.W.S.C. line as required to meet future demands.

This is the least advantageous scenario for the City of Fort Worth. It's share of the 2020 design year cost would be \$14.48 million compared with \$12.16 million for Option 1a. Fort Worth's 2070 design year cost would be \$14.48 compared with \$13.46 for Option 1a.

This is also the least advantageous scenario for Haltom City. It's share of the 2020 design year cost would be \$1.80 million compared with \$1.59 million for Option 1a. Haltom City's 2070 design year cost would be \$1.88 million compared with \$1.65 million for Option 1a.

This Option is by far the worst scenario for North Richland Hills. It's share of the cost with Richland Hills for construction of a new T.C.W.S.C. parallel line would be about \$5.24 million for the 2020 design year, as compared with only \$0.96 million for its share of the C.O.F.W. parallel Outfall in Option 1a.

This Option is also by far the worst scenario for Richland Hills. It's share of the cost with North Richland Hills for construction of a new T.C.W.S.C. parallel line would be about \$1.88 million for the 2020 design year, as compared with only \$0.18 million for its share of the C.O.F.W. parallel Outfall in Option 1a.

### Summary of Options and Recommendations

The following table is a matrix based on the relative cost of each Option considered on a scale of 1 to 6, for the 2070 design year, with 1 being the least expensive alternative.

| PARTICIPATING CITY | EVALUATION OPTION NUMBER |    |    |    |    |    |
|--------------------|--------------------------|----|----|----|----|----|
|                    | 1a                       | 1b | 1c | 1d | 2  | 3  |
| FORT WORTH         | 3                        | 2  | 1  | 5  | 4  | 6  |
| HALTOM CITY        | 2                        | 5  | 3  | 1  | 4  | 6  |
| NRH                | 1                        | 4  | 2  | 5  | 3  | 6  |
| RICHLAND HILLS     | 1                        | 3  | 2  | 4  | 5  | 6  |
| TOTAL SCORE        | 7                        | 14 | 8  | 15 | 16 | 24 |

Based on this evaluation, Option 1a is the best alternative for all participating cities.





**OPTION 3a - Areas Served by C.O.F.W. Big Fossil Outfall Include Haltom City (with Little Fossil), Marine Creek Area, BFX Area, Intel Flow, but Excluding Richland Hills and NRH.**

| PARTICIPATING CITY | YEAR 2000 |         |              | YEAR 2005 |         |              | YEAR 2010 |         |              | YEAR 2015 |         |              | YEAR 2020 |         |              | YEAR 2050 |         |              | YEAR 2070 |         |              |
|--------------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|
|                    | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST |
| FORT WORTH         | 59.15     | 84.33%  | \$8.26       | 64.26     | 85.04%  | \$9.94       | 68.74     | 85.56%  | \$10.88      | 81.26     | 87.17%  | \$12.86      | 88.50     | 87.79%  | \$12.95      | 107.39    | 88.33%  | \$14.16      | 118.45    | 88.51%  | \$14.48      |
| HALTOM CITY        | 10.99     | 15.67%  | \$1.54       | 11.3      | 14.96%  | \$1.75       | 11.6      | 14.44%  | \$1.84       | 11.96     | 12.83%  | \$1.89       | 12.31     | 12.21%  | \$1.80       | 14.19     | 11.67%  | \$1.87       | 15.38     | 11.49%  | \$1.88       |
| NRH                | 0.00      | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       |
| RICHLAND HILLS     | 0.00      | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       |
| TOTAL              | 70.14     | 100.00% | \$9.80       | 75.56     | 100.00% | \$11.69      | 80.34     | 100.00% | \$12.72      | 93.22     | 100.00% | \$14.75      | 100.81    | 100.00% | \$14.75      | 121.58    | 100.00% | \$16.03      | 133.83    | 100.00% | \$16.36      |

**OPTION 3b - Richland Hills and NRH Served by Tarrant County Water Supply Corporation Line (TCWSC) only, and not included in C.O.F.W. Big Fossil Outfall.**

| PARTICIPATING CITY | YEAR 2000 |         |              | YEAR 2005 |         |              | YEAR 2010 |         |              | YEAR 2015 |         |              | YEAR 2020 |         |              | YEAR 2050 |         |              | YEAR 2070 |         |              |
|--------------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|-----------|---------|--------------|
|                    | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST | PEAK FLOW | % SHARE | PROJECT COST |
| FORT WORTH         | 0.00      | 0.00%   | \$0.00       | 0.00      | 0.00%   | \$0.00       | 0.00      | 0.00%   | \$0.00       | 0.00      | 0.00%   | \$0.00       | 0.00      | 0.00%   | \$0.00       | 0.00      | 0.00%   | \$0.00       | 0.00      | 0.00%   | \$0.00       |
| HALTOM CITY        | 0.00      | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       | 0         | 0.00%   | \$0.00       |
| NRH                | 18.01     | 77.70%  | \$4.55       | 18.93     | 77.52%  | \$4.54       | 21.16     | 75.41%  | \$5.21       | 22.81     | 74.40%  | \$5.30       | 24.47     | 73.53%  | \$5.24       | 24.98     | 73.54%  | \$5.24       | 24.98     | 73.54%  | \$5.24       |
| RICHLAND HILLS     | 5.17      | 22.30%  | \$1.31       | 5.49      | 22.48%  | \$1.32       | 6.9       | 24.59%  | \$1.70       | 7.85      | 25.60%  | \$1.82       | 8.81      | 26.47%  | \$1.88       | 8.99      | 26.46%  | \$1.88       | 8.99      | 26.46%  | \$1.88       |
| TOTAL              | 23.18     | 100.00% | \$5.86       | 24.42     | 100.00% | \$5.86       | 28.06     | 100.00% | \$6.91       | 30.66     | 100.00% | \$7.12       | 33.28     | 100.00% | \$7.12       | 33.97     | 100.00% | \$7.12       | 33.97     | 100.00% | \$7.12       |

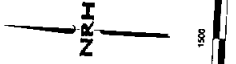
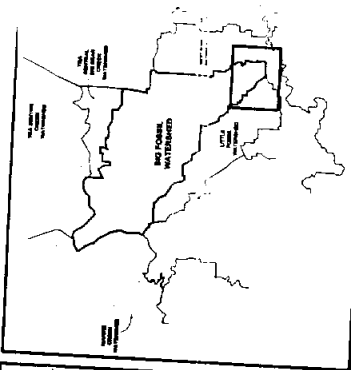
| CITY OF FORT WORTH ESTIMATED SHARE OF PROJECT COSTS |  |                 |        |         |         |         |         |         |
|---|--|-----------------|--------|---------|---------|---------|---------|---------|
| OPTION NO.  | OPTION DESCRIPTION   | CIP DESIGN YEAR |        |         |         |         |         |         |
|   |  | 2000            | 2005   | 2010    | 2015    | 2020    | 2050    | 2070    |
| 1a  | All Cities Served By C.O.F.W. Big Fossil Outfall, Including NRH, Haltom City, Richland Hills, Marine Creek Area, Year 2020 BFX Area, and 6.0 MGD Intel Flow, Plus Haltom City Little Fossil Area Extra | \$9.01          | \$9.52 | \$9.71  | \$11.90 | \$12.16 | \$13.37 | \$13.46 |
| 1b  | Same as Option 1a above, but less Marine Creek Area  | \$6.29          | \$6.83 | \$8.60  | \$10.18 | \$11.04 | \$11.89 | \$11.95 |
| 1c  | Same As Option 1b, but also less Intel Facility Flow   | \$4.80          | \$6.01 | \$6.58  | \$8.97  | \$9.45  | \$9.88  | \$10.67 |
| 1d  | Same As Option 1a, but less Haltom City Little Fossil Area   | \$8.05          | \$9.94 | \$10.62 | \$12.70 | \$12.81 | \$13.97 | \$14.02 |
| 2   | All Cities Served by C.O.F.W. Big Fossil Outfall except Richland Hills Which will be served by the TCWSC Line. (Includes L.F.)   |                 |        |         |         |         |         |         |
| 2a  | Big Fossil Data (H.C + NRH + F.W.)   | \$9.13          | \$9.21 | \$10.12 | \$12.06 | \$12.40 | \$13.45 | \$13.53 |
| 2b  | TCWSC Data (Richland Hills Only)   | \$0.00          | \$0.00 | \$0.00  | \$0.00  | \$0.00  | \$0.00  | \$0.00  |
| 3   | Only Fort Worth and Haltom City served by the Big Fossil Line, with Richland Hills and NRH served by the TCWSC Line  |                 |        |         |         |         |         |         |
| 3a  | Big Fossil Data (H.C. + F.W.)  | \$8.26          | \$9.94 | \$10.88 | \$12.86 | \$12.95 | \$14.16 | \$14.48 |
| 3b  | TCWSC Data (R.Hills + NRH)   | \$0.00          | \$0.00 | \$0.00  | \$0.00  | \$0.00  | \$0.00  | \$0.00  |

| HALTOM CITY ESTIMATED SHARE OF PROJECT COSTS |  |                 |        |        |        |        |        |        |
|--|--|-----------------|--------|--------|--------|--------|--------|--------|
| OPTION NO.                                   | OPTION DESCRIPTION   | CIP DESIGN YEAR |        |        |        |        |        |        |
|  |  | 2000            | 2005   | 2010   | 2015   | 2020   | 2050   | 2070   |
| 1a   | All Cities Served By C.O.F.W. Big Fossil Outfall, Including NRH, Haltom City, Richland Hills, Marine Creek Area, Year 2020 BFX Area, and 6.0 MGD Intel Flow, Plus Haltom City Little Fossil Area Extra | \$1.55          | \$1.55 | \$1.52 | \$1.64 | \$1.59 | \$1.66 | \$1.65 |
| 1b   | Same as Option 1a above, but less Marine Creek Area  | \$1.26          | \$1.28 | \$1.54 | \$1.61 | \$1.68 | \$1.75 | \$1.76 |
| 1c   | Same As Option 1b, but also less Intel Facility Flow   | \$1.08          | \$1.25 | \$1.30 | \$1.54 | \$1.55 | \$1.55 | \$1.66 |
| 1d   | Same As Option 1a, but less Haltom City Little Fossil Area   | \$0.63          | \$0.75 | \$0.79 | \$0.86 | \$0.85 | \$0.99 | \$1.03 |
| 2  | All Cities Served by C.O.F.W. Big Fossil Outfall except Richland Hills Which will be served by the TCWSC Line. (Includes L.F.)   |                 |        |        |        |        |        |        |
| 2a   | Big Fossil Data (H.C + NRH + F.W.)   | \$1.00          | \$1.54 | \$1.62 | \$1.69 | \$1.65 | \$1.70 | \$1.69 |
| 2b   | TCWSC Data (Richland Hills Only)   | \$0.00          | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 3  | Only Fort Worth and Haltom City served by the Big Fossil Line, with Richland Hills and NRH served by the TCWSC Line  |                 |        |        |        |        |        |        |
| 3a   | Big Fossil Data (H.C./L.F. + F.W.)   | \$1.54          | \$1.75 | \$1.84 | \$1.89 | \$1.80 | \$1.87 | \$1.88 |
| 3b   | TCWSC Data (R.Hills + NRH)   | \$0.00          | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |

| NORTH RICHLAND HILLS ESTIMATED SHARE OF PROJECT COSTS |  |                 |        |        |        |        |        |        |
|---|--|-----------------|--------|--------|--------|--------|--------|--------|
| OPTION NO.  | OPTION DESCRIPTION   | CIP DESIGN YEAR |        |        |        |        |        |        |
|   |  | 2000            | 2005   | 2010   | 2015   | 2020   | 2050   | 2070   |
| 1a  | All Cities Served By C.O.F.W. Big Fossil Outfall, Including NRH, Haltom City, Richland Hills, Marine Creek Area, Year 2020 BFX Area, and 6.0 MGD Intel Flow, Plus Haltom City Little Fossil Area Extra | \$0.96          | \$0.99 | \$0.96 | \$1.01 | \$0.96 | \$0.86 | \$0.79 |
| 1b  | Same as Option 1a above, but less Marine Creek Area  | \$0.78          | \$0.82 | \$0.98 | \$0.99 | \$1.01 | \$0.91 | \$0.84 |
| 1c  | Same As Option 1b, but also less Intel Facility Flow   | \$0.67          | \$0.80 | \$0.82 | \$0.95 | \$0.94 | \$0.80 | \$0.80 |
| 1d  | Same As Option 1a, but less Haltom City Little Fossil Area   | \$0.89          | \$1.07 | \$1.09 | \$1.11 | \$1.04 | \$0.92 | \$0.84 |
| 2   | All Cities Served by C.O.F.W. Big Fossil Outfall except Richland Hills Which will be served by the TCWSC Line. (Includes L.F.)   |                 |        |        |        |        |        |        |
| 2a  | Big Fossil Data (H.C + NRH + F.W.)   | \$1.00          | \$0.98 | \$1.03 | \$1.05 | \$1.00 | \$0.88 | \$0.81 |
| 2b  | TCWSC Data (Richland Hills Only)   | \$0.00          | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 3   | Only Fort Worth and Haltom City served by the Big Fossil Line, with Richland Hills and NRH served by the TCWSC Line  |                 |        |        |        |        |        |        |
| 3a  | Big Fossil Data (H.C. + F.W.)  | \$0.00          | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 3b  | TCWSC Data (R.Hills + NRH)   | \$4.55          | \$4.54 | \$5.21 | \$5.30 | \$5.24 | \$5.24 | \$5.24 |



| RICHLAND HILLS ESTIMATED SHARE OF PROJECT COSTS |  |                 |        |        |        |        |        |        |
|---|--|-----------------|--------|--------|--------|--------|--------|--------|
| OPTION NO.                                      | OPTION DESCRIPTION   | CIP DESIGN YEAR |        |        |        |        |        |        |
|   |  | 2000            | 2005   | 2010   | 2015   | 2020   | 2050   | 2070   |
| 1a  | All Cities Served By C.O.F.W. Big Fossil Outfall, Including NRH, Haltom City, Richland Hills, Marine Creek Area, Year 2020 BFX Area, and 6.0 MGD Intel Flow, Plus Haltom City Little Fossil Area Extra | \$0.17          | \$0.18 | \$0.17 | \$0.20 | \$0.18 | \$0.14 | \$0.13 |
| 1b  | Same as Option 1a above, but less Marine Creek Area  | \$0.12          | \$0.14 | \$0.14 | \$0.18 | \$0.16 | \$0.15 | \$0.14 |
| 1c  | Same As Option 1b, but also less Intel Facility Flow   | \$0.08          | \$0.12 | \$0.12 | \$0.17 | \$0.14 | \$0.12 | \$0.12 |
| 1d  | Same As Option 1a, but less Haltom City Little Fossil Area   | \$0.18          | \$0.19 | \$0.22 | \$0.21 | \$0.20 | \$0.15 | \$0.14 |
| 2   | All Cities Served by C.O.F.W. Big Fossil Outfall except Richland Hills Which will be served by the TCWSC Line. (Includes L.F.)   |                 |        |        |        |        |        |        |
| 2a  | Big Fossil Data (H.C + NRH + F.W.)   | \$0.00          | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 2b  | TCWSC Data (Richland Hills Only)   | \$0.72          | \$0.72 | \$0.72 | \$0.72 | \$0.72 | \$0.72 | \$0.72 |
| 3   | Only Fort Worth and Haltom City served by the Big Fossil Line, with Richland Hills and NRH served by the TCWSC Line  |                 |        |        |        |        |        |        |
| 3a  | Big Fossil Data (H.C. + F.W.)  | \$0.00          | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| 3b  | TCWSC Data (R.Hills + NRH)   | \$1.31          | \$1.32 | \$1.70 | \$1.82 | \$1.88 | \$1.88 | \$1.88 |



Notes:  
 1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.  
 2. Watershed areas shown are based on watershed and drainage area maps included in the City of Fort Worth Sanitary Sewer Masterplan dated September, 1998, prepared by Freese and Nichols, Inc., Montgomery Watson and Brown & Root, Inc. Data furnished to KEF for this study by the City of Fort Worth Water Dept.

**BIG FOSSIL SEWER STUDY**

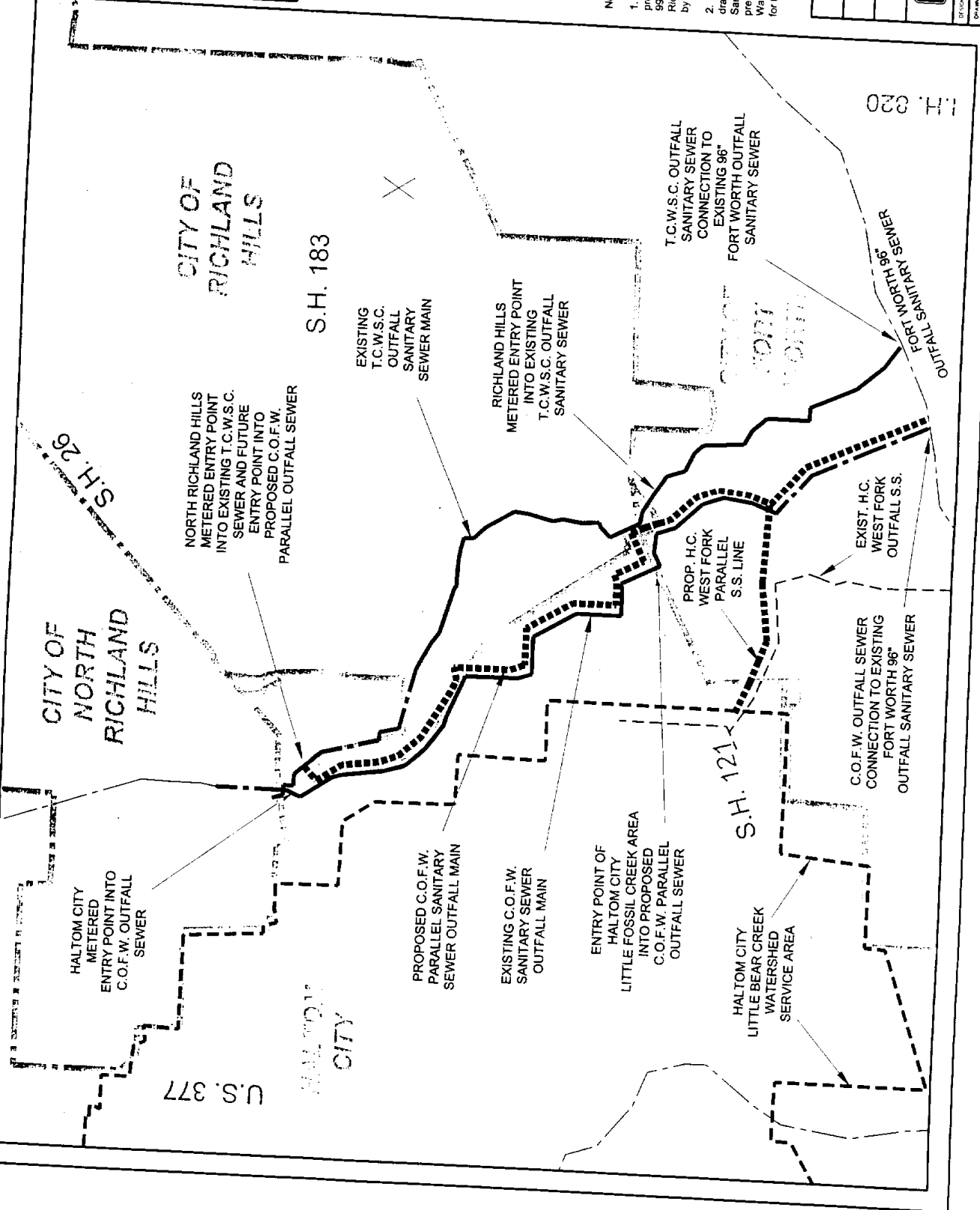
**C.O.F.W. AND T.C.W.S.C.O. MAINS**

**CITY OF NORTH RICHLAND HILLS**

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
 CONSULTING ENGINEERS / Fort Worth, Texas

DESIGNED BY: KEF DATE: 07/20/04  
 DRAWN BY: KEF DATE: 07/20/04  
 CHECKED BY: KEF DATE: 07/20/04

**EXHIBIT 1**



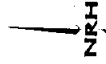
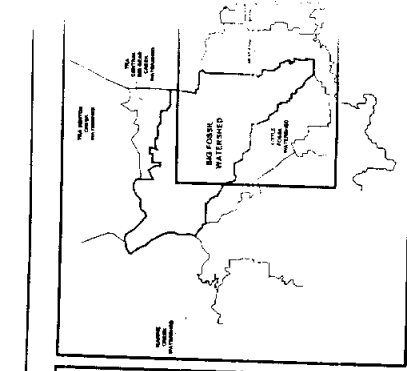
**TAB 2**

***BIG FOSSIL SEWER STUDY***

***WATERSHED AREA MAPS***


***(See Revised Maps TAB 9)***

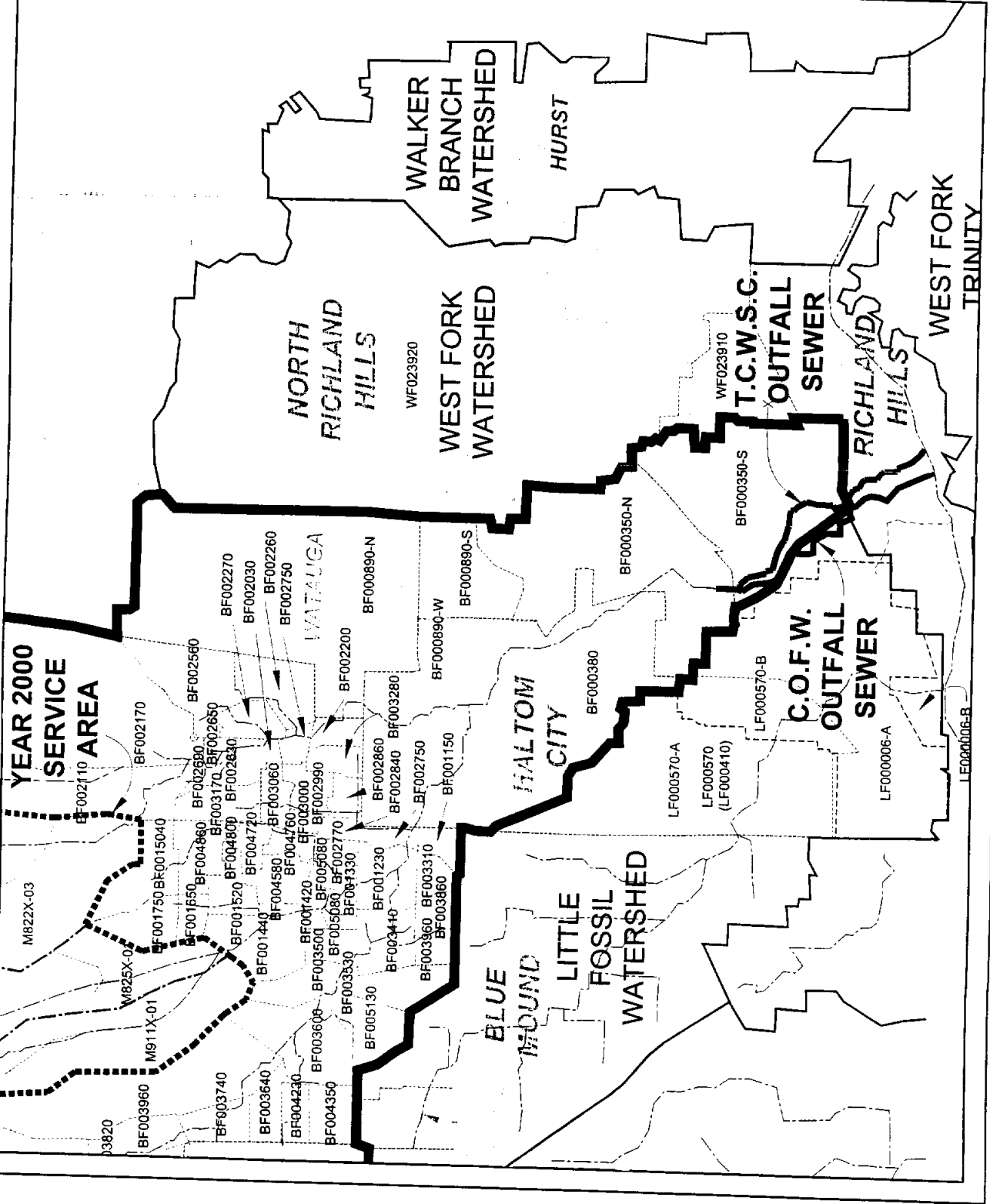




**Notes:**

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
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|   |
|---|
| <b>BIG FOSSIL SEWER STUDY</b>   |
| <b>LOWER BIG FOSSIL WATERSHED</b>   |
| <b>CITY OF NORTH RICHLAND HILLS</b>   |
|  <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br>CONSULTING ENGINEERS / Fort Worth, Texas |
| DRAWN BY: [ ]<br>CHECKED BY: [ ]<br>DATE: [ ]<br>SCALE: [ ]<br>SHEET NO. [ ] OF [ ]   |

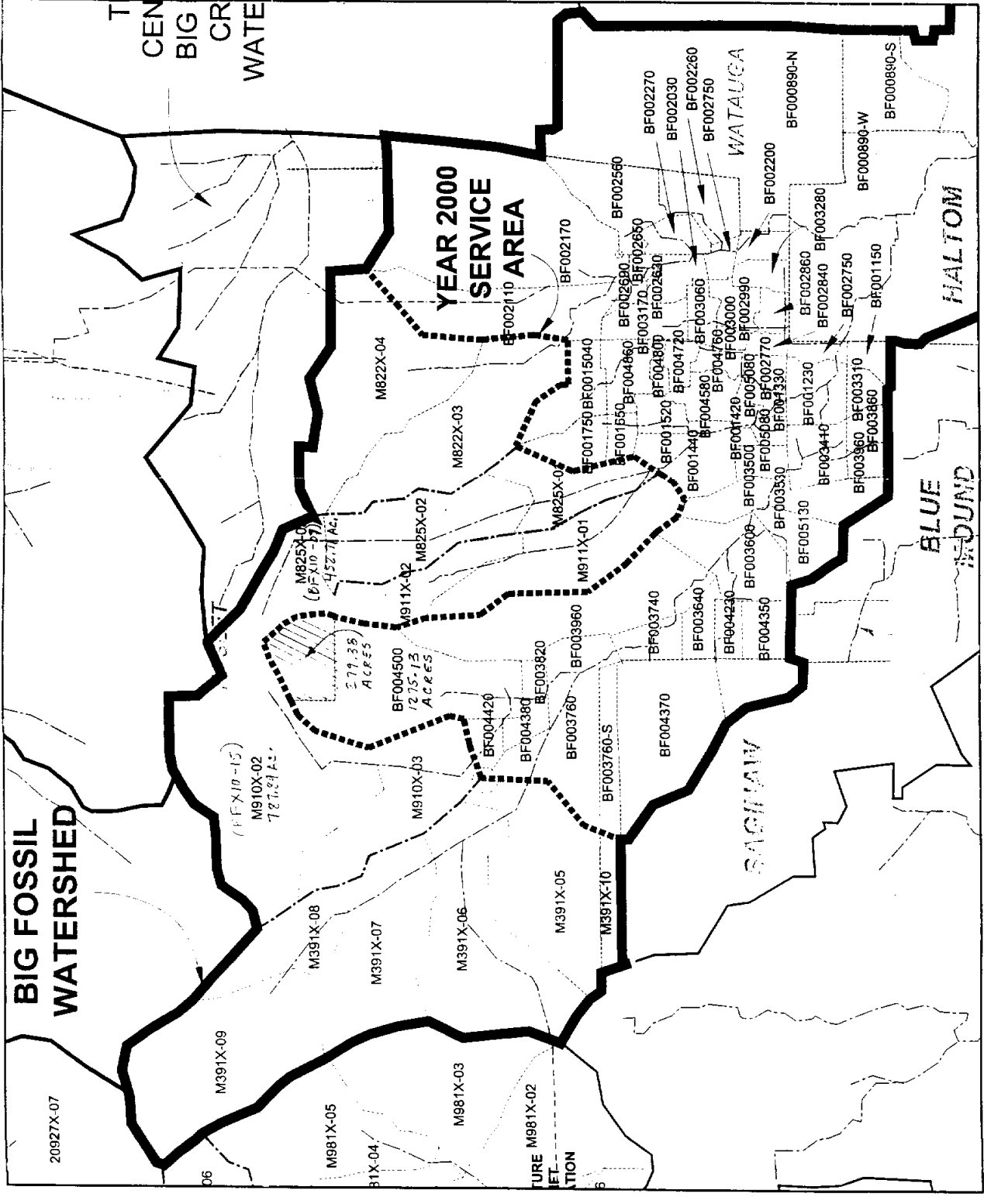


1. For ASB/Individual (1000, 1000, 1000, 1000)

# BIG FOSSIL WATERSHED

T  
CEN  
BIG  
CR  
WATE

## YEAR 2000 SERVICE AREA



20927X-07

M391X-07

M391X-08

M391X-09

M391X-10

M391X-11

M391X-12

M391X-13

M391X-14

M391X-15

M391X-16

M391X-17

M391X-18

M391X-19

M391X-20

M391X-21

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M391X-59

M391X-60

**Notes:**

- This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 89-483-308, dated 5/18/89, between the City of North Richland Hills and the TMPB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
- Watershed areas shown are based on watershed and drainage area maps included in the City of Fort Worth Sanitary Sewer Masterplan dated September, 1998, prepared by Freese and Nichols, Inc., Montgomery Watson, and Brown & Root, Inc. Data furnished to KEF for this study by the City of Fort Worth Water Dept.

**BIG FOSSIL SEWER STUDY**

**UPPER BIG FOSSIL WATERSHED**

**CITY OF NORTH RICHLAND HILLS**

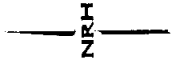
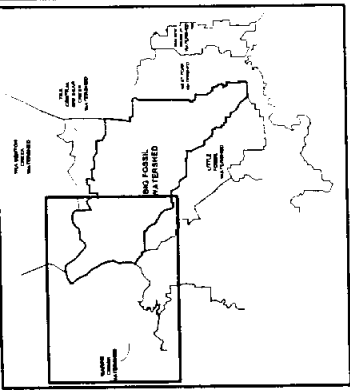
**KNOWLTON - ENGLISH-FLOWERS, INC.**  
CONSULTING ENGINEERS / Fort Worth, Texas

DESIGNED BY: [Name] DATE: [Date]  
DRAWN BY: [Name] DATE: [Date]  
CHECKED BY: [Name] DATE: [Date]



0 5,000 10,000

NRH

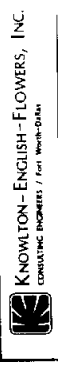


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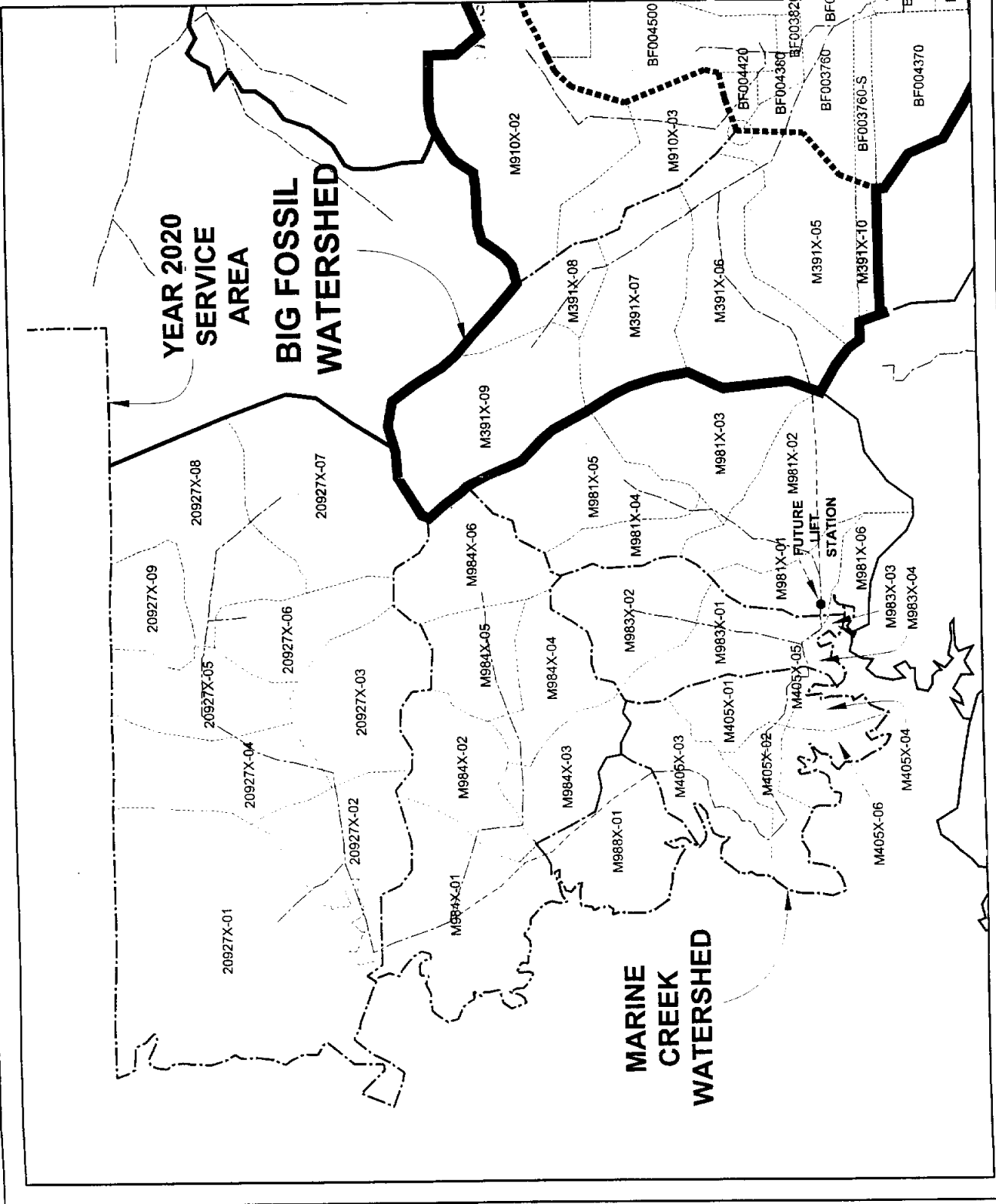
1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. Watershed areas shown are based on watershed and drainage area maps included in the City of Fort Worth Sanitary Sewer Masterplan dated September, 1998, prepared by Fresse and Nichols, Inc., Montgomery Watson, and Brown & Root, Inc. Data furnished to KEF for this study by the City of Fort Worth Water Dept.

**BIG FOSSIL SEWER STUDY**  
**MARINE CREEK WATERSHED AREA**

**CITY OF NORTH RICHLAND HILLS**



|             |      |       |    |         |
|-------------|------|-------|----|---------|
| PROJECT NO. | DATE | SCALE | BY | CHECKED |
|             |      |       |    |         |
|             |      |       |    |         |
|             |      |       |    |         |



# Big Fossil Creek Watershed

## LEGEND

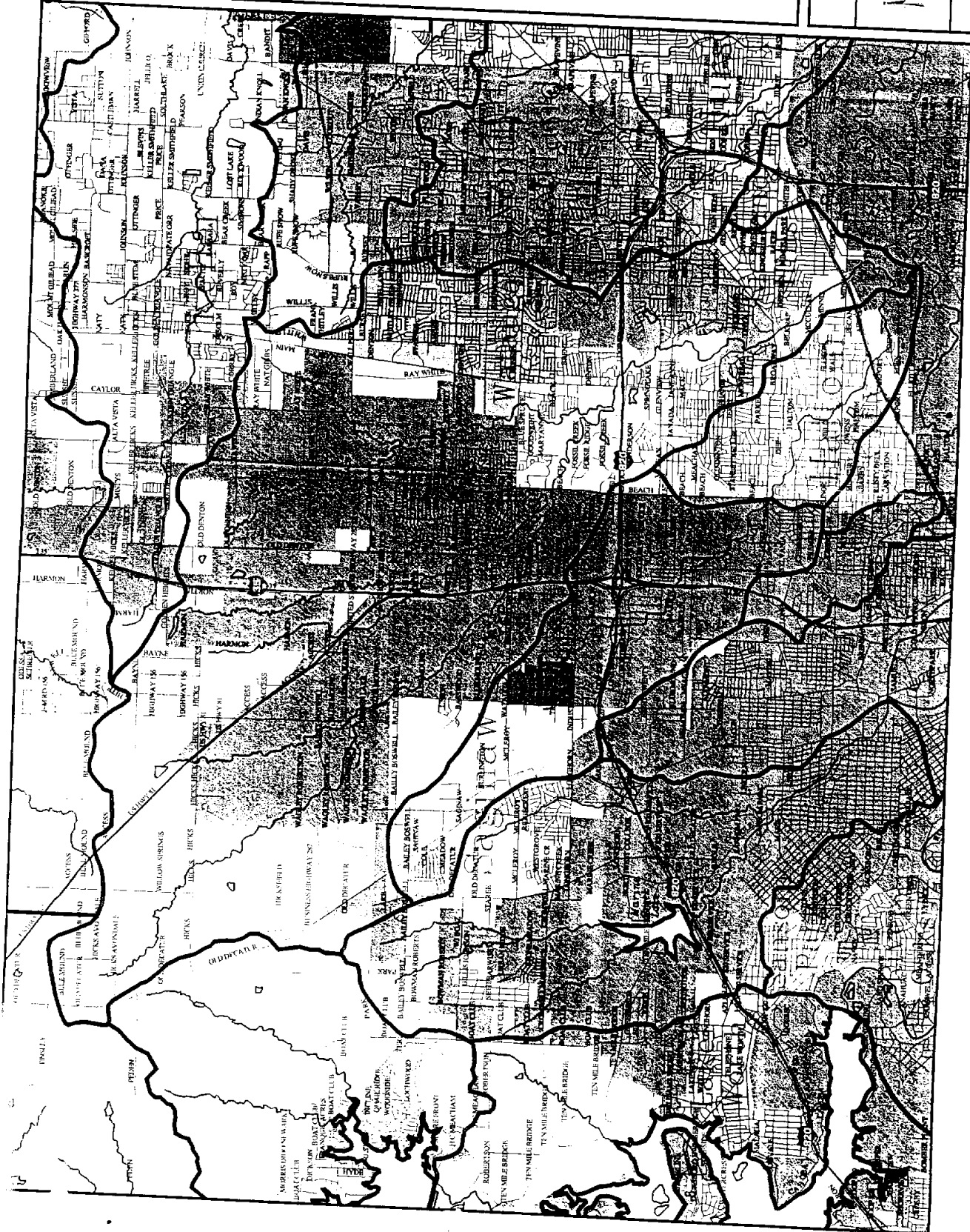
- County Boundaries
- Other Routes
- Major Roads
- D.I.G. Streams
- Watershed Boundaries

ENVIRONMENTAL RESOURCES PROJECTS  
NORTH CENTRAL TEXAS



Scale: 1 inch = 1 Mile







Custom Area





**Big Fossil Creek  
Watershed**  
**12 meter resolution**  
(Conservation Data)

**LEGEND**

-  Fema Q3 100 Year Flood Boundary
-  Fema Q3 500 Year Flood Boundary
-  Road Centerlines
-  Streams
-  County Boundaries
-  Watershed Boundaries

ENVIRONMENTAL RESOURCES PROJECTS  
CENTRAL TEXAS



1997  
Mills  
North Ave



**TAB 3**

***BIG FOSSIL SEWER STUDY***

***CITY OF FORT WORTH***

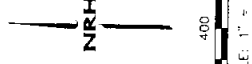
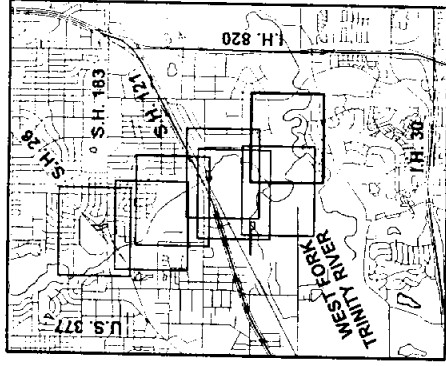
***AND***

***TARRANT COUNTY WATER SUPPLY CORP.***

***SANITARY SEWER OUTFALLS***


***RIGHT-OF-WAY PLAN SHEETS***

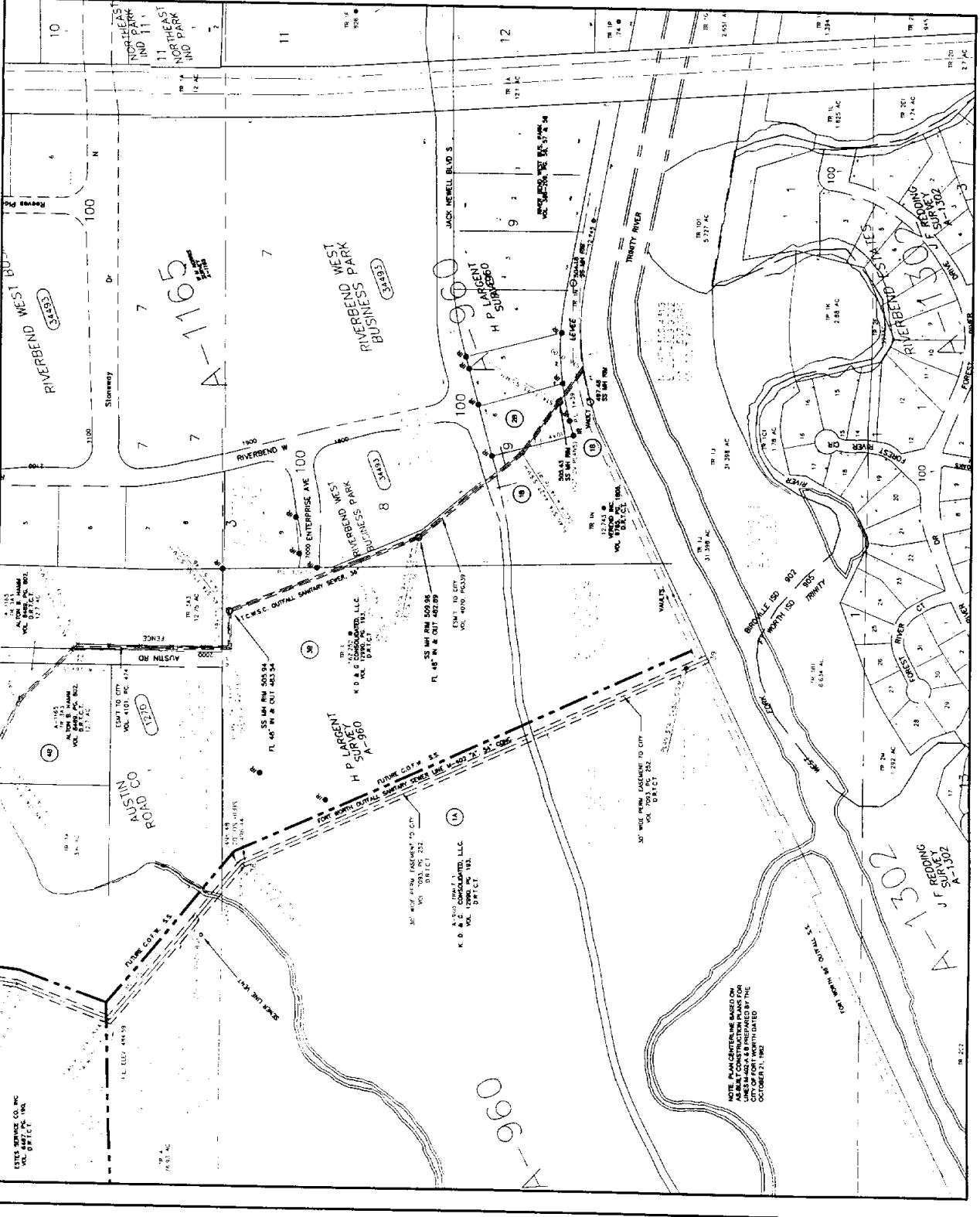
***(See Revised Sheets TAB 9)***



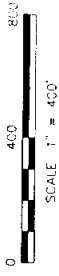
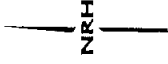
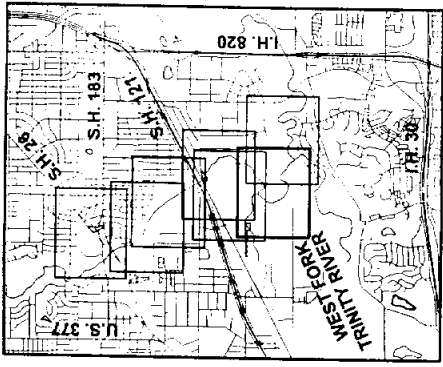
Notes:

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors, (817-282-6981), dated 11/11/99, with R.O.W. document research by Universal Field Services, Inc. (918-494-7600), and KEF, Inc. (817-283-6211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

|   |                         |                     |
|---|-------------------------|---------------------|
| <b>BIG FOSSIL SEWER STUDY</b>   |                         |                     |
| <b>R.O.W. STRIP MAP</b>   |                         |                     |
| CITY OF NORTH RICHLAND HILLS  |                         |                     |
|  <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br>CONSULTING ENGINEERS / SURVEYORS |                         |                     |
| DESIGNED BY: RWA  | REV. NO.: DATE: 5/18/99 | DATE: DECEMBER 1999 |
| DRAWN BY: RWA   | JOB NO. 34-3A           |                     |
| CHECKED BY: HAT   | SHEET NO. 1 OF 5        |                     |



NOTE: PLAN CENTERLINE BASED ON AS-BUILT CONSTRUCTION PLANS FOR BIG FOSSIL SEWER STRIP MAP BY THE CITY OF FORT WORTH DATED OCTOBER 21, 1982



**Notes:**

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**BIG FOSSIL SEWER STUDY**

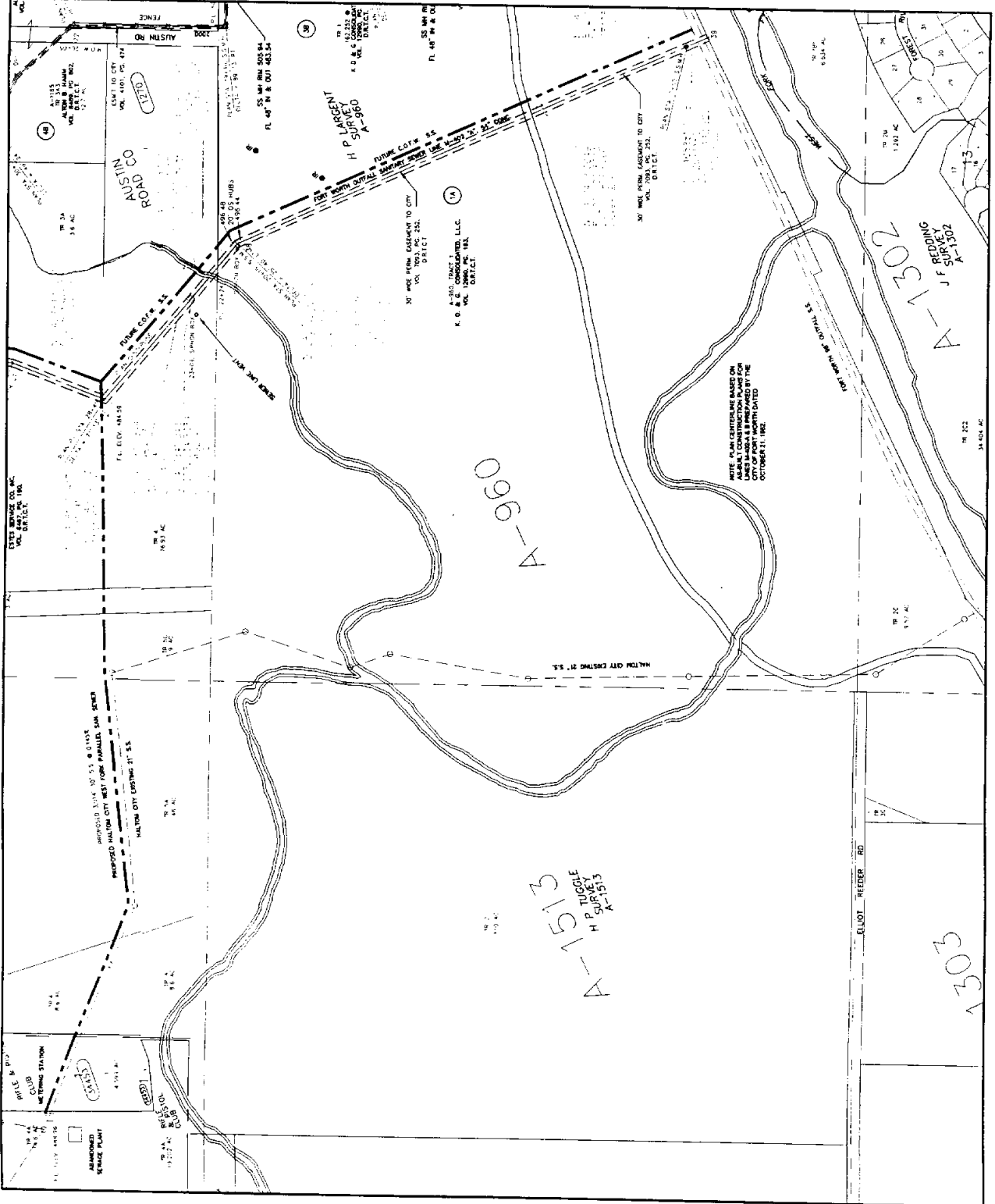
**R.O.W. STRIP MAP**

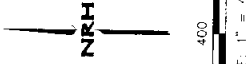
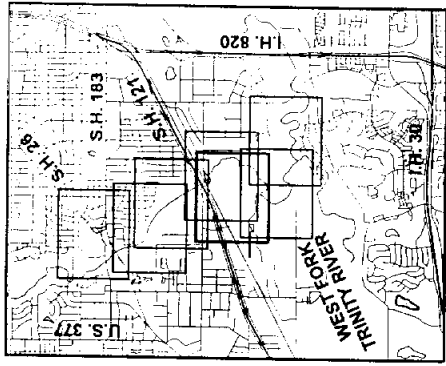
CITY OF NORTH RICHLAND HILLS



**KNOWLTON-ENGLISH-FLOWERS, INC.**  
CONSULTING ENGINEERS / P.E. NORTH-DALLAS

|                         |                 |                   |                     |
|-------------------------|-----------------|-------------------|---------------------|
| DESIGNED BY: RWA        | REV. BY: J.E.F. | DATE: 11/11/99    | DATE: 11/11/99      |
| DRAWN BY: BBA           | SCALE: AS SHOWN | SHEET NO.: 1302-1 | SHEET TOTAL: 1302-1 |
| PROJECT NO.: 99-485-308 |                 |                   |                     |





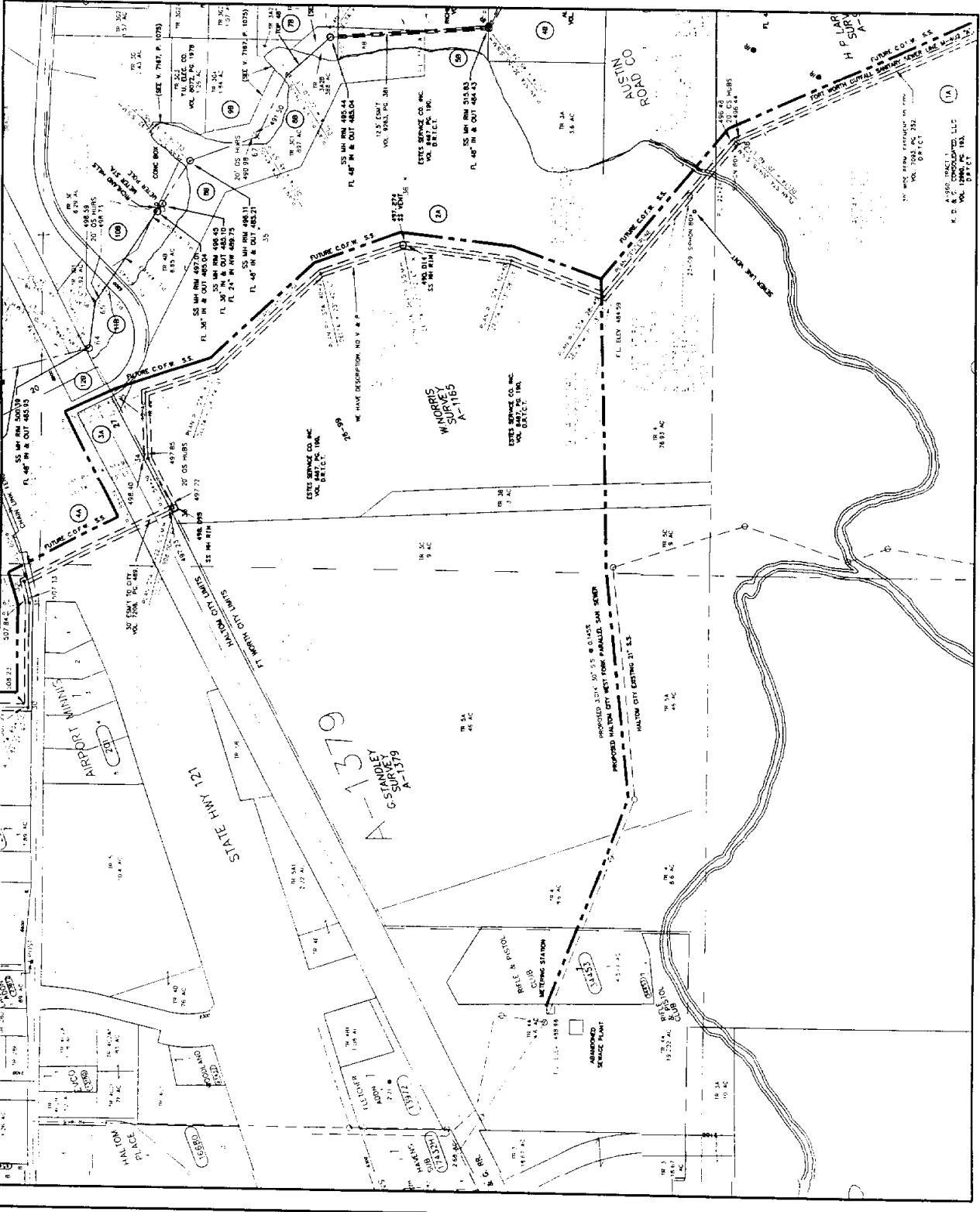
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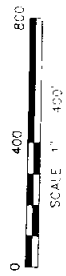
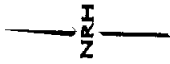
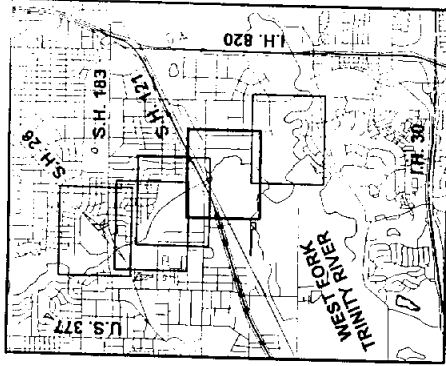
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**BIG FOSSIL SEWER STUDY**  
**R.O.W. STRIP MAP**  
 CITY OF NORTH RICHLAND HILLS

**K** KNOWLTON-ENGLISH-FLOWERS, INC.  
 CONSULTING ENGINEERS / P.E. / N.E. / D. / S.

DESIGNED BY: [Signature] DATE: 11/11/89  
 DRAWN BY: [Signature] DATE: 11/11/89  
 CHECKED BY: [Signature] DATE: 11/11/89

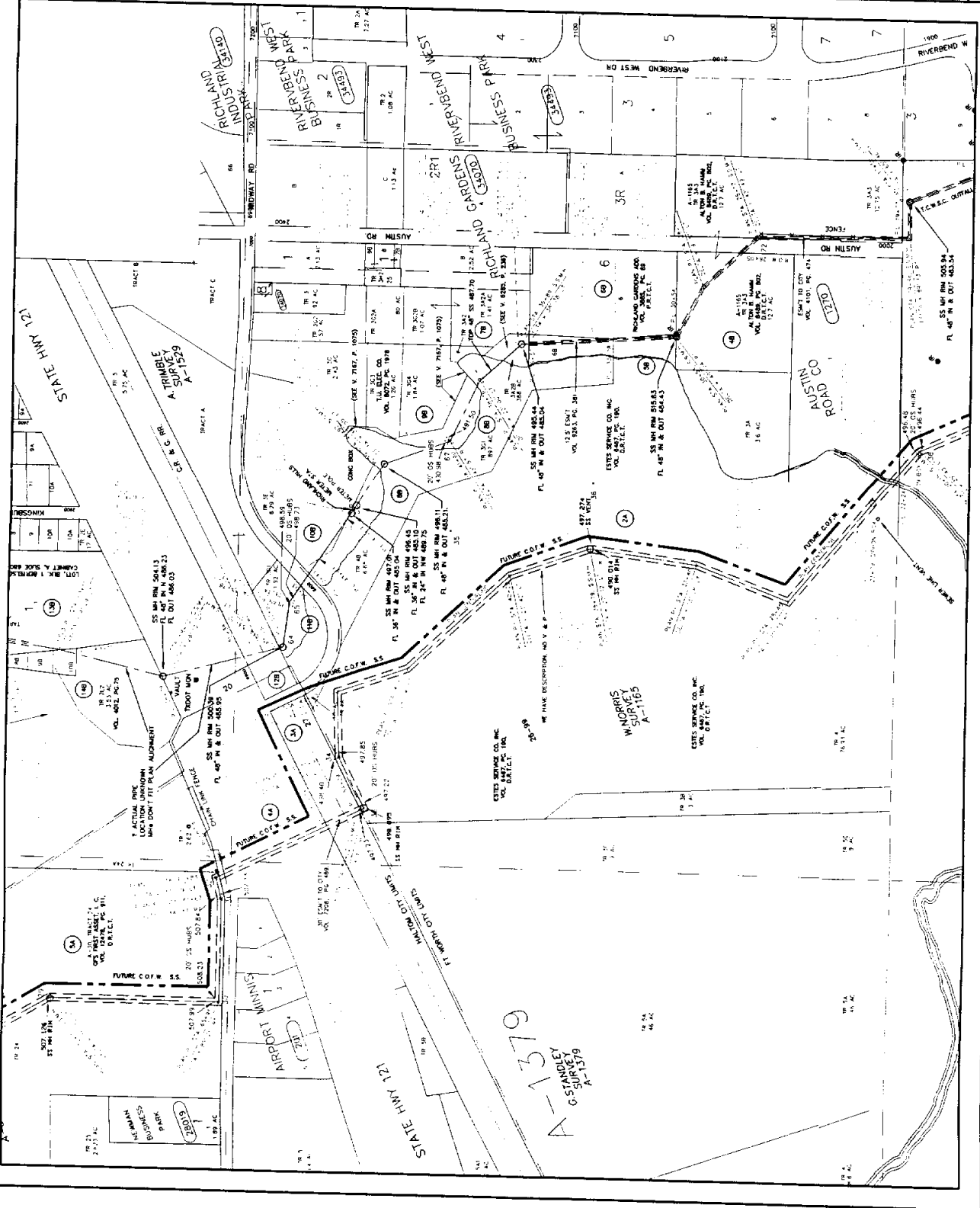


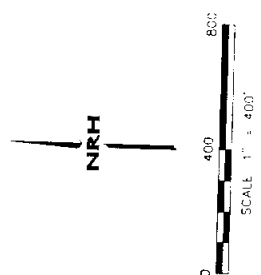
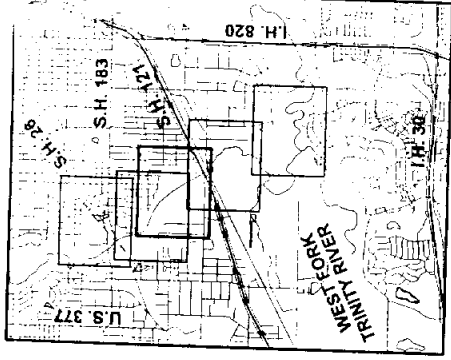


**Notes:**

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-306, dated 5/18/89, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors, (817-282-6981), dated 11/1/89, with R.O.W. document 99-483-306, dated 5/18/89, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.

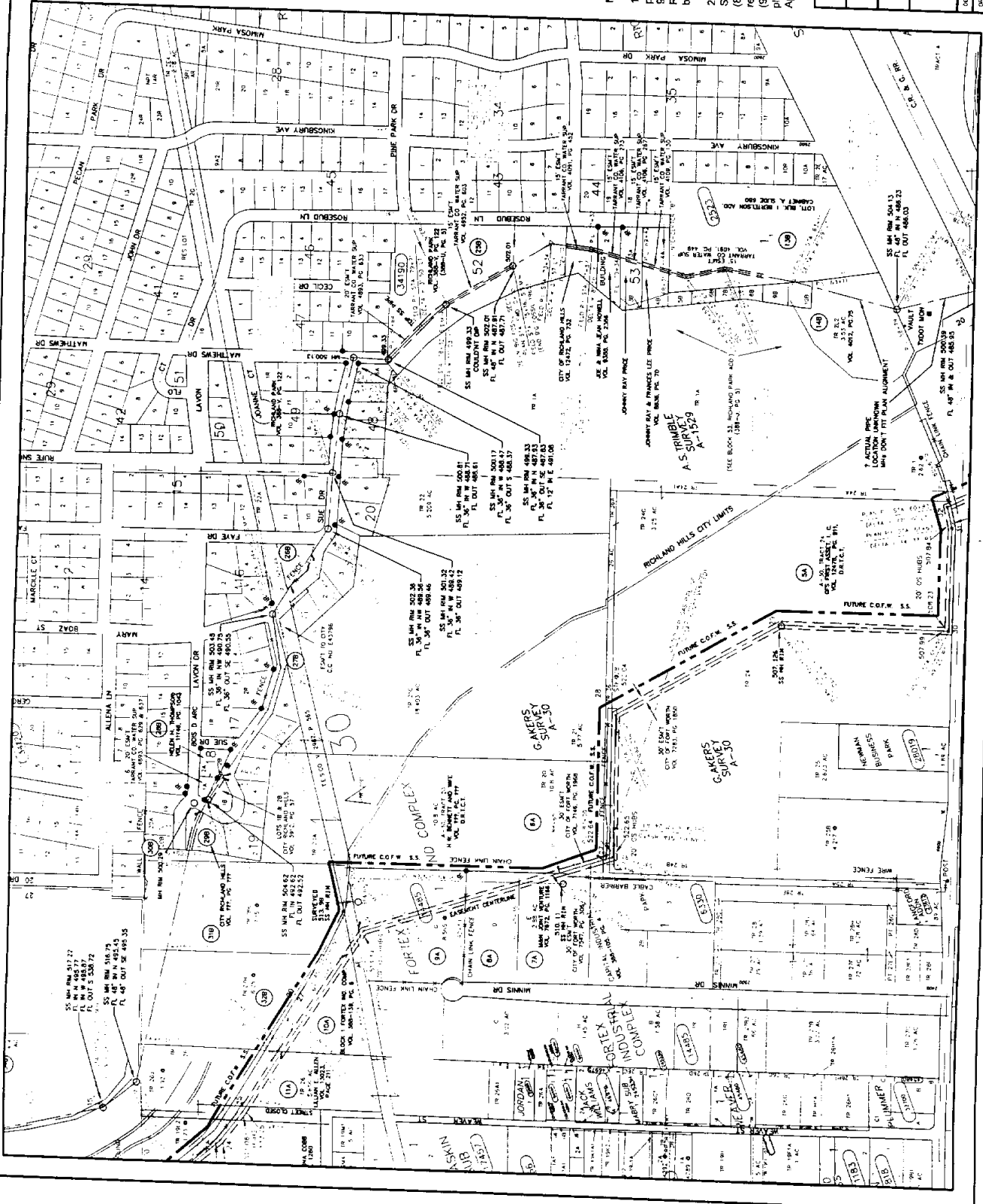
|   |                    |
|---|--------------------|
| <b>BIG FOSSIL SEWER STUDY</b>   |                    |
| <b>R.O.W. STRIP MAP</b>   |                    |
| CITY OF NORTH RICHLAND HILLS  |                    |
| <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br>CONSULTING ENGINEERS / Fort Worth, Texas |                    |
| DESIGNED BY: R.H.A.   | DATE: 05/18/89     |
| DRAWN BY: R.H.A.  | CHECKED BY: R.H.A. |
| DATE: 05/18/89  | SCALE: 1" = 400'   |

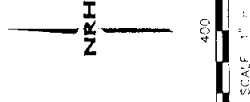
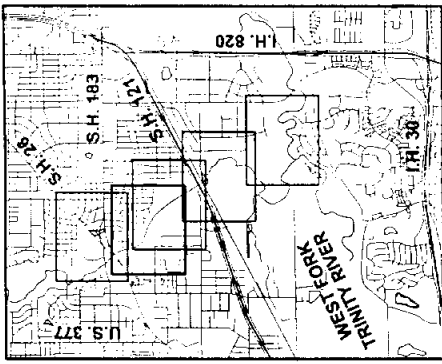




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|  |                     |
|--|---------------------|
| <b>BIG FOSSIL SEWER STUDY</b>  |                     |
| <b>R.O.W. STRIP MAP</b>  |                     |
| CITY OF NORTH RICHLAND HILLS   |                     |
| <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br>CONSULTING ENGINEERS 7401 Westchase Drive |                     |
| DESIGNED BY: RWA   | SCALE: AS SHOWN     |
| DRAWN BY: RWA  | DATE: DECEMBER 1999 |
| CHECKED BY: JML  | JOB NO: 3-1-18      |
|  | SHEET NO: 3 OF 3    |





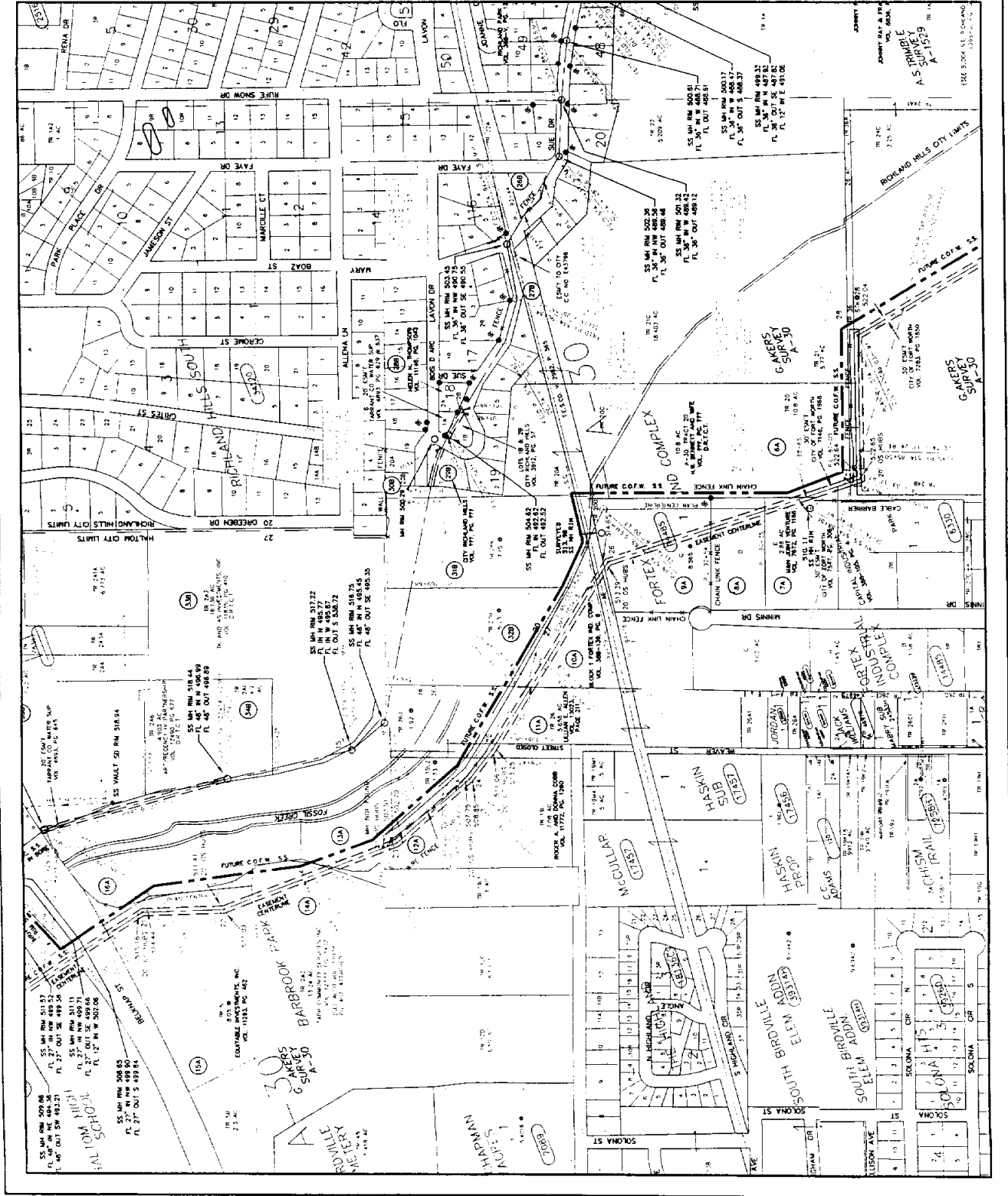
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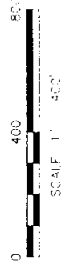
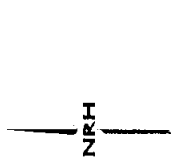
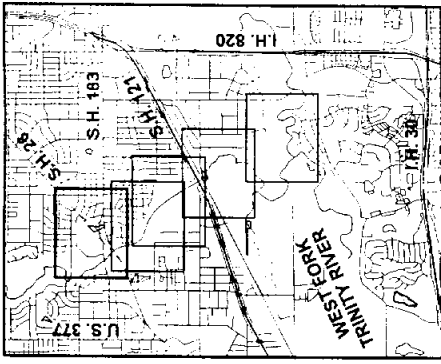
**BIG FOSSIL SEWER STUDY**  
**R.O.W. STRIP MAP**  
 CITY OF NORTH RICHLAND HILLS

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
 CONSULTING ENGINEERS / Fort Worth, Texas

DATE: 11/17/99  
 DRAWN BY: J. W. HARRIS  
 CHECKED BY: J. W. HARRIS  
 SCALE: AS SHOWN





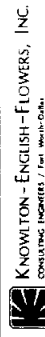


Notes:

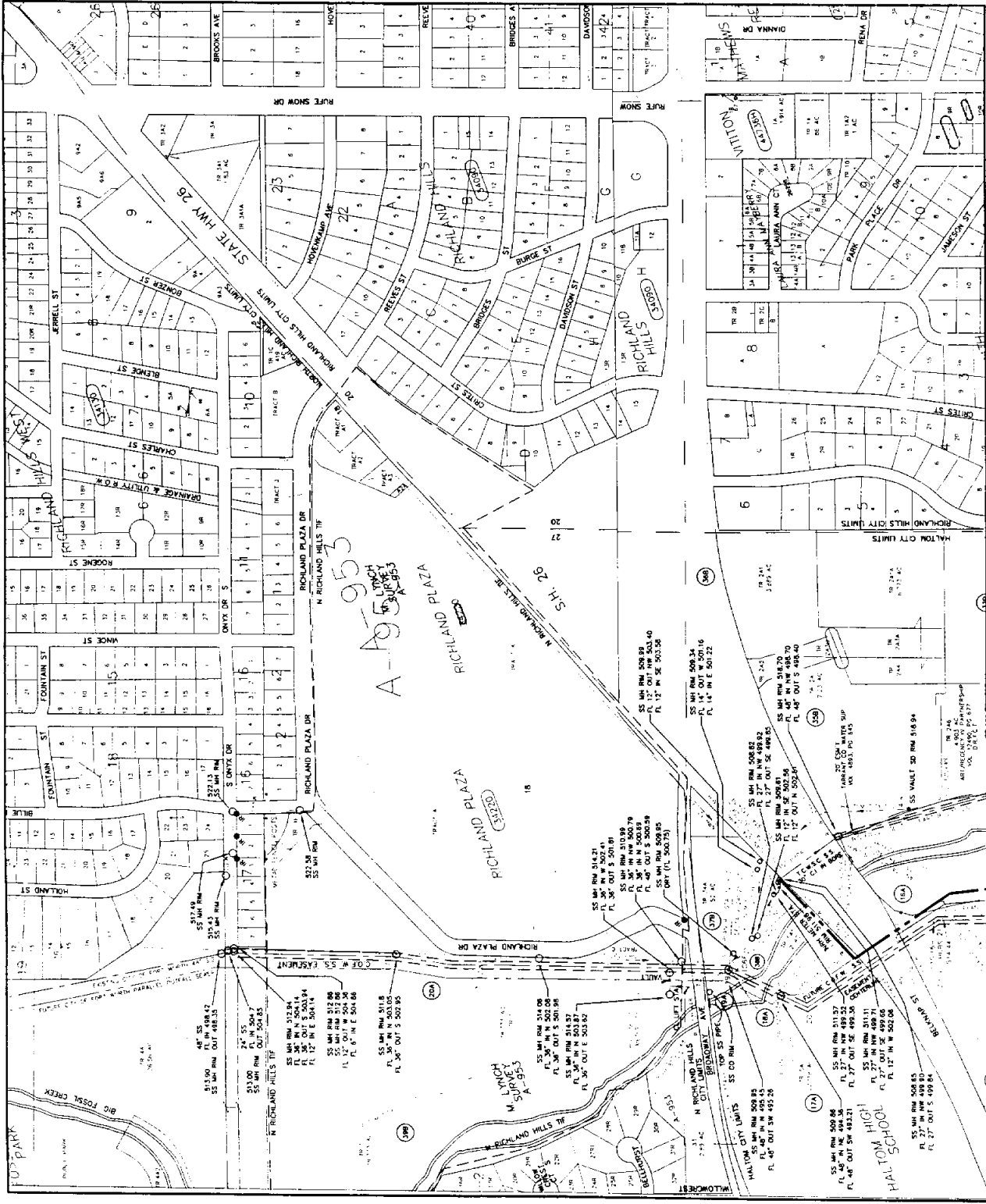
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**BIG FOSSIL SEWER STUDY**  
**R.O.W. STRIP MAP**

CITY OF NORTH RICHLAND HILLS



|                       |                 |                         |
|-----------------------|-----------------|-------------------------|
| DESIGNED BY: BAA      | CHECKED BY: BAA | DATE: 11/1/89           |
| DRAWN BY: BAA         | SCALE: AS SHOWN | PROJECT NO.: 89-483-308 |
| DATE PLOTTED: 11/1/89 | BY: BAA         |                         |



| Parcel | Location             | Owner                        | Address                     | City             | ST. | Zip   | Survey  | Abstract | Tract | Subdivision            | Lot Block | Date       | Volume | Page | Easement Volume | Page |
|--------|----------------------|------------------------------|-----------------------------|------------------|-----|-------|---------|----------|-------|------------------------|-----------|------------|--------|------|-----------------|------|
| 1A     | Fort Worth           | KD&G Consolidated LLC        | PO BOX 185219               | Fl. Worth        | TX  | 76181 | Largent | 960      | 1     |                        |           | 11/19/1997 | 12990  | 193  | 7093            | 252  |
| 2A     | Fort Worth           | SCA Services of FW Inc.      | 669 Airport Fwy. #500       | Hurst            | TX  | 76053 | Norris  | 1165     | 4     |                        |           |            |        |      |                 |      |
| 3A     | Haltom City          | Railroad                     |                             |                  |     |       | Norris  | 1165     |       |                        |           |            |        |      |                 |      |
| 4A     | Haltom City          | State Hwy. 121               |                             |                  |     |       | Norris  | 1165     |       |                        |           |            |        |      |                 |      |
|        | Haltom City          | State Hwy. 121               |                             |                  |     |       | Stanley | 1379     |       |                        |           |            |        |      |                 |      |
|        | Haltom City          | State Hwy. 121               |                             |                  |     |       | Trimble | 529      |       |                        |           |            |        |      |                 |      |
| 5A     | Haltom City          | 50% GFS First Asset LC (E)AI | 8441 E. 32nd St. N. #200    | Wichita          | KS  | 67226 | Akers   | 30       | 24    | (Condemnation Hearing) |           | 06/14/1996 | 12478  | 911  | 7283            | 1850 |
| 6A     | Haltom City          | Bennet H.W. Mrs. Est. [2]    | 5942 Abrams Rd. #113        | Dallas           | TX  | 75231 | Akers   | 30       | 36    | (Small Strip)          |           | 05/20/1979 | 6741   | 2479 |                 |      |
| 7A     | Haltom City          | Bennet H.W. Mrs. Est. [3]    | 3400 W. Park Blvd. Apt 1031 | Plano            | TX  | 75075 | Akers   | 30       | 20    |                        |           | 05/10/1945 | 1745   | 413  | 7146            | 1967 |
| 8A     | Haltom City          | M&N JV                       | 3401 W. Park Blvd. Apt 1031 | Plano            | TX  | 75076 | Akers   | 30       |       |                        |           | 11/16/1983 | 7672   | 1166 | 7547            | 306  |
| 9A     | Haltom City          | [1] Gunn Investments, L.P.   | PO BOX 100206               | Fl. Worth        | TX  | 76109 | Akers   | 30       |       | Fortex Ind. Complex    | E 1       | 07/20/1999 | 13931  | 70   | 7547            | 306  |
| 10A    | Haltom City          | Klabzuba Properties II       | 3909 Ann Arbor Ct.          | Fl. Worth        | TX  | 76102 | Akers   | 30       |       | Fortex Ind. Complex    | D 1       | 04/01/1996 | 12621  | 1460 | 7547            | 306  |
| 11A    | Haltom City          |                              | 930 W. 1st St.              | Bedford          | TX  | 76021 | Akers   | 30       | 26    |                        |           | 10/22/1997 | 13023  | 211  | 7547            | 306  |
| 12A    | Haltom City          | Allen Lillian E              | 2140 San Fernando St.       | Fl. Worth        | TX  | 76117 | Akers   | 30       | 19L   |                        |           | 10/24/1994 | 11772  | 1260 | 7084            | 2284 |
| 13A    | Richland Hills       | Cobb Roger A & Donna         | 3220 Haltom Rd              | Fl. Worth        | TX  | 76117 | Akers   | 30       | 2A2   |                        |           | 02/11/1998 | 13078  | 407  | 7175            | 416  |
| 14A    | Haltom City          | Tapp Community Services      | 2404 Yeager St              | White Settlement | TX  | 76112 | Akers   | 30       | 5     |                        |           | 10/22/1993 | 11293  | 462  | 7146            | 1948 |
| 15A    | Haltom City          | Equitable Investments Inc    | 7600 Scott St.              | White Settlement | TX  | 76108 | Akers   | 30       |       |                        |           |            |        |      |                 |      |
| 16A    | Haltom City          | Grapevine Hwy                |                             |                  |     |       | Akers   | 30       |       |                        |           |            |        |      |                 |      |
| 17A    | Haltom City          | Birdville I S D              |                             |                  |     |       | Akers   | 30       |       |                        |           |            |        |      |                 |      |
| 18A    | Haltom City          | City Of Richland Hills       | E. Belnap St.               | Fl. Worth        | TX  | 76117 | Akers   | 30       | 5A    | Haltom Hills           |           | 03/12/1956 | 2969   | 383  | 4922            | 448  |
| 19A    | Haltom City          | Same As 17?                  | E. Belnap St.               | Fl. Worth        | TX  | 76118 | Akers   | 30       | 5A1   |                        |           | 03/05/1964 | 3906   | 355  | 7146            | 1946 |
| 20A    | North Richland Hills | Birdville I S D              | Broadway Ave.               | NRH              |     |       | Lynch   | 953      | 1     | Haltom Hills           |           | 03/12/1956 | 2969   | 383  | 4922            | 448  |
| NOTES: |                      |                              |                             |                  |     |       |         |          |       |                        |           |            |        |      |                 |      |
| [1]    | Previous Owner.      | Terry Fricks                 |                             |                  |     |       |         |          |       |                        |           |            |        |      |                 |      |
| [2]    |                      | & General Financial Services | 2524 Minnis Drive           | Fl. Worth        | TX  | 76117 |         |          |       |                        |           |            |        |      |                 |      |
| [3]    |                      | Attn. Patsy Brown            |                             |                  |     |       |         |          |       |                        |           |            |        |      |                 |      |

T.C.W.S.C. (Tarrant County Water Supply Corporation Outfall Sewer -- Currently Serves Richland Hills and North Richland Hills)

| Parcel | Location       | Owner                          | Address           | City           | ST. | Zip   | Survey       | Abstract | Tract | Area   | Addition | Lot | Block | Date       | Volume | Page | Easement Volume | Page |      |
|--------|----------------|--------------------------------|-------------------|----------------|-----|-------|--------------|----------|-------|--------|----------|-----|-------|------------|--------|------|-----------------|------|------|
| 1B     | Fort Worth     | LRB Holdings Inc               | 7101 Alcoa Drive  | Ft Worth       | TX  | 76118 | H.P. Largent | 960      | 1N    | 12.734 |          | 6   | 9     | 09/15/1997 | 12914  | 141  | TAD             | 4070 | 339  |
| 2B     | Fort Worth     | LRB Holdings Inc               | 7101 Alcoa Drive  | Ft Worth       | TX  | 76118 | H.P. Largent | 960      | 1N    | 12.734 |          | 6   | 9     | 09/15/1997 | 12914  | 141  | TAD             | 4070 | 339  |
| 3B     | Fort Worth     | LRB Holdings Inc               | 7101 Alcoa Drive  | Ft Worth       | TX  | 76118 | H.P. Largent | 960      | 1N    | 12.734 |          | 6   | 9     | 09/15/1997 | 12914  | 141  | TAD             | 4070 | 339  |
| 4B     | Fort Worth     | KD&G Consolidated LLC          | P.O. BOX 185219   | Dallas         | TX  | 75204 | W.M. Norris  | 1165     | 3A3   | 162.25 |          | 6   | 6     | 04/09/1999 | 12961  | 193  | TAD             | 4070 | 339  |
| 5B     | Fort Worth     | Austin International Ventures  | 3525 Travis #300  | Dallas         | TX  | 75204 | W.M. Norris  | 1165     | 3A3   | 162.25 |          | 6   | 6     | 04/09/1999 | 12961  | 193  | TAD             | 4070 | 339  |
| 6B     | Fort Worth     | A.E. Jones & Buamla Etux       | 2405 Austin Road  | Ft Worth       | TX  | 76118 | W.M. Norris  | 1165     | 3A3   | 162.25 |          | 6   | 6     | 07/13/1964 | 3022   | 508  | ABS             | 4058 | 335  |
| 7B     | Fort Worth     | City of Richland Hills         | 3201 Diana Drive  | Ft Worth       | TX  | 76180 | W.M. Norris  | 1165     | 3A2B  |        |          | 6B  | 6     | 12/23/1964 | 4012   | 675  |                 |      |      |
| 8B     | Fort Worth     | City of Richland Hills         | 3201 Diana Drive  | Ft Worth       | TX  | 76180 | W.M. Norris  | 1165     | 3A2B  |        |          | 6B  | 6     | 12/23/1964 | 4012   | 675  |                 |      |      |
| 9B     | Fort Worth     | City of Richland Hills         | 3201 Diana Drive  | Ft Worth       | TX  | 76180 | W.M. Norris  | 1165     | 3A2B  |        |          | 6B  | 6     | 12/23/1964 | 4012   | 675  |                 |      |      |
| 10B    | Fort Worth     | City of Richland Hills         | 3201 Diana Drive  | Ft Worth       | TX  | 76180 | W.M. Norris  | 1165     | 3A2B  |        |          | 6B  | 6     | 12/23/1964 | 4012   | 675  |                 |      |      |
| 11B    | Fort Worth     | City of Richland Hills         | 3201 Diana Drive  | Ft Worth       | TX  | 76180 | W.M. Norris  | 1165     | 3A2B  |        |          | 6B  | 6     | 12/23/1964 | 4012   | 675  |                 |      |      |
| 12B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | W.M. Norris  | 1165     | 3D1   |        |          |     |       |            |        |      |                 |      |      |
| 13B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | W.M. Norris  | 1165     | 3D1   |        |          |     |       |            |        |      |                 |      |      |
| 14B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | W.M. Norris  | 1165     | 3D1   |        |          |     |       |            |        |      |                 |      |      |
| 15B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | W.M. Norris  | 1165     | 3D1   |        |          |     |       |            |        |      |                 |      |      |
| 16B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | W.M. Norris  | 1165     | 3D1   |        |          |     |       |            |        |      |                 |      |      |
| 17B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | W.M. Norris  | 1165     | 3D1   |        |          |     |       |            |        |      |                 |      |      |
| 18B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | W.M. Norris  | 1165     | 3D1   |        |          |     |       |            |        |      |                 |      |      |
| 19B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | W.M. Norris  | 1165     | 3D1   |        |          |     |       |            |        |      |                 |      |      |
| 20B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | W.M. Norris  | 1165     | 3D1   |        |          |     |       |            |        |      |                 |      |      |
| 21B    | Richland Hills | Price Johnny R. & Frances ETUX | 2600 Rosebud Lane | Ft Worth       | TX  | 76118 | A. Trimble   | 1529     | 2L2   |        |          | 10  | 53    | 12/23/1964 | 3915   | 355  |                 |      | 329  |
| 22B    | Richland Hills | Price Johnny R. & Frances ETUX | 2653 Rosebud Ln   | Ft Worth       | TX  | 76118 | A. Trimble   | 1529     | 2L2   |        |          | 9   | 53    | 12/23/1964 | 4012   | 675  |                 |      |      |
| 23B    | Richland Hills | Price Johnny R. & Frances ETUX | 2654 Rosebud Ln   | Ft Worth       | TX  | 76118 | A. Trimble   | 1529     | 2L2   |        |          | 1   | 53    | 12/23/1964 | 4012   | 675  |                 |      |      |
| 24B    | Richland Hills | Howell Joe & Nina Jean ETUX    | 2659 Rosebud Ln   | Ft Worth       | TX  | 76118 | A. Trimble   | 1529     | 2L2   |        |          | 4A1 | 53    | 02/04/1987 | 7822   | 801  |                 |      | 449  |
| 25B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76118 | A. Trimble   | 1529     | 2L2   |        |          | 4A1 | 53    | 02/04/1987 | 7822   | 801  |                 |      | 449  |
| 26B    | Richland Hills | Harvey Thomas E                | 6600 Sue Drive    | Ft Worth       | TX  | 76118 | G. Akers     | 30       | 20C   |        |          | 3A  | 53    | 09/15/1988 | 9388   | 2366 | TAD             | 4106 | 267  |
| 27B    | Richland Hills | Texas Electric Service Company | 6600 Sue Drive    | Ft Worth       | TX  | 76118 | G. Akers     | 30       | 20C   |        |          | 2   | 53    | 08/12/1996 | 12472  | 732  |                 |      | 273  |
| 28B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76118 | G. Akers     | 30       | 20C   |        |          | 1   | 52    | 08/05/1953 | 2603   | 392  | ABS             | 4091 | 452  |
| 29B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76118 | G. Akers     | 30       | 20C   |        |          | 1   | 20    | 05/04/1976 | 6008   | 956  |                 |      | 601  |
| 30B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76118 | G. Akers     | 30       | 20C   |        |          | 1   | 20    | 05/04/1976 | 6008   | 956  |                 |      | 601  |
| 31B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76118 | G. Akers     | 30       | 20C   |        |          | 1   | 20    | 05/04/1976 | 6008   | 956  |                 |      | 601  |
| 32B    | Richland Hills | City of Richland Hills         | 3202 Diana Drive  | Ft Worth       | TX  | 76118 | G. Akers     | 30       | 20C   |        |          | 1   | 20    | 05/04/1976 | 6008   | 956  |                 |      | 601  |
| 33B    | Hallom City    | TK & AS Investments Inc        | P.O. Box 498042   | Garland        | TX  | 75049 | G. Akers     | 30       | 20C   |        |          | 1   | 19    | 03/20/1964 | 3912   | 57   |                 |      | 4883 |
| 34B    | Hallom City    | TK & AS Investments Inc        | P.O. Box 498042   | Garland        | TX  | 75049 | G. Akers     | 30       | 20C   |        |          | 1   | 19    | 03/20/1964 | 3912   | 57   |                 |      | 4883 |
| 35B    | Hallom City    | ART/REGENCY TV Ptnrshp         | 21616 Cezanne Pl  | Woodland Hills | CA  | 91364 | G. Akers     | 30       | 2A7   |        |          |     |       |            |        |      |                 |      |      |
| 36B    | Hallom City    | TK & AS Investments Inc        | P.O. Box 498042   | Garland        | TX  | 75049 | G. Akers     | 30       | 2A6   |        |          |     |       |            |        |      |                 |      |      |
| 37B    | Hallom City    | TK & AS Investments Inc        | P.O. Box 498042   | Garland        | TX  | 75049 | G. Akers     | 30       | 2A6   |        |          |     |       |            |        |      |                 |      |      |
| 38B    | Hallom City    | TK & AS Investments Inc        | P.O. Box 498042   | Garland        | TX  | 75049 | G. Akers     | 30       | 2A6   |        |          |     |       |            |        |      |                 |      |      |
| 39B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 40B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 41B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 42B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 43B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 44B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 45B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 46B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 47B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 48B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 49B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 50B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 51B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 52B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 53B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 54B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 55B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 56B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 57B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 58B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 59B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 60B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 61B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 62B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 63B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 64B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 65B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 66B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 67B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 68B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 69B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 70B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 71B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 72B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 73B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 74B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  | 76181 | G. Akers     | 30       | 5A    |        |          |     |       |            |        |      |                 |      |      |
| 75B    | NRH            | Birdville I.S.D                | 3202 Diana Drive  | Ft Worth       | TX  |       |              |          |       |        |          |     |       |            |        |      |                 |      |      |

**PROPOSED ALTERNATE ROUTE  
FOR THE BIG FOSSIL PARALLEL OUTFALL LINE**

**BY**

**CITY OF FORT WORTH**

**WATER DEPARTMENT**

**(See Revised Map TAB 9)**



City of Fort Worth Water Department  
 Administration Division  
 P.O. Box 870 - 1000 Throckmorton Street  
 Fort Worth, TX 76101-0870  
 Phone 817/871-8220  
 Fax 817/871-8195


**FAX**

Date: 12-29-99  
 Number of pages including cover sheet: 3

To: Richard Albin  
Knowlton-English-Flowers

Phone 283-6211  
 Fax 354-4389

From:



**KUO-CHING "PETER" FU**  
 WASTEWATER FACILITIES ENGINEER

WATER DEPARTMENT  
 ENGINEERING SERVICES DIVISION

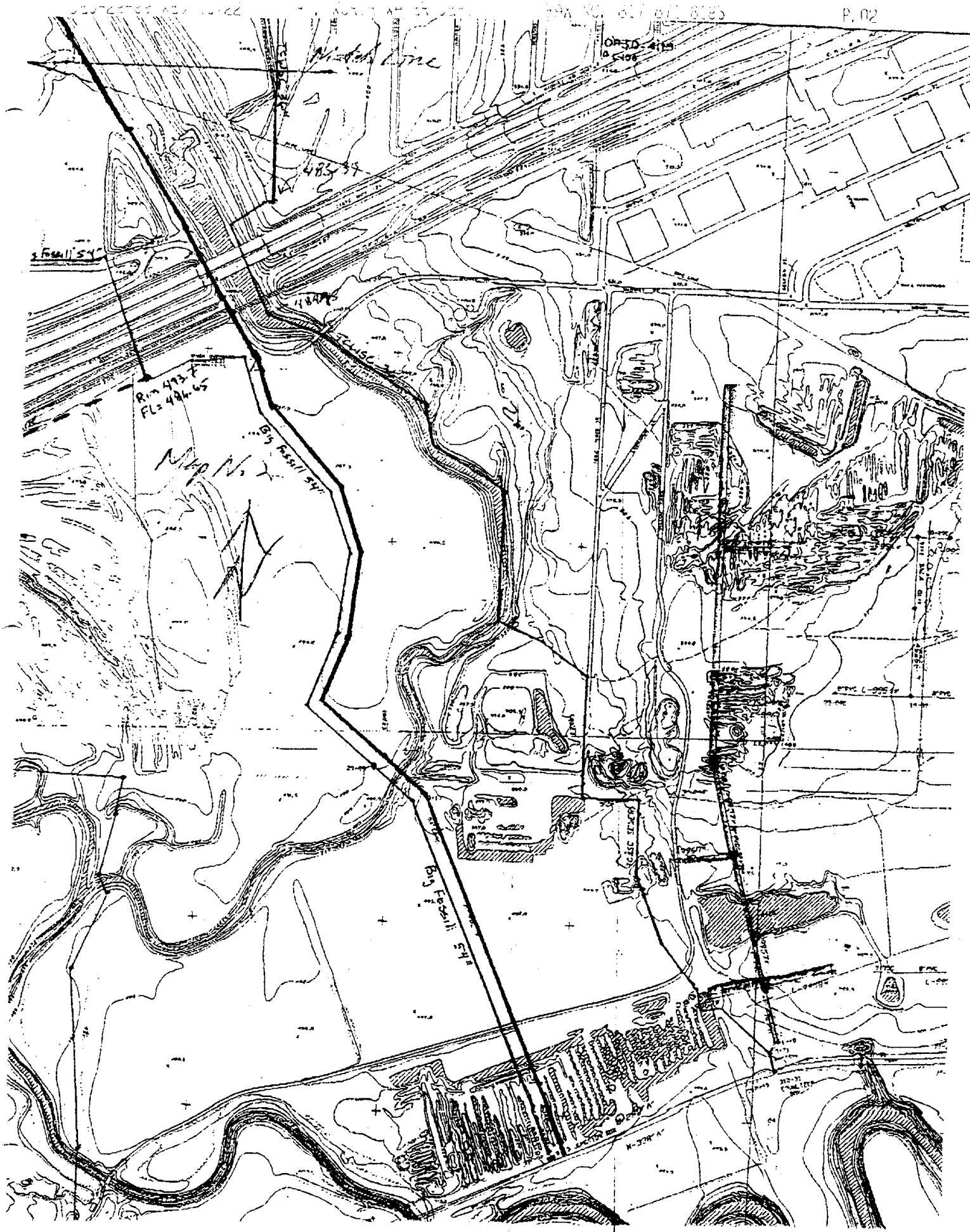
CITY OF FORT WORTH  
 1000 THROCKMORTON STREET • FORT WORTH, TEXAS 76102  
 (817) 871-8438 • FAX (817) 871-8195

Remarks:  Urgent  For your review  Reply ASAP  Please comment  FYI

*Richard, per our previous discussion as shown on the attached map is an alternative alignment selected, based on accessibility and maintainability in mind. If you have any questions please let me know.*

*Thanks*  
*Peter*





**TAB 4**

**BIG FOSSIL SEWER STUDY**

**CITY OF FORT WORTH**

**AND**

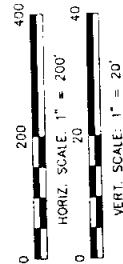
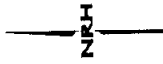
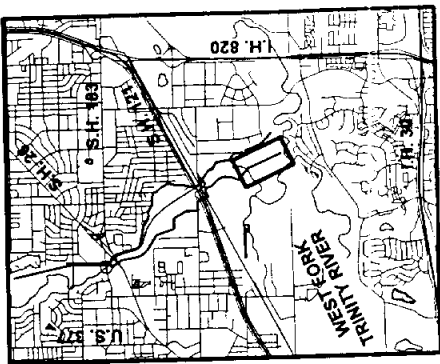
**TARRANT COUNTY WATER SUPPLY CORP.**

**SANITARY SEWER OUTFALLS**

**PROFILE SHEETS**



***CITY OF FORT WORTH***  
***OUTFALL SEWER***  
***PROFILES***



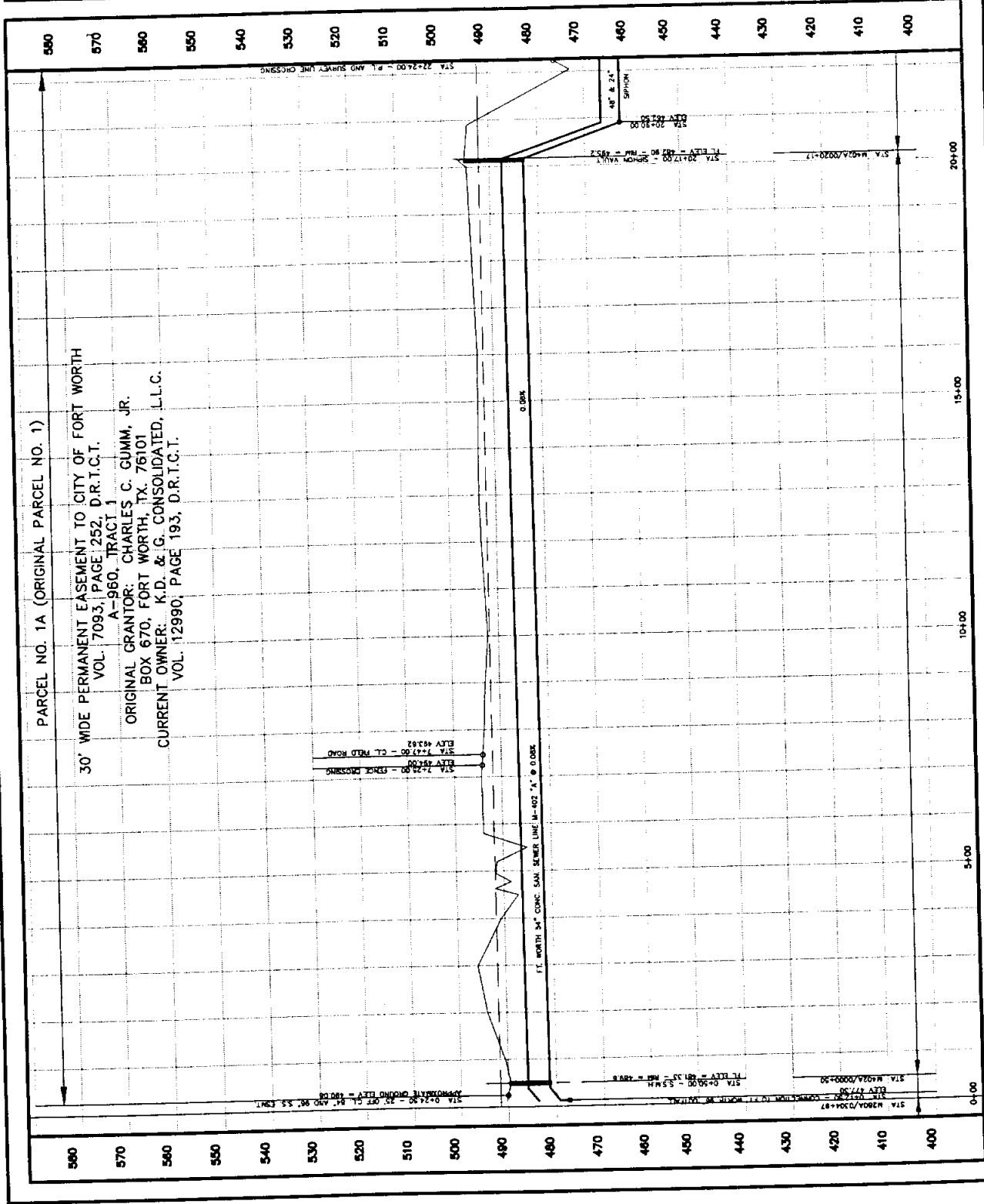
Notes:

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/1/89, between the City of North Richland Hills and the TYPDB, with funding participation by the City of Fort Worth, Haltom City and Richardson Hills.
2. This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors (817-282-8981), dated 11/1/99, with R.O.W. document research by Universal Field Services, Inc. (918-484-7600), and KEF, Inc., (817-283-6211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

**BIG FOSSIL SEWER STUDY**  
**FORT WORTH OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
 CONSULTING ENGINEERS / FORT WORTH, TEXAS

DESIGNED BY: [blank] DATE: [blank]  
 DRAWN BY: [blank] DATE: [blank]  
 CHECKED BY: [blank] DATE: [blank]



PARCEL NO. 1A (ORIGINAL PARCEL NO. 1)  
 30' WIDE PERMANENT EASEMENT TO CITY OF FORT WORTH  
 VOL. 7093, PAGE 252, D.R.T.C.T.  
 A-960, TRACT 1  
 ORIGINAL GRANTOR: CHARLES C. GUMM, JR.  
 BOX 670, FORT WORTH, TX, 76101  
 CURRENT OWNER: K.D. & G. CONSOLIDATED, L.L.C.  
 VOL. 12990, PAGE 193, D.R.T.C.T.

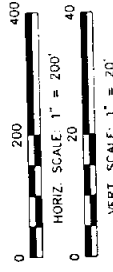
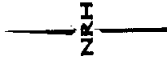
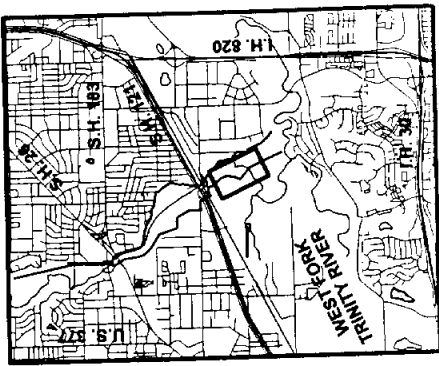
STA 1+72.00 - FENCE CROSSING  
 ELEV 487.00  
 STA 1+72.00 - CL FIELD ROAD  
 ELEV 483.82

12" NORTH 34° CORIC SAN. SEWER LINE IN 60' A. @ 0.00%

48' x 24" MANHOLE  
 STA 2+21.70 - SPURON VALVE  
 ELEV 487.00  
 STA 2+24.00 - SPURON VALVE  
 ELEV 485.2

STA 0+24.90 - 20' OFF CL. RT. AND 90' SS. CRT.  
 APPROXIMATE GROUND ELEV = 480.00  
 STA 0+50.00 - 5.9' RT.  
 STA 0+50.00 - 91.55' - 90' RT. - 90' RT.

STA 10+00/20+00-87  
 STA 10+00/20+00-87  
 STA 10+00/20+00-87

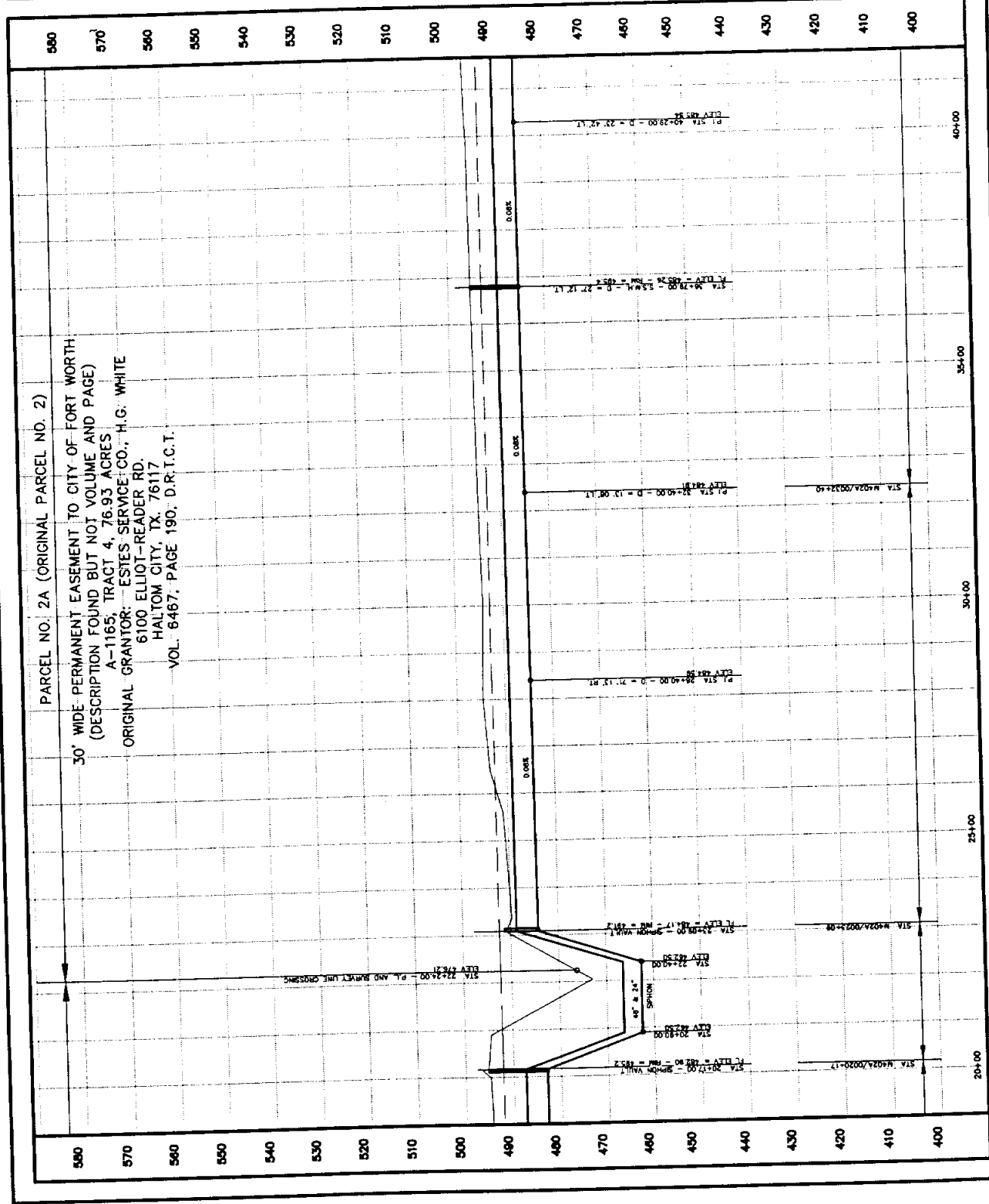


Notes:

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 89-483-308, dated 5/18/98, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors, (817-282-5981), dated 11/17/99, with R.O.W. document research by Universal Field Services, Inc. (918-494-7500), and KEF, Inc. (817-283-6211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

**BIG FOSSIL SEWER STUDY**  
**FORT WORTH OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS  
**KNOWLTON - ENGLISH-FLOWERS, INC.**  
 CONSULTING ENGINEER / PLAN WORK-ORDER

DESIGNED BY: RHA  
 DRAWN BY: RHA  
 CHECKED BY: JAL  
 DATE: 11/18/99  
 JOB NO. 3-158  
 SHEET NO. 2 OF 7



PARCEL NO. 2A (ORIGINAL PARCEL NO. 2)

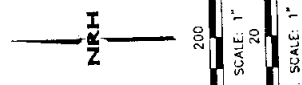
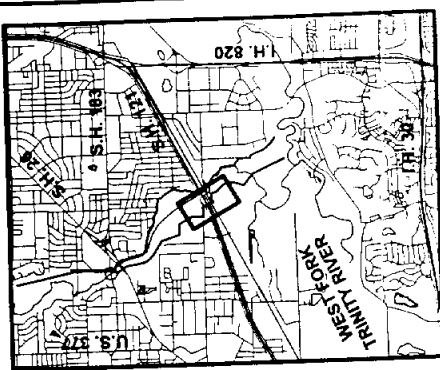
30' WIDE PERMANENT EASEMENT TO CITY OF FORT WORTH  
 (DESCRIPTION FOUND BUT NOT VOLUME AND PAGE)

A-1165, TRACT 4, 76.93 ACRES

ORIGINAL GRANTOR: ESTES SERVICE CO., H.G. WHITE

6100 ELLIOT-READER RD.  
 HALTOM CITY, TX. 76117

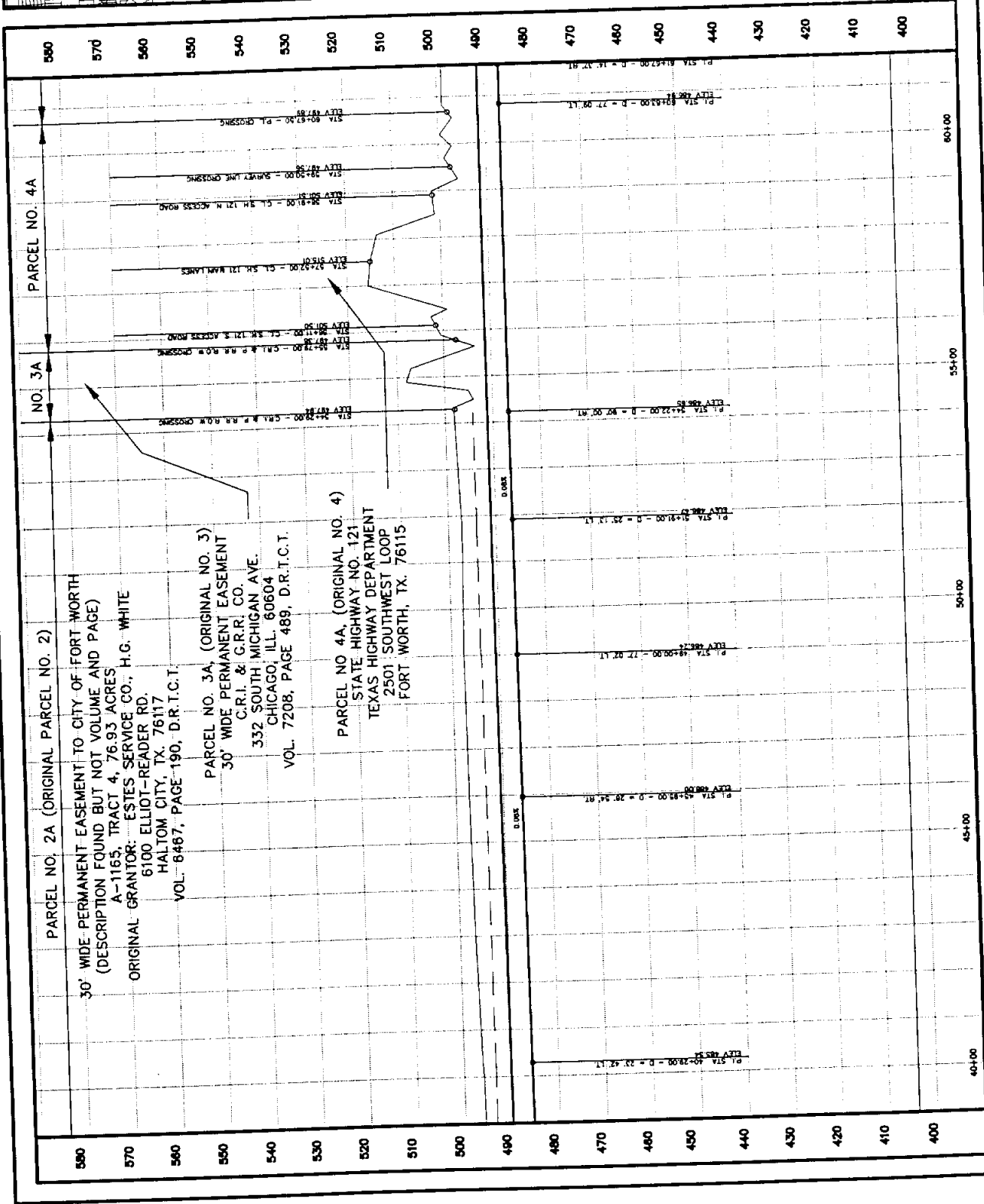
VOL. 6467, PAGE 190; D.R.T.C.T.



**Notes:**

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/89, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors, (817-282-6981), dated 11/11/99, with R.O.W. document research by Universal Field Services, Inc. (818-494-7600), and KEF, Inc. (817-283-0211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

**BIG FOSSIL SEWER STUDY**  
**FORT WORTH OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS



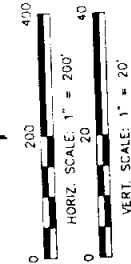
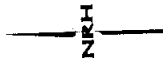
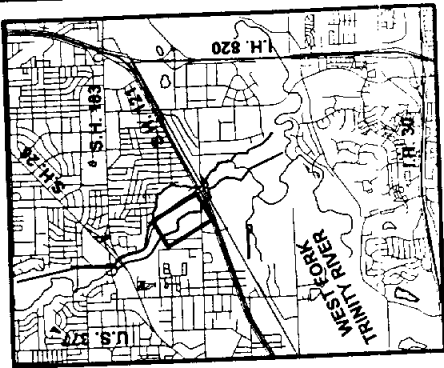
PARCEL NO. 2A (ORIGINAL PARCEL NO. 2)

30' WIDE PERMANENT EASEMENT TO CITY OF FORT WORTH  
 (DESCRIPTION FOUND BUT NOT VOLUME AND PAGE)  
 A-1165, TRACT 4, 76.93 ACRES  
 ORIGINAL GRANTOR: ESTES SERVICE CO., H.G. WHITE  
 6100 ELLIOT-READER RD.  
 HALTOM CITY, TX, 76117  
 VOL. 6467, PAGE 190, D.R. I.C.T.

PARCEL NO. 3A, (ORIGINAL NO. 3)  
 30' WIDE PERMANENT EASEMENT  
 C.R.I. & G.R.R. CO.  
 332 SOUTH MICHIGAN AVE.  
 CHICAGO, ILL. 60604  
 VOL. 7208, PAGE 489, D.R. I.C.T.

PARCEL NO. 4A, (ORIGINAL NO. 4)  
 STATE HIGHWAY NO. 121  
 TEXAS HIGHWAY DEPARTMENT  
 2501 SOUTHWEST LOOP  
 FORT WORTH, TX, 76115

|                        |                    |                  |
|------------------------|--------------------|------------------|
| PROJECT NO. 99-483-308 | DATE 11/11/99      | SHEET NO. 3 OF 7 |
| DRAWN BY: [Name]       | CHECKED BY: [Name] | SCALE: 1" = 20'  |



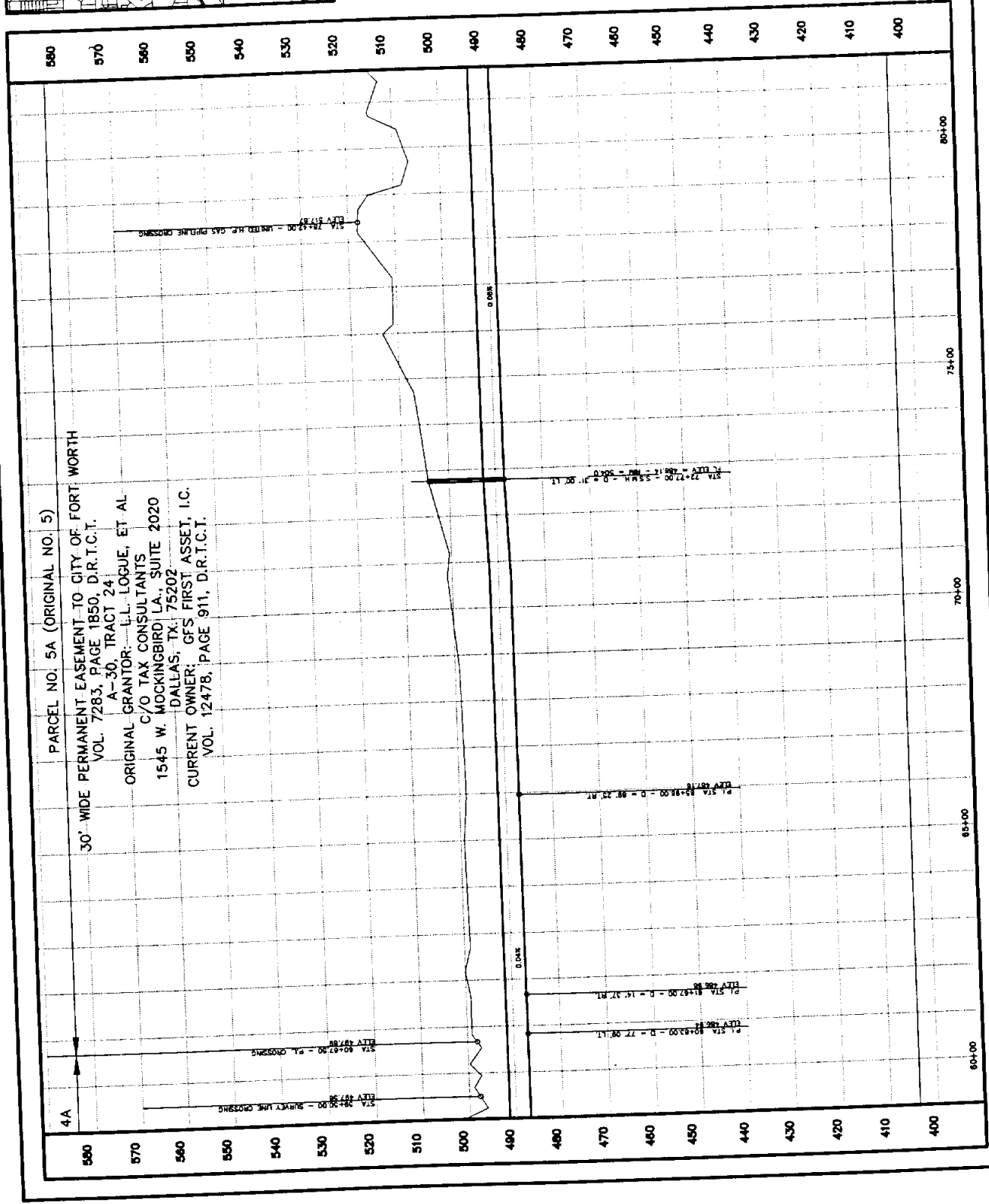
**Notes:**

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. This drawing is based on a field survey prepared by Spomer & Associates, Inc., Land Surveyors, (817-282-8891), dated 11/1/99, with R.O.W. document research by Universal Field Services, Inc. (818-354-7600), and KEF, Inc. (817-283-6211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

**BIG FOSSIL SEWER STUDY**  
**FORT WORTH OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS

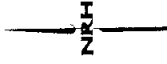
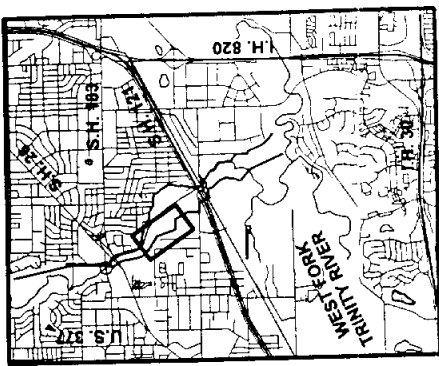
**KIMMELTON-ENGLISH-FLOWERS, INC.**  
 CONSULTING ENGINEERS / FORT WORTH OFFICE

DATE: 11/1/99  
 SHEET NO. 1-10  
 PROJECT NO. 99-483-308  
 SCALE: 1" = 20'



PARCEL NO. 5A (ORIGINAL NO. 5)  
 30' WIDE PERMANENT EASEMENT TO CITY OF FORT WORTH  
 VOL. 7283, PAGE 1850, D.R.T.C.T.  
 A-30, TRACT 24  
 ORIGINAL GRANTOR: L.L. LOGUE, ET AL  
 C/O TAX CONSULTANTS  
 1545 W. MOCKINGBIRD LA., SUITE 2020  
 DALLAS, TX. 75202  
 CURRENT OWNER: GFS FIRST ASSET, I.C.  
 VOL. 12478, PAGE 911, D.R.T.C.T.

4A



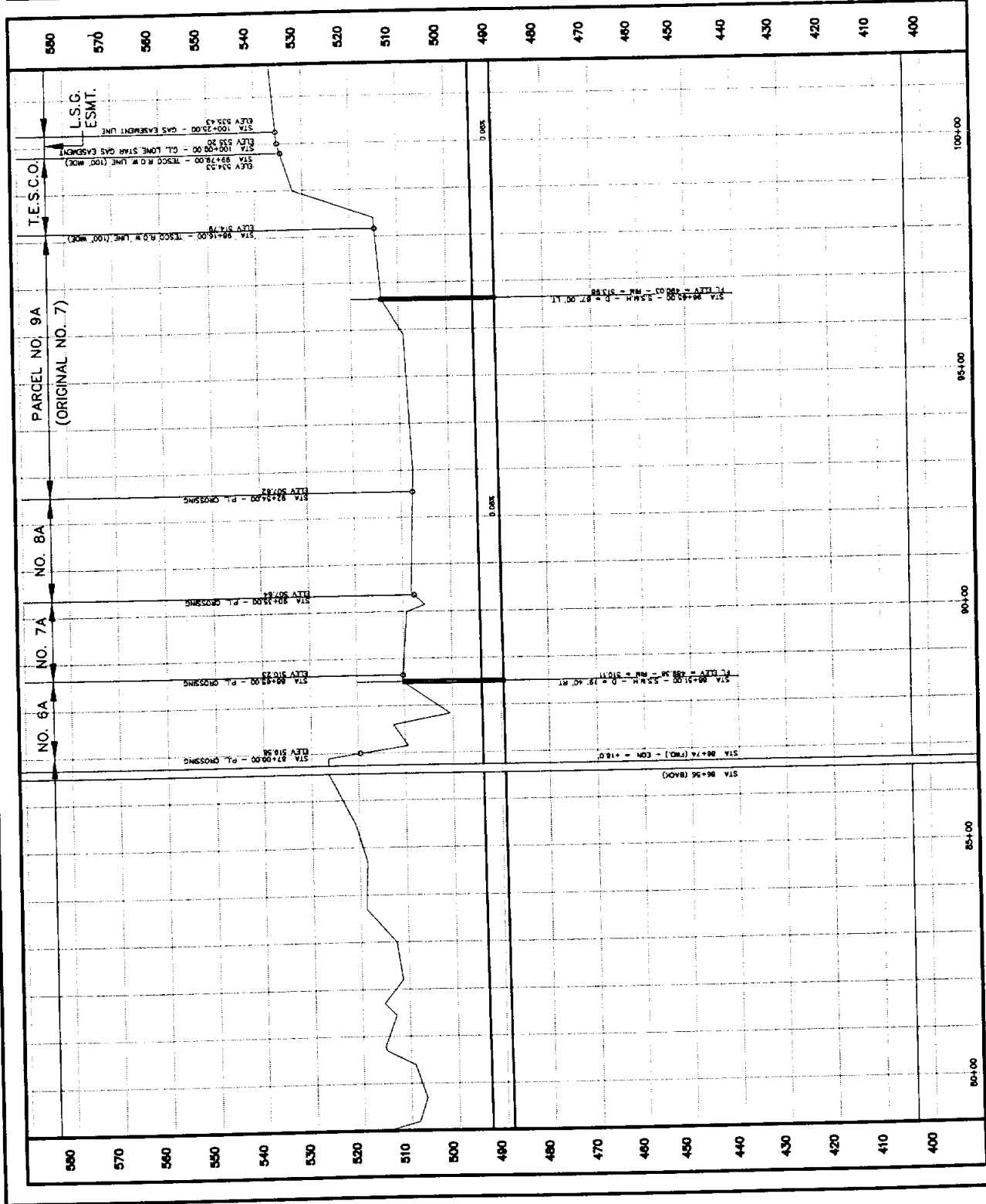
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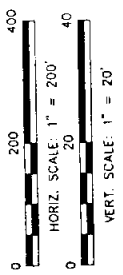
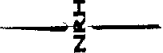
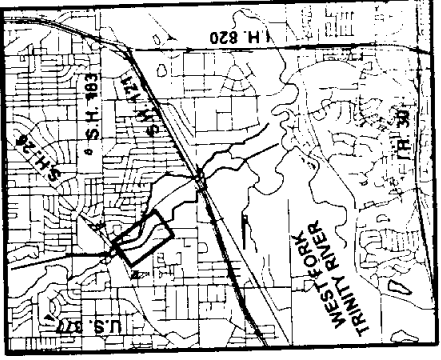
- This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-208, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
- This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors (817-282-6987), dated 1/11/99, with R.O.W. document research by Universal Field Services, Inc. (918-494-7600), and KEF, Inc., (817-283-6211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

**BIG FOSSIL SEWER STUDY**  
**FORT WORTH OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS



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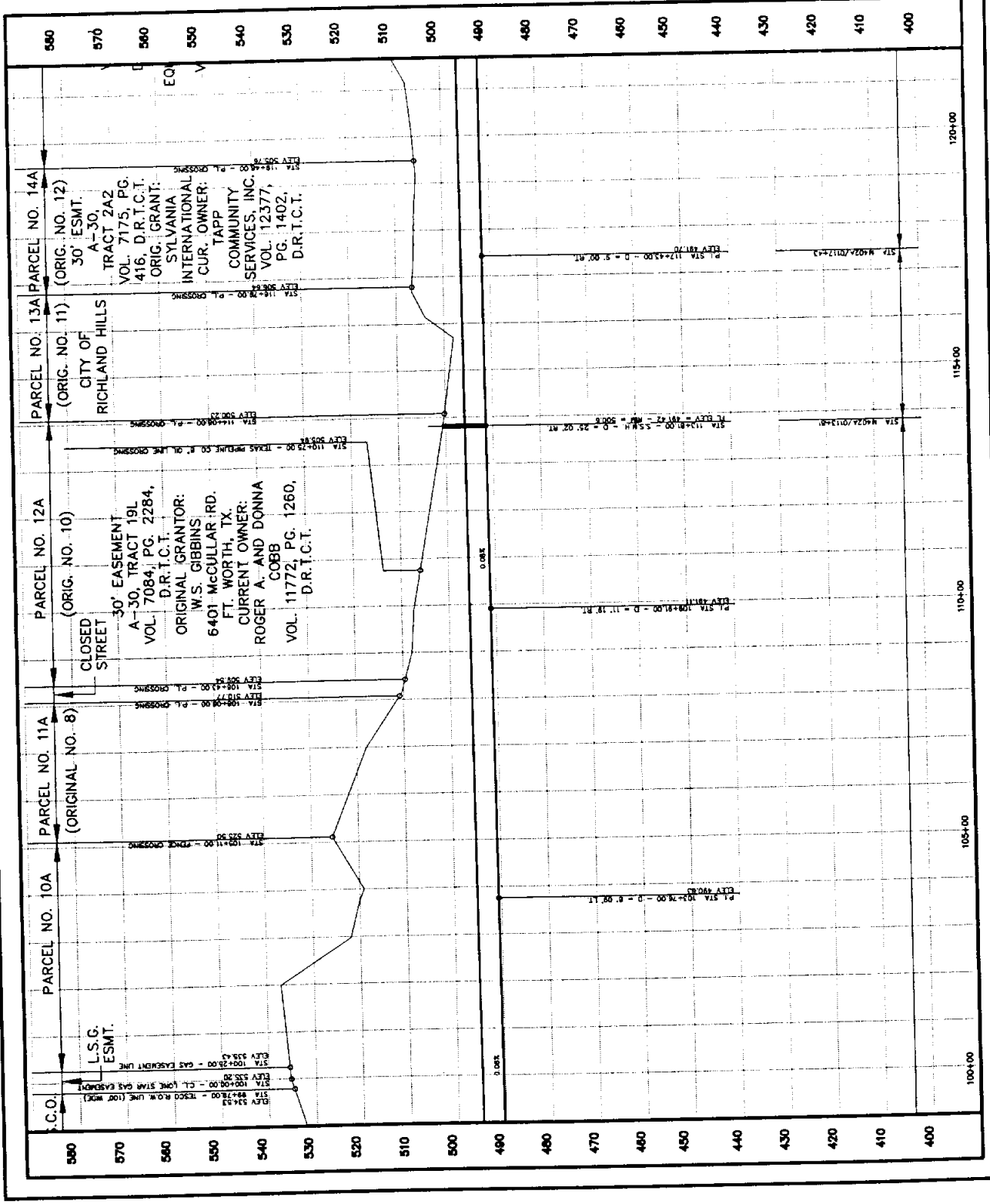
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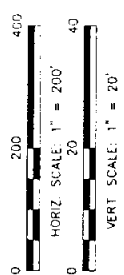
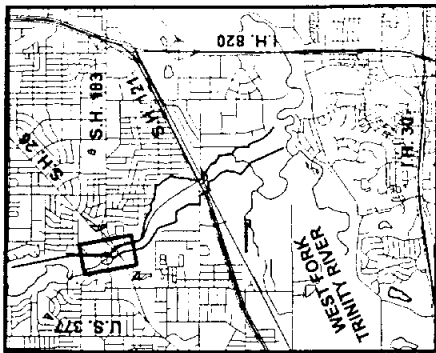
**BIG FOSSIL SEWER STUDY**  
**FORT WORTH OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS

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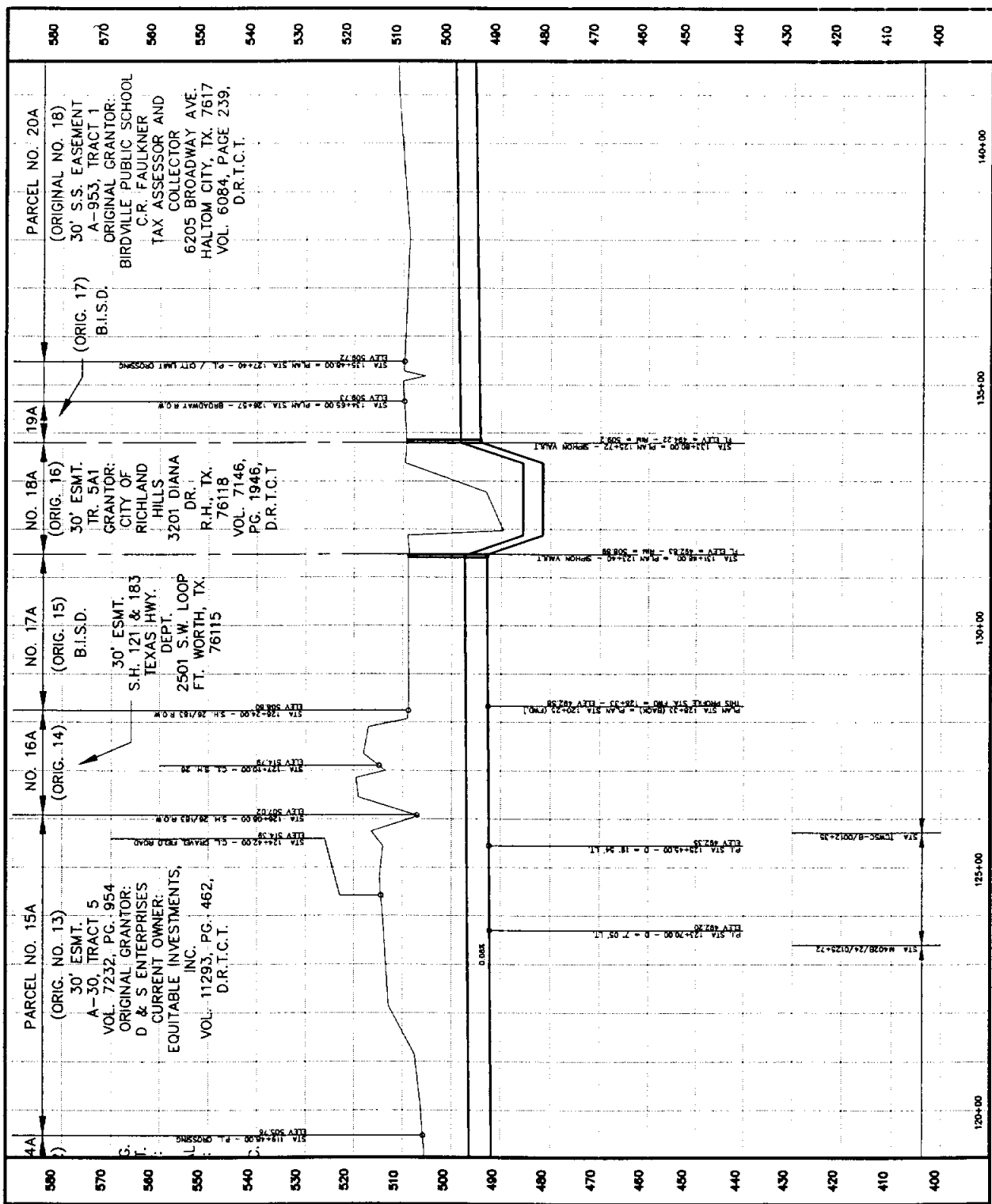


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**BIG FOSSIL SEWER STUDY**  
**FORT WORTH OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
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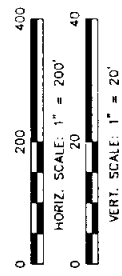
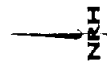
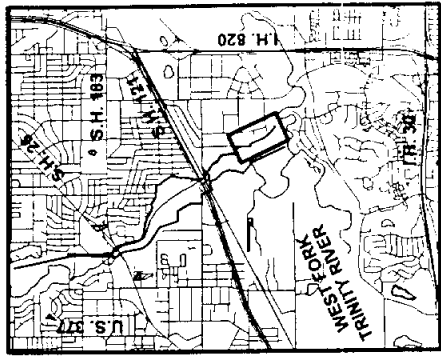




**TARRANT COUNTY WATER SUPPLY CORP.**

**OUTFALL SEWER**

**PROFILES**



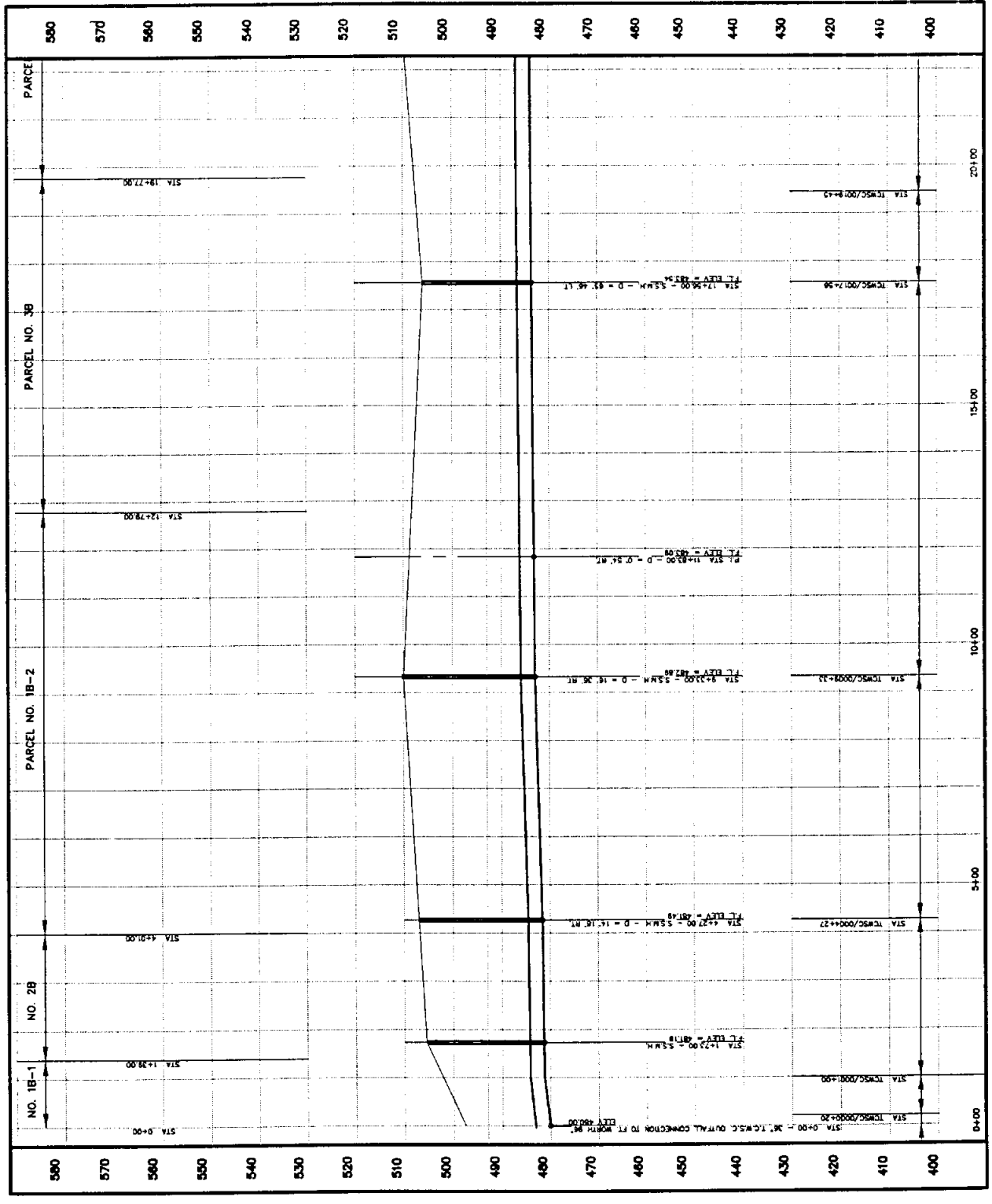
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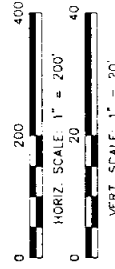
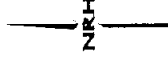
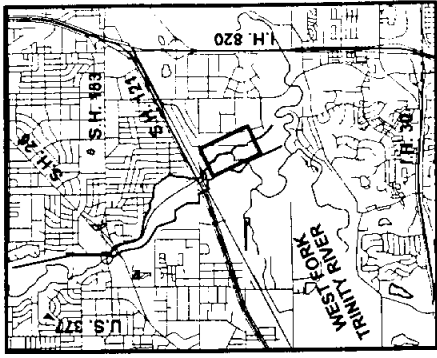
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**BIG FOSSIL SEWER STUDY**  
**T.C.W.S.C. OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
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 CHECKED BY: [Signature] DATE: 01/28/04





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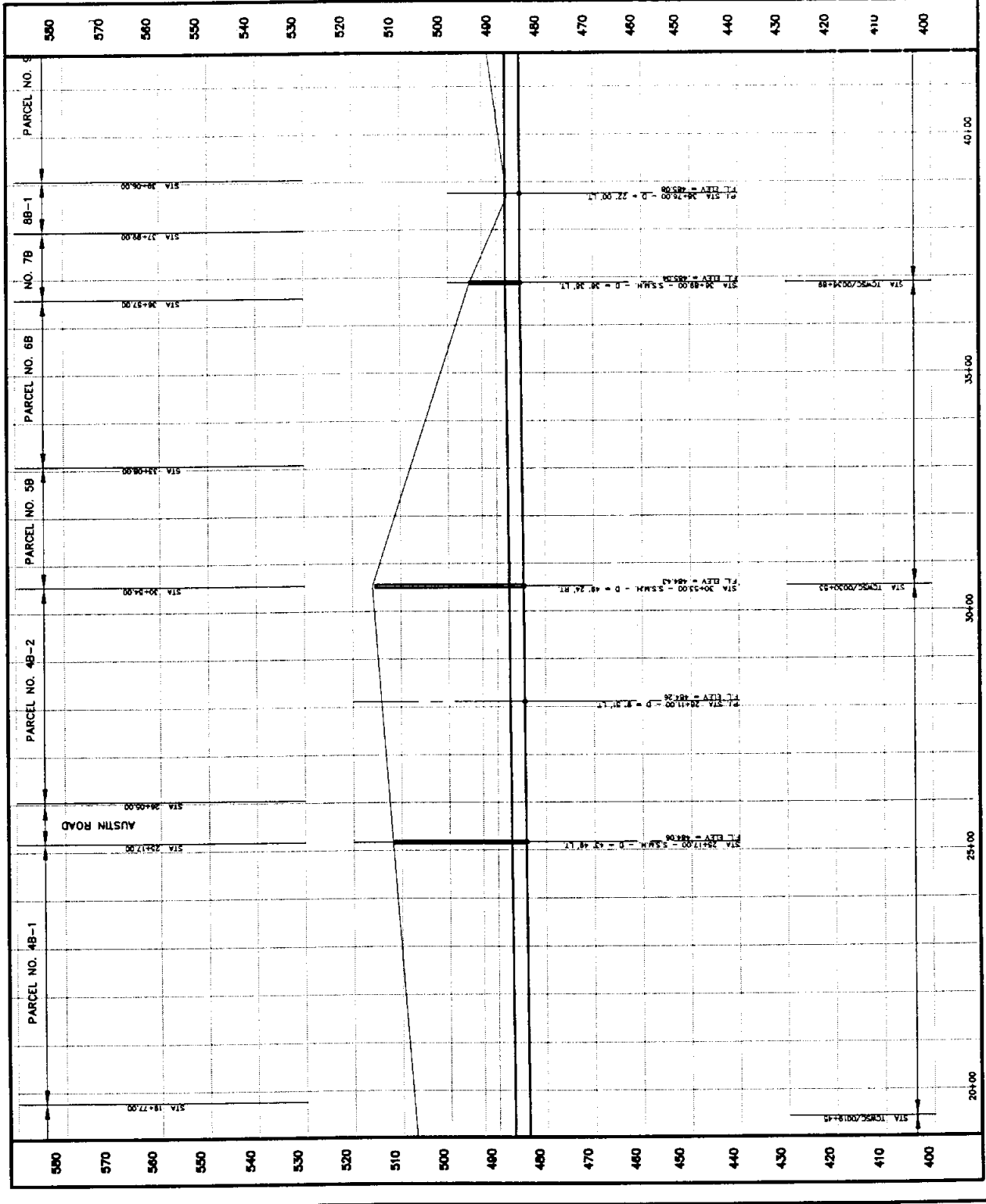
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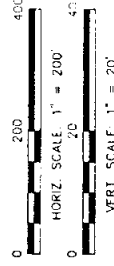
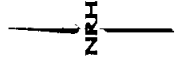
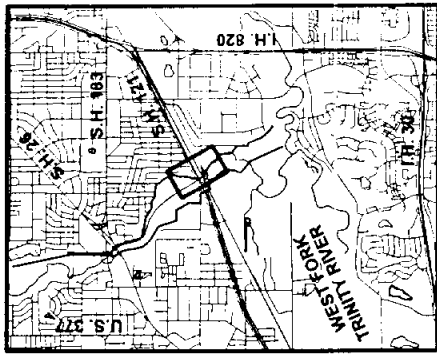
**BIG FOSSIL SEWER STUDY**  
**T.C.W.S.C. OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
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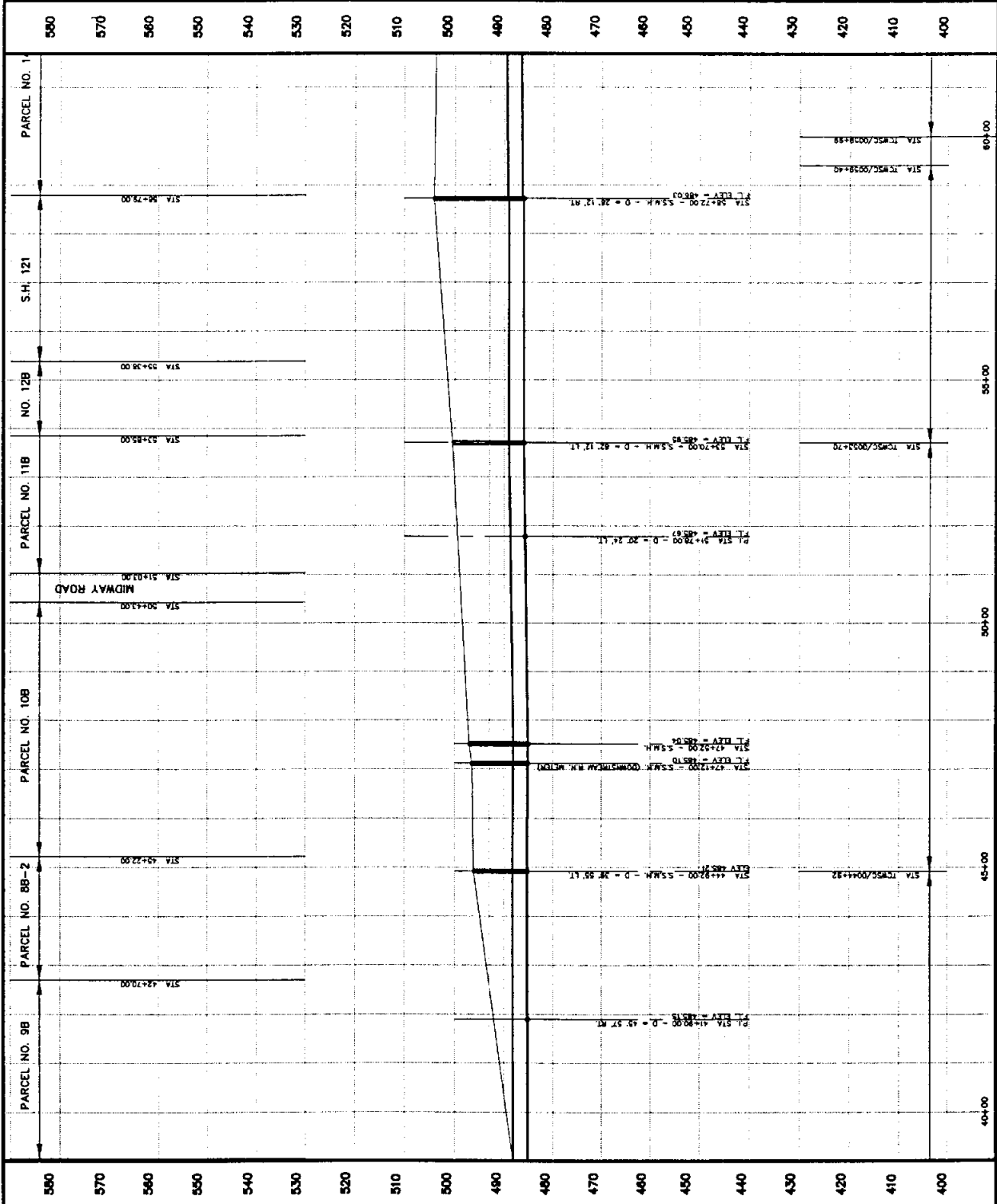


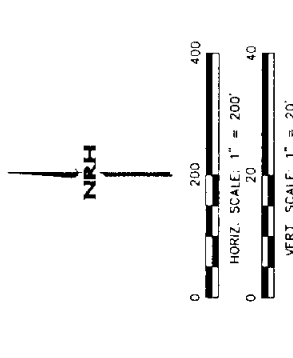
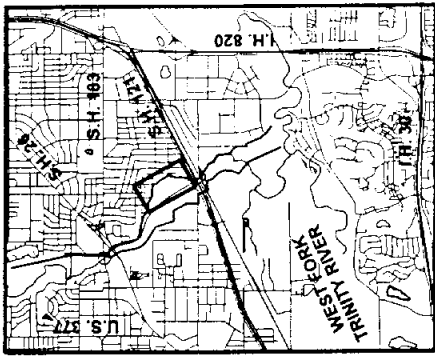
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**BIG FOSSIL SEWER STUDY**  
**T.C.W.S.C. OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS  
**KNOWLTON - ENGLISH - FLOWERS, INC.**  
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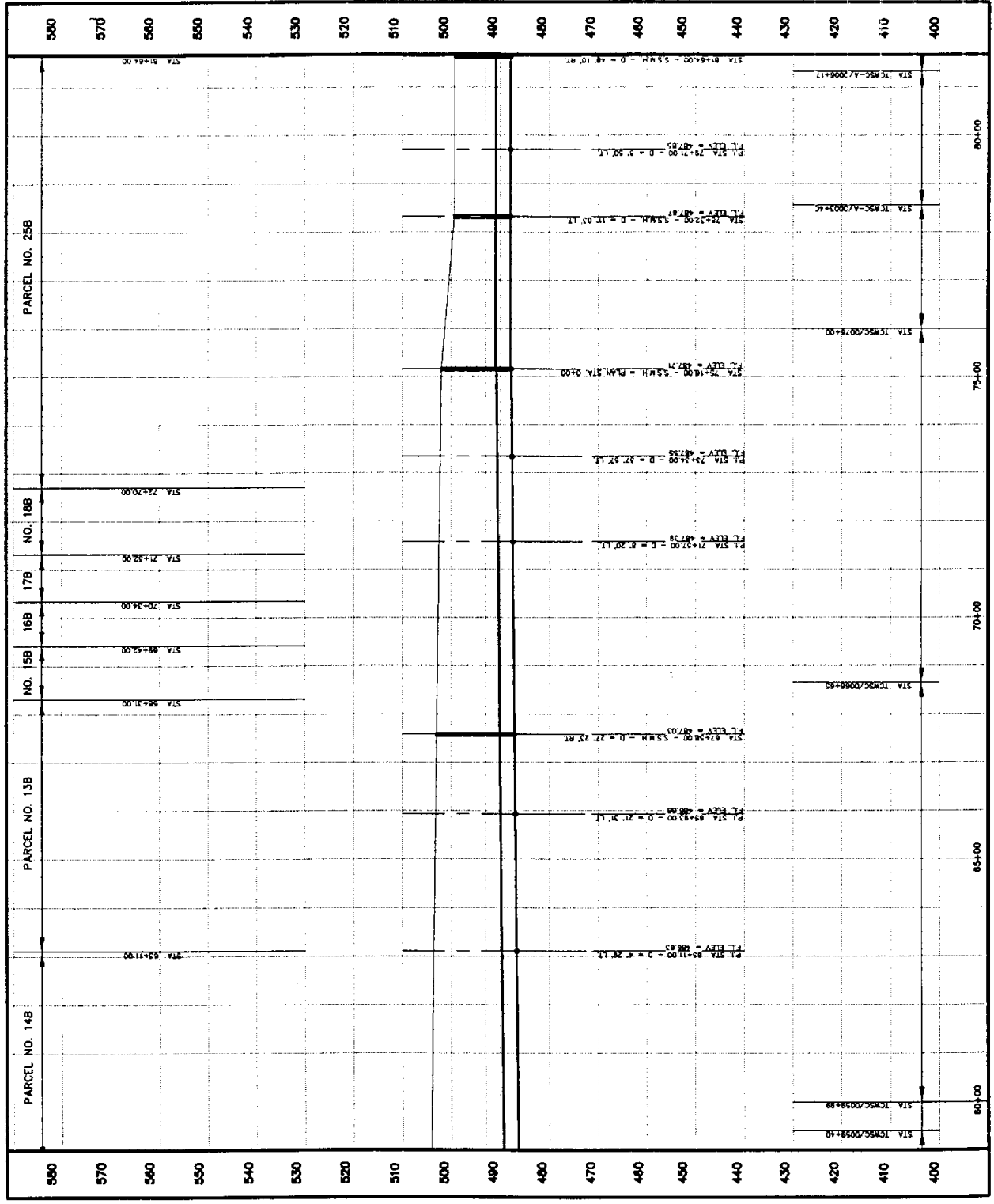


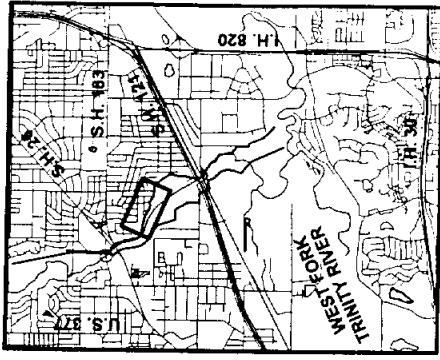


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**BIG FOSSIL SEWER STUDY**  
**T.C.W.S.C. OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS  
  
 CONSULTING ENGINEERS / Fort Worth, Dallas  
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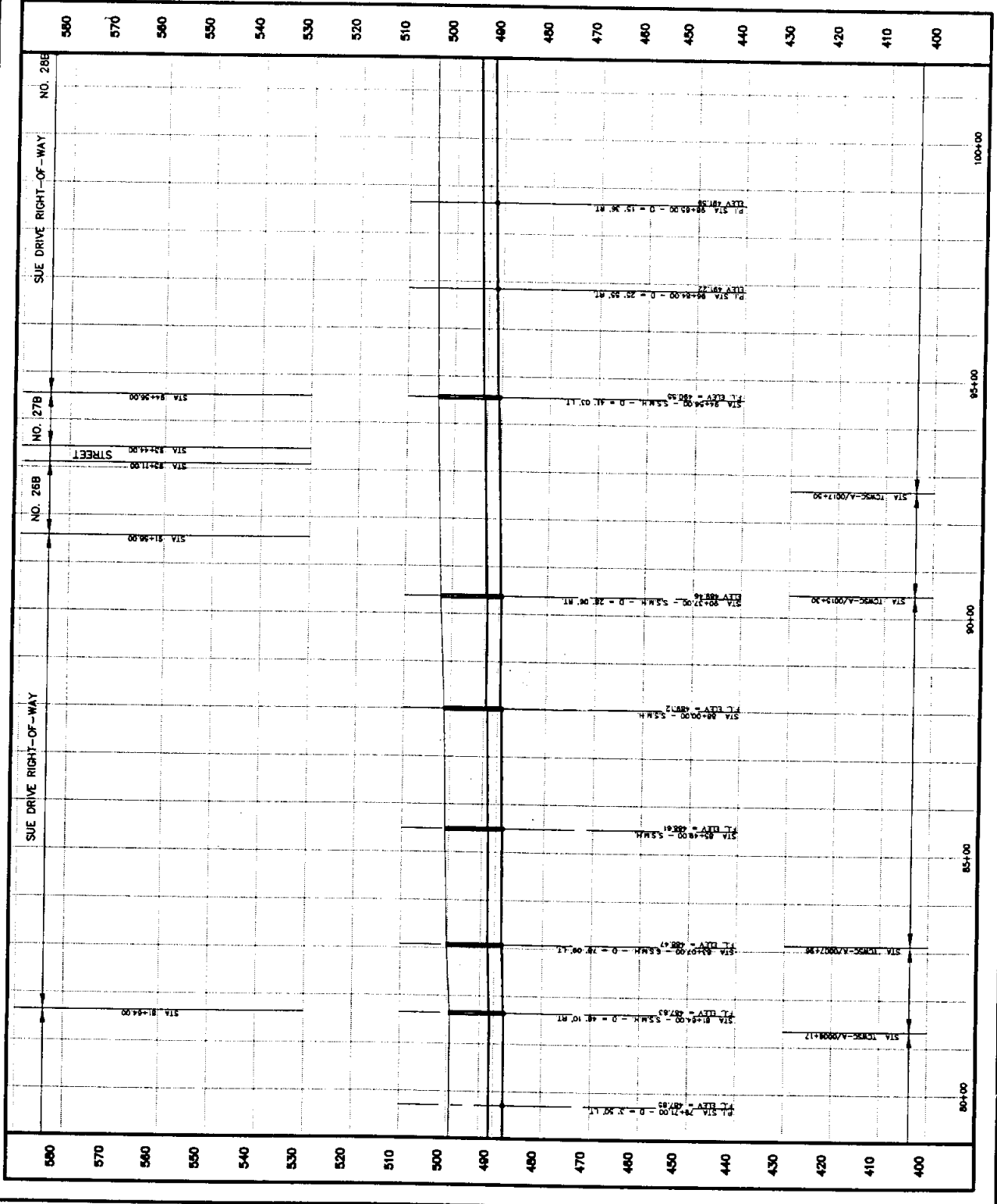


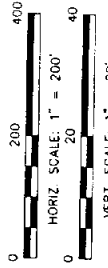
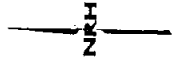
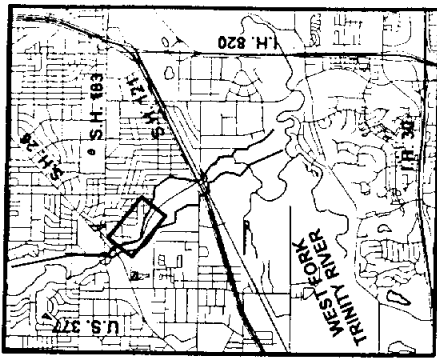


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 2. This drawing is based on a field survey prepared by Spoope & Associates, Inc., Land Surveyors, (817-282-8981), dated 11/11/99, with R.O.W. document research by Universal Field Services, Inc. (918-494-7600), and KEF, Inc. (817-283-6211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

**BIG FOSSIL SEWER STUDY**  
**T.C.W.S.C. OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
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 PROJECT NO. 98-483-308  
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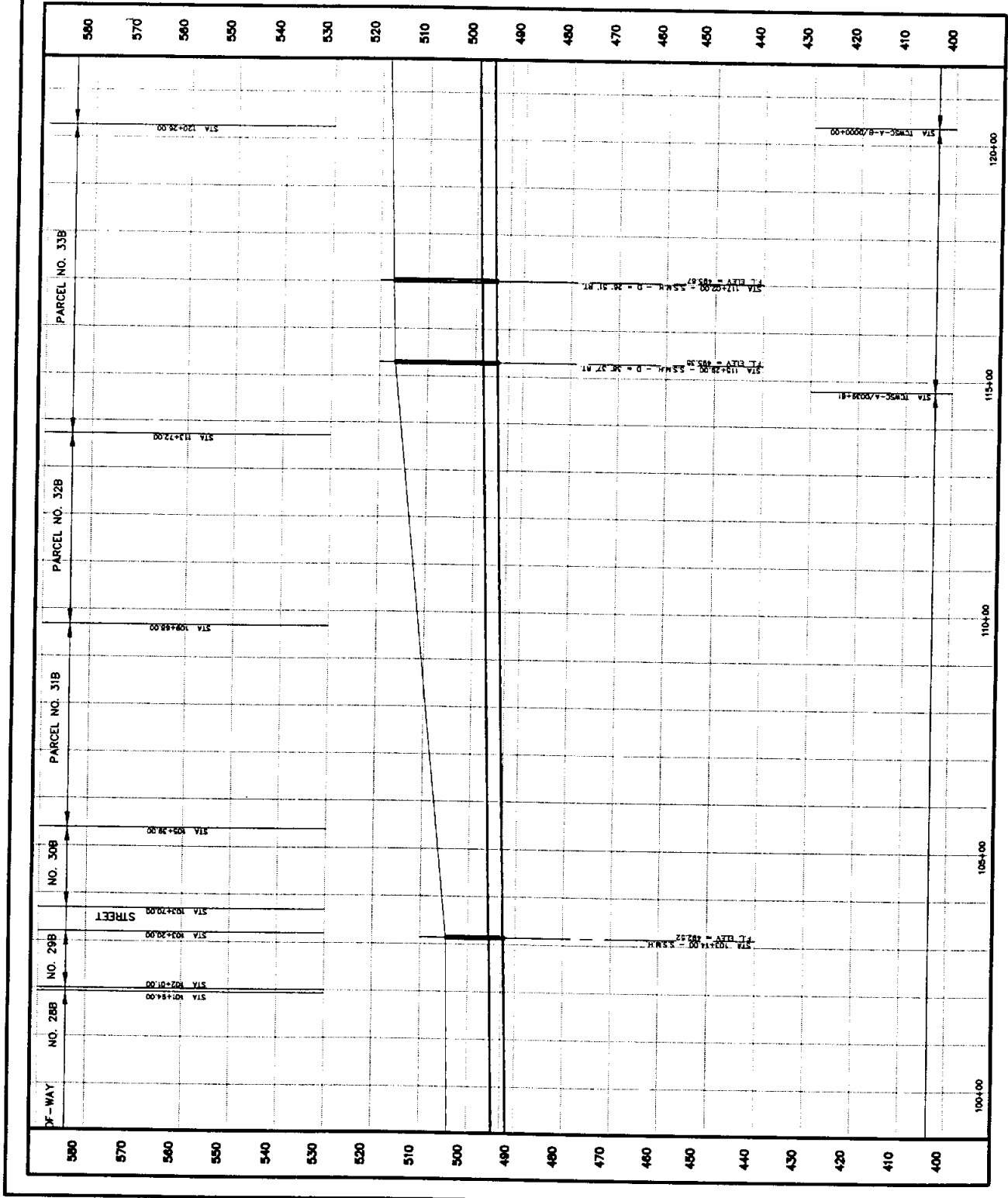
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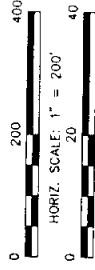
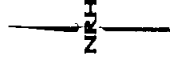
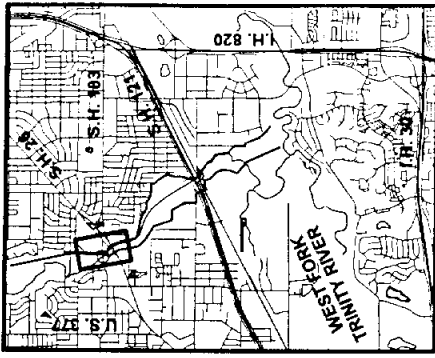
- This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-306, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
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**BIG FOSSIL SEWER STUDY**  
**T.C.W.S.C. OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS



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| DESIGNED BY: NHA | REV. BY: D.L.S. | DATE: DECEMBER 1998 |
| DRAWN BY: NHA    |                 |                     |
| CHECKED BY: NHA  |                 |                     |
| DATE: 12-15-98   |                 |                     |
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VERT. SCALE: 1" = 20'

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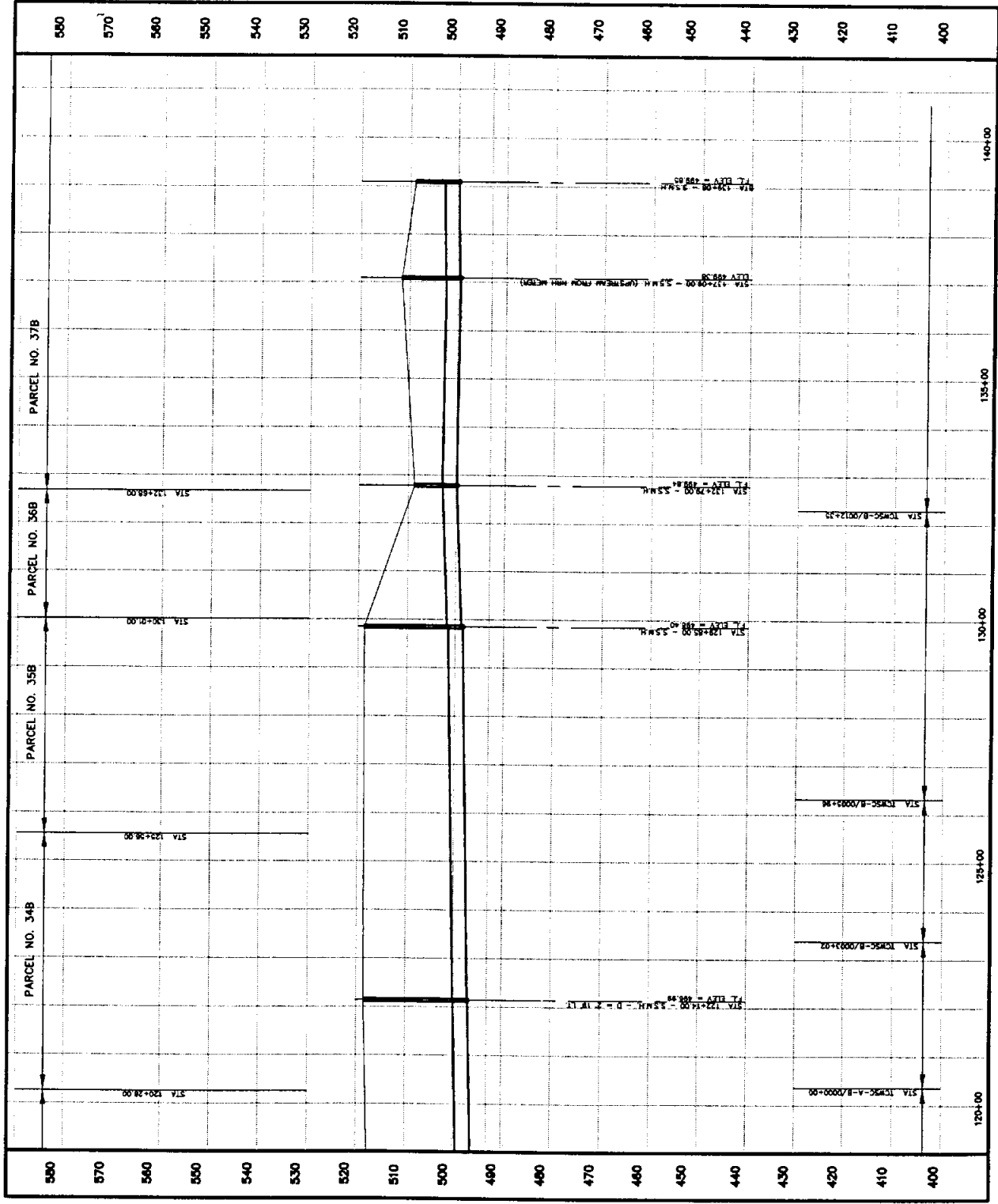
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**BIG FOSSIL SEWER STUDY**  
**T.C.W.S.C. OUTFALL PROFILE**  
 CITY OF NORTH RICHLAND HILLS

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
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 CHECKED BY: KEE

SHEET NO. 2 OF 7



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PARCEL NO. 34B

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**TAB 5**

**BIG FOSSIL SEWER STUDY**

**POPULATION PROJECTIONS**

**(See Further Discussion TAB 9)**

## INTRODUCTION

Evaluate Big Fossil drainage area by determining the existing flows for 1995 and potential flows for the years 2005 & 2025. Determine what percentages of the flows are contributed by each city contained within the Big Fossil boundary.

The Big Fossil wastewater service area receives flow from seven cities and a select area of Tarrant County.

## LAND USE AND POPULATION PROJECTIONS

Land use and population data provide information necessary to establish wastewater flow patterns for different land use types and wastewater quantities based on employment and population distributions. This information is used in calculating present and future wastewater flow requirements for each city's service area. The population and land use projections can also provide a basis for the selection and staging of identified capital improvements to the wastewater system.

Land use and population data were compiled using data from the North Central Texas Council of Governments' (NCTCOG) databases. The NCTCOG maintains population and land use data based on the latest census data.

For this assignment, the land use data compiled by NCTCOG was grouped into categories based on developed and undeveloped areas for each city contained in the defined study area. The developed area was further broken down into sewerred and unsewerred categories. The sewerred groups of the NCTCOG land uses were defined as: single family & high-density residential, industrial, institutional, and commercial. The non-sewerred group includes the NCTCOG categories: infrastructure, parks & flood plain, and water. The following table summarizes 1995 NCTCOG population and land use data for the cities which contribute to the Big Fossil wastewater service area.

**Table 1.**  
**1995 Summary of Cities in Big Fossil Study**

| CITY                 | 1995 Population | 1995 Employment | DEVELOPED                                |   |  | Total Developed (acres) | UNDEVELOPED | TOTAL CITY (acres) |
|----------------------|-----------------|-----------------|--|---|--|-------------------------|-------------|--------------------|
|                      |                 |                 | Sewered                                  | UnSewered                               | Total <sup>(4)</sup> Undeveloped (acres) |                         |             |                    |
|                      |                 |                 | Total <sup>(1)</sup> Residential (acres) | Total <sup>(2)</sup> Employment (acres) | Total <sup>(3)</sup> UnSewered (acres)   |                         | 1995        |                    |
| Haslet               | 1000            | 353             | 1046                                     | 79                                      | 85                                       | 1210                    | 1995        | 3205               |
| Haltom City          | 33500           | 11476           | 3506                                     | 1502                                    | 642                                      | 5650                    | 2285        | 7935               |
| Watauga              | 21100           | 1515            | 1756                                     | 202                                     | 29                                       | 1987                    | 613         | 2600               |
| North Richland Hills | 50650           | 13567           | 5495                                     | 1426                                    | 684                                      | 7605                    | 4070        | 11675              |
| Richland Hills       | 8150            | 5199            | 1170                                     | 374                                     | 155                                      | 1699                    | 308         | 2007               |
| Saginaw              | 9400            | 3452            | 773                                      | 811                                     | 503                                      | 2087                    | 2691        | 4778               |
| Fort Worth           | 473600          | 339778          | 47223                                    | 22958                                   | 29789                                    | 99970                   | 83826       | 183796             |

- (1) single family, multi-family, mobile homes, and group quarters  
 (2) industrial, commercial, and institutional  
 (3) infrastructure, parks, water, and flood plain  
 (4) under construction and vacant

In order to determine future population and employment data, a systematic method was developed incorporating census tracts, forecast districts, and city boundaries. Each city lies within the boundary of several forecast districts and census tracts. A map was developed of each city showing the corresponding census tracts and forecast districts for that certain city. From this map the population per house density of each of the contributing forecast districts was computed by defining the census tracts contained in each forecast district. These forecast district densities were then used to figure population data for the years: 1995, 2005, & 2025. A similar method was then used to determine population and employment data for areas in each city, which contribute to the Big Fossil watershed. The employment and population numbers were factored for each census tract and forecast district in order to determine the population and employment data for the study. This preliminary analysis was used for comparison purposes only.

The following table shows population and employment data for the cities located in the Big Fossil watershed area which were developed from the City of Fort Worth Sanitary Sewer Master Plan and Land Use Assumptions Plan furnished by the City of Fort Worth Water Department for use in this study.

**EXHIBIT "F"**  
**Table 2.**  
**(Revised)**  
**Population and Employment Summaries**  
**of Cities in the Big Fossil Study**

| CITY                 | Service Area (Ac.) | POPULATION    |               |                | EMPLOYMENT    |               |               |
|----------------------|--------------------|---------------|---------------|----------------|---------------|---------------|---------------|
|                      |                    | 1995          | 2005          | 2025           | 1995          | 2005          | 2025          |
| Fort Worth           | 48,363             | 19,074        | 24,305        | 38,741         | 5,162         | 7,216         | 21,374        |
| Haltom City          | 3,227              | 12,151        | 13,151        | 15,271         | 1,870         | 3,339         | 6,805         |
| Haslet               | 453                | 130           | 258           | 583            | 47            | 88            | 223           |
| North Richland Hills | 2,465              | 13,371        | 14,809        | 16,887         | 3,565         | 4,244         | 5,696         |
| Richland Hills       | 1,365              | 6,164         | 6,897         | 7,745          | 2,508         | 3,011         | 4,075         |
| Saginaw              | 763                | 255           | 695           | 1,625          | 141           | 196           | 443           |
| Watauga              | 2,600              | 18,834        | 20,591        | 23,934         | 1,730         | 1,958         | 2,504         |
| <b>TOTAL</b>         | <b>59,236</b>      | <b>69,979</b> | <b>80,706</b> | <b>104,786</b> | <b>15,023</b> | <b>20,052</b> | <b>41,120</b> |

Note: Source of Population Data: City of Fort Worth Sanitary Sewer Master Plan  
 See Database Tables "LUAPOP-1" and "LUAPOP-2", under TAB 5.  
 City of Fort Worth area also includes unincorporated Tarrant County Areas in Watershed

**EXHIBIT "B"**  
**COMPARISON OF PROJECTED GROWTH IN SELECTED CITIES BETWEEN 2005 AND 2025**  
**FROM 2002 SWP AND CHAPTER 5, TABLE 2 (CORRECTED), BIG FOSSIL SEWER STUDY**

| CITY              | 1990    | 2000    | 2005    | P2005  | 2010    | 2020    | 2025    | P2025   | 2002 SWP<br>% INCREASE | BIG FOSSIL STUDY<br>% INCREASE |
|-------------------|---------|---------|---------|--------|---------|---------|---------|---------|------------------------|--------------------------------|
| HASLET            | 795     | 1,260   | 1,352   | 258    | 1,443   | 1,899   | 2,113   | 583     | 56.29%                 | 125.97%                        |
| HALTOM CITY       | 32,856  | 38,845  | 40,275  | 13,151 | 41,704  | 43,272  | 43,628  | 15,271  | 8.33%                  | 16.12%                         |
| WATAUGA           | 20,009  | 22,233  | 23,254  | 20,591 | 24,274  | 26,157  | 27,063  | 23,934  | 16.38%                 | 16.24%                         |
| N. RICHLAND HILLS | 45,895  | 55,884  | 61,624  | 14,809 | 67,363  | 81,200  | 85,804  | 16,887  | 39.24%                 | 14.03%                         |
| RICHLAND HILLS    | 7,978   | 8,886   | 9,633   | 6,897  | 10,379  | 12,109  | 12,864  | 7,745   | 33.54%                 | 12.30%                         |
| SAGINAW           | 8,551   | 12,172  | 13,047  | 695    | 13,922  | 15,878  | 16,481  | 1,625   | 26.32%                 | 133.81%                        |
| FORT WORTH        | 447,619 | 496,622 | 514,670 | 24,305 | 532,717 | 580,375 | 588,244 | 38,741  | 14.30%                 | 59.40%                         |
| TOTALS            | 563,703 | 635,902 | 663,855 | 80,706 | 691,802 | 760,890 | 776,197 | 104,786 | 16.92%                 | 29.84%                         |

NOTES:  
P2005 AND P2025 POPULATION PROJECTIONS INCLUDE ONLY BIG FOSSIL WATERSHED AREAS  
SEE EXHIBIT "C" FOR SUMMARY OF POPULATION PROJECTIONS FOR YEARS 1990 THROUGH 2070  
PERCENT INCREASES BASED ON COMPARISON OF YEARS 2005 AND 2025

**EXHIBIT "C"  
 "POPULATION" PROJECTIONS USED IN THE BIG FOSSIL SEWER STUDY BASED ON  
 DATA FROM THE CITY OF FORT WORTH SANITARY SEWER MASTER PLAN REPORT**

| CITY              | TOTAL CITY AREA (AC.) | TOTAL BIG FOS. SERV. AR. (AC.) | TAB. LUAPOP-1 PAGE 8 OF 12 |        |        |        | TAB. LUAPOP-1 PAGE 12 OF 12 |        |        | INTERP. | TAB. LUAPOP-2 PAGE 10 OF 20 |         |
|-------------------|-----------------------|--------------------------------|----------------------------|--------|--------|--------|-----------------------------|--------|--------|---------|-----------------------------|---------|
|                   |                       |                                | 1990                       | 1995   | 2000   | 2005   | 2010                        | 2015   | 2020   |         | 2025                        | 2050    |
| Haslet            | 3,205                 | 453                            | 66                         | 130    | 194    | 258    | 322                         | 416    | 509    | 583     | 952                         | 1,247   |
| Haltom City       | 7,935                 | 3,227                          | 11,650                     | 12,151 | 12,651 | 13,151 | 13,651                      | 14,203 | 14,754 | 15,271  | 17,858                      | 19,928  |
| Watauga           | 2,600                 | 2,600                          | 17,955                     | 18,834 | 19,712 | 20,591 | 21,469                      | 22,275 | 23,080 | 23,934  | 28,205                      | 31,622  |
| N. Richland Hills | 11,675                | 2,465                          | 12,652                     | 13,371 | 14,091 | 14,809 | 15,528                      | 15,906 | 16,282 | 16,887  | 19,912                      | 22,332  |
| Richland Hills    | 2,007                 | 1,365                          | 5,797                      | 6,164  | 6,530  | 6,897  | 7,264                       | 7,365  | 7,467  | 7,745   | 9,137                       | 10,250  |
| Saginaw           | 4,778                 | 763                            | 35                         | 255    | 475    | 695    | 915                         | 1,157  | 1,398  | 1,625   | 2,761                       | 3,670   |
| Fort Worth        | 183,796               | 48,363                         | 16,459                     | 19,074 | 21,690 | 24,305 | 26,921                      | 31,239 | 35,558 | 38,741  | 54,657                      | 67,389  |
| <b>TOTALS</b>     | 215,996               | 59,236                         | 64,614                     | 69,979 | 75,343 | 80,706 | 86,070                      | 92,561 | 99,048 | 104,787 | 133,482                     | 156,438 |

**NOTES:**  
 Big Fossil Service Area Includes Marine Creek Watershed Area, but not Little Fossil Creek Watershed Area  
 Source of Data: City of Fort Worth Database Tables "LUAPOP-1" and "LUAPOP-2"  
 Population Estimates for Year 2025 Interpolated between Years 2020 and 2050

**EXHIBIT "D"**  
**"EMPLOYMENT" PROJECTIONS USED IN THE BIG FOSSIL SEWER STUDY BASED ON**  
**DATA FROM THE CITY OF FORT WORTH SANITARY SEWER MASTER PLAN REPORT**

| CITY              | TOTAL CITY AREA (AC.) | TOTAL BIG FOS. SERV. AR. (AC.) | TAB. LUAIPOP-1<br>PAGE 4 OF 12 |               |               |               |               |               |               | INTERP.       | TAB. LUAIPOP-2<br>PAGE 10 OF 20 |               |
|-------------------|-----------------------|--------------------------------|--------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------------------------|---------------|
|                   |                       |                                | 1990                           | 1995          | 2000          | 2005          | 2010          | 2015          | 2020          |               | 2025                            | 2050          |
| Haslet            | 3,205                 | 453                            | 27                             | 47            | 68            | 88            | 108           | 152           | 195           | 223           | 363                             | 475           |
| Haltom City       | 7,935                 | 3,227                          | 1,136                          | 1,870         | 2,605         | 3,339         | 4,074         | 5,035         | 5,995         | 6,805         | 10,855                          | 14,095        |
| Watauga           | 2,600                 | 2,600                          | 1,615                          | 1,730         | 1,844         | 1,958         | 2,072         | 2,225         | 2,377         | 2,504         | 3,139                           | 3,647         |
| N. Richland Hills | 11,675                | 2,465                          | 3,226                          | 3,565         | 3,904         | 4,244         | 4,583         | 4,963         | 5,343         | 5,696         | 7,461                           | 8,873         |
| Richland Hills    | 2,007                 | 1,365                          | 2,256                          | 2,508         | 2,760         | 3,011         | 3,263         | 3,539         | 3,815         | 4,075         | 5,374                           | 6,414         |
| Saginaw           | 4,778                 | 763                            | 113                            | 141           | 169           | 196           | 224           | 310           | 396           | 443           | 679                             | 868           |
| Fort Worth        | 183,796               | 48,363                         | 4,135                          | 5,162         | 6,189         | 7,216         | 8,243         | 13,577        | 18,911        | 21,374        | 33,687                          | 43,538        |
| <b>TOTALS</b>     | <b>215,996</b>        | <b>59,236</b>                  | <b>12,508</b>                  | <b>15,023</b> | <b>17,539</b> | <b>20,052</b> | <b>22,567</b> | <b>29,801</b> | <b>37,032</b> | <b>41,120</b> | <b>61,558</b>                   | <b>77,910</b> |

NOTES:  
 Big Fossil Service Area Includes Marine Creek Watershed Area, but not Little Fossil Creek Watershed Area  
 Source of Data: City of Fort Worth Database Tables "LUAIPOP-1" and "LUAIPOP-2"  
 Employment Estimates for Year 2025 Interpolated between Years 2020 and 2050

**EXHIBIT "E"  
 "EQUIVALENT" POPULATION PROJECTIONS USED IN THE BIG FOSSIL SEWER STUDY BASED ON  
 DATA FROM THE CITY OF FORT WORTH SANITARY SEWER MASTER PLAN REPORT**

| CITY              | TOTAL CITY AREA (AC.) |               | TOTAL BIG FOS. SERV. AR. (AC.) | TAB. LUAPOP-1 PAGE 8 OF 12 |               |               |               |                | TAB. LUAPOP-1 PAGE 12 OF 12 |                |                | INTERP. 2025   | TAB. LUAPOP-2 PAGE 10 OF 20 |      |
|-------------------|-----------------------|---------------|--------------------------------|----------------------------|---------------|---------------|---------------|----------------|-----------------------------|----------------|----------------|----------------|-----------------------------|------|
|                   | 1990                  | 1995          |                                | 2000                       | 2005          | 2010          | 2015          | 2020           | 2010                        | 2015           | 2020           |                | 2025                        | 2050 |
| Haslet            | 3,205                 | 453           | 80                             | 154                        | 228           | 302           | 376           | 492            | 607                         | 694            | 1,134          | 1,485          |                             |      |
| Haltom City       | 7,935                 | 3,227         | 12,218                         | 13,086                     | 13,954        | 14,821        | 15,688        | 16,721         | 17,752                      | 18,674         | 23,286         | 26,976         |                             |      |
| Watauga           | 2,600                 | 2,600         | 18,763                         | 19,699                     | 20,634        | 21,570        | 22,505        | 23,388         | 24,269                      | 25,186         | 29,775         | 33,446         |                             |      |
| N. Richland Hills | 11,675                | 2,465         | 14,265                         | 15,154                     | 16,043        | 16,931        | 17,820        | 18,388         | 18,954                      | 19,735         | 23,643         | 26,769         |                             |      |
| Richland Hills    | 2,007                 | 1,365         | 6,925                          | 7,418                      | 7,910         | 8,403         | 8,896         | 9,135          | 9,375                       | 9,783          | 11,824         | 13,457         |                             |      |
| Saginaw           | 4,778                 | 763           | 92                             | 326                        | 560           | 793           | 1,027         | 1,312          | 1,596                       | 1,847          | 3,101          | 4,104          |                             |      |
| Fort Worth        | 183,796               | 48,363        | 18,527                         | 21,655                     | 24,785        | 27,913        | 31,043        | 38,028         | 45,014                      | 49,428         | 71,501         | 89,158         |                             |      |
| <b>TOTALS</b>     | <b>215,996</b>        | <b>59,236</b> | <b>70,868</b>                  | <b>77,491</b>              | <b>84,113</b> | <b>90,732</b> | <b>97,354</b> | <b>107,462</b> | <b>117,564</b>              | <b>125,347</b> | <b>164,261</b> | <b>195,393</b> |                             |      |

**NOTES:**  
 Big Fossil Service Area Includes Marine Creek Watershed Area, but not Little Fossil Creek Watershed Area  
 Source of Data: City of Fort Worth Database Tables "LUAPOP-1" and "LUAPOP-2"  
 Equivalent Population Estimate for Year 2025 Interpolated between Years 2020 and 2050  
 Equivalent Population = Population (Exhibit "B") + 0.5 x Employment (Exhibit "C")

### Population Projection Methodology

1. One of the initial steps required Internet research to compile COG data for Tarrant County.
2. It was discovered that two forms of data existed.
3. Census Tract (CT) data gave detailed land use information for each tract, which was used to compute population and employment densities.
4. Forecast District (FD) data contained information governing household and employment numbers for the years 1995, 2005, & 2025.
5. Since the Forecast District & Census Tract boundaries did not necessarily fall on city limit lines, it was necessary to calculate what percentage of each Forecast District & Census Tract fell within each city's limits.
6. Once this was determined, we used this data to calculate the population for each city for the years 1995, 2005, & 2025.
7. These population numbers were then used to figure future population and employment land use areas.
8. These data were compared with population and employment projections by the City of Fort Worth in their Land Use Assumptions Plan and Sanitary Sewer Master Plan, and the results compared favorably. Therefore, the Fort Worth Population Database Information is used for this Big Fossil study. A table of population projections by the Texas Water Development Board is included in this section for reference.



| EXHIBIT "A"<br>Big Fossil Sewer Study, Table No. TWDB-1<br>TEXAS WATER DEVELOPMENT BOARD POPULATION AND WATER USE PROJECTIONS |                 |           |         |        |           |           |         |           |         |           |         |         |       |         |
|---|-----------------|-----------|---------|--------|-----------|-----------|---------|-----------|---------|-----------|---------|---------|-------|---------|
| CITY  | TOTAL LAND AREA | YEAR 1990 |         |        | YEAR 2000 |           |         | YEAR 2010 |         |           | POP.    | POP/AC. | GPCD  | POP/AC. |
|   |                 | POP.      | AC-FT   | GPCD   | POP/AC.   | POP.      | AC-FT   | GPCD      | POP/AC. | POP.      |         |         |       |         |
| Fort Worth  | 183,796         | 447,619   | 105,420 | 210.24 | 2.44      | 496,622   | 127,946 | 229.98    | 2.70    | 532,717   | 134,262 | 224.98  | 2.90  |         |
| North Richland Hills  | 11,675          | 45,895    | 6,331   | 123.14 | 3.93      | 55,884    | 9,640   | 153.99    | 4.79    | 67,363    | 11,394  | 150.99  | 5.77  |         |
| Haltom City   | 7,935           | 32,856    | 4,575   | 124.30 | 4.14      | 38,845    | 6,309   | 144.98    | 4.90    | 41,704    | 6,633   | 141.98  | 5.26  |         |
| Richland Hills  | 2,007           | 7,978     | 1,301   | 145.57 | 3.98      | 8,886     | 1,334   | 134.01    | 4.43    | 10,379    | 1,523   | 130.99  | 5.17  |         |
| Watauga   | 2,600           | 20,009    | 2,761   | 123.18 | 7.70      | 22,233    | 3,835   | 153.98    | 8.55    | 24,274    | 4,106   | 151.00  | 9.34  |         |
| Haslet  | 3,205           | 795       | 108     | 121.27 | 0.25      | 1,260     | 229     | 162.24    | 0.39    | 1,443     | 267     | 165.17  | 0.45  |         |
| Saginaw   | 4,778           | 8,551     | 1,238   | 129.24 | 1.79      | 12,172    | 2,059   | 151.00    | 2.55    | 13,922    | 2,495   | 159.98  | 2.91  |         |
| Tarrant County  | 574,450         | 1,170,247 | 226,690 | 172.92 | 2.04      | 1,415,759 | 308,195 | 194.33    | 2.46    | 1,594,218 | 341,530 | 191.24  | 2.78  |         |
| CITY  | TOTAL LAND AREA | YEAR 2020 |         |        | YEAR 2030 |           |         | YEAR 2040 |         |           | POP.    | POP/AC. | GPCD  | POP/AC. |
|   |                 | POP.      | AC-FT   | GPCD   | POP/AC.   | POP.      | AC-FT   | GPCD      | POP/AC. | POP.      |         |         |       |         |
| Fort Worth  | 183,796         | 580,375   | 143,673 | 220.99 | 3.16      | 596,112   | 144,230 | 215.99    | 3.24    | 632,480   | 150,195 | 211.99  | 3.44  |         |
| North Richland Hills  | 11,675          | 81,200    | 13,461  | 147.99 | 6.96      | 90,408    | 14,684  | 144.99    | 7.74    | 100,661   | 16,011  | 141.99  | 8.62  |         |
| Haltom City   | 7,935           | 43,272    | 6,737   | 138.98 | 5.45      | 43,963    | 6,700   | 135.98    | 5.54    | 44,197    | 6,584   | 132.98  | 5.57  |         |
| Richland Hills  | 2,007           | 12,109    | 1,750   | 129.01 | 6.03      | 13,618    | 1,922   | 125.99    | 6.79    | 16,497    | 2,273   | 123.00  | 8.22  |         |
| Watauga   | 2,600           | 26,157    | 4,336   | 147.98 | 10.06     | 27,969    | 4,543   | 145.00    | 10.76   | 29,906    | 4,757   | 141.99  | 11.50 |         |
| Haslet  | 3,205           | 1,899     | 372     | 174.87 | 0.59      | 2,327     | 456     | 174.93    | 0.73    | 2,587     | 478     | 164.94  | 0.81  |         |
| Saginaw   | 4,778           | 15,878    | 2,970   | 166.98 | 3.32      | 17,084    | 3,062   | 160.00    | 3.58    | 18,915    | 3,284   | 154.99  | 3.96  |         |
| Tarrant County  | 574,450         | 1,798,894 | 377,333 | 187.25 | 3.13      | 1,915,375 | 391,338 | 182.39    | 3.33    | 2,111,193 | 416,854 | 176.26  | 3.68  |         |
| CITY  | TOTAL LAND AREA | YEAR 2050 |         |        | POP.      | POP/AC.   | GPCD    | POP/AC.   |         |           |         |         |       |         |
|   |                 | POP.      | AC-FT   | GPCD   |           |           |         |           | POP/AC. |           |         |         |       |         |
| Fort Worth  | 183,796         | 671,067   | 155,600 | 206.99 | 3.65      |           |         |           |         |           |         |         |       |         |
| North Richland Hills  | 11,675          | 112,232   | 17,475  | 138.99 | 9.61      |           |         |           |         |           |         |         |       |         |
| Haltom City   | 7,935           | 44,412    | 6,517   | 130.99 | 5.60      |           |         |           |         |           |         |         |       |         |
| Richland Hills  | 2,007           | 19,985    | 2,709   | 121.00 | 9.96      |           |         |           |         |           |         |         |       |         |
| Watauga   | 2,600           | 29,906    | 4,656   | 138.98 | 11.50     |           |         |           |         |           |         |         |       |         |
| Haslet  | 3,205           | 2,808     | 503     | 159.91 | 0.88      |           |         |           |         |           |         |         |       |         |
| Saginaw   | 4,778           | 20,942    | 3,519   | 150.00 | 4.38      |           |         |           |         |           |         |         |       |         |
| Tarrant County  | 574,450         | 2,205,610 | 430,303 | 174.16 | 3.84      |           |         |           |         |           |         |         |       |         |

Notes:

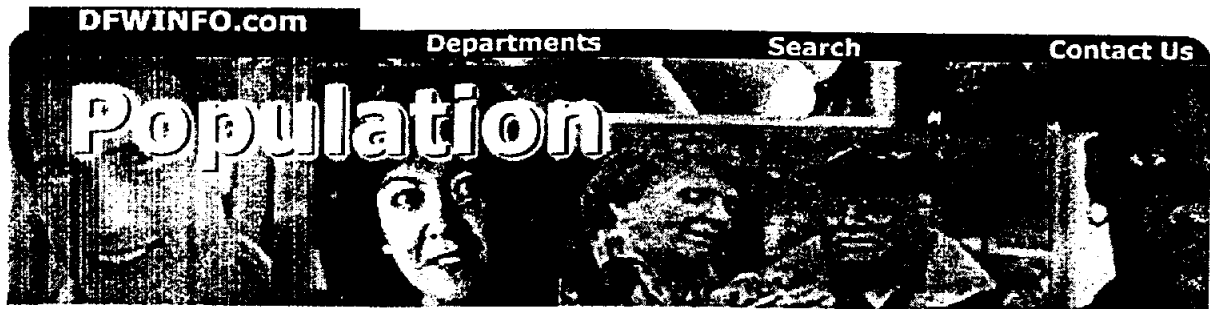
Population Projections Web Site:  
<http://www.twdb.state.tx.us/popwuse/PopulationC.htm>

Water Use Web Site:  
<http://www.twdb.state.tx.us/popwuse/MunicipalC.htm>

GPCD = AC-FT x 43,560 c.f./acre-ft x 7.48 gal/c.f. / 365 days/year / Population

***N.C.T.C.O.G.***

***REGIONAL POPULATION DATA***



## 1999 Population Estimates



### 1999 Population Estimates By City

April 22, 1999 Population Estimates  
Presentation to the NCTCOG Executive Board

Dallas Morning News article, April 23, 1999

Fort Worth Star Telegram article, April 23, 1999

Fort Worth Star Telegram article- NE Tarrant, April 23, 1999

Fort Worth Star Telegram article- Arlington, April 23, 1999

Fort Worth Star Telegram article- Arlington, April 26, 1999



### 1998 Population Estimates By Census Tract

Interactive query of Population Estimates Data

**\*\*For additional assistance please call (817) 695-9150 or [email us](#).**

## Downloadable Data

1999 Population Estimates by City  
Excel , Text File , Dbf File , README

1998 Population Estimates by Census Tract  
Text File , Dbf File , README

1970, 1980, 1990 Census Population Data

Text File

1990 U.S. Census Reports Population & Housing Profile for North Central Texas  
Cities and Counties

Geographic Information Systems(GIS) Data - City Boundaries, Census Tracts, etc...

## Other Related Links

County Population Data - 1970 to present, US States, MSA and Counties. Texas A&M Real Estate Center

1990 and 1996 Estimates of Cities with Populations over 100,000 - Ranks Cities Nationally

Historical Population and Projections, Texas State Data Center

Population Projections by race/ethnicity for counties in Texas, Texas Comptroller of Public Accounts

Population and Economic Detail - .XLS files for Cities, Counties, MSA's and States, Texas Comptroller of Public Accounts.

Counties and Places Population Projections in Texas - Texas Water Development Board

Fastest Growing Cities in D/FW Metroplex, 1997

1997 Total Population Growth: Top 10 Cities in D/FW Metroplex

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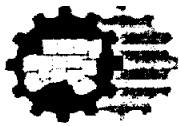
LAST UPDATED: May 10, 1999

North Central Texas Council of Governments

616 Six Flags Drive P.O. Box 5888 Arlington, TX 76005-5888



April 1999



## North Central Texas Council of Governments Research and Information Services

### Summary of Regional Population Estimates

North Central Texas added 136,847 new residents last year for a total population of 4,963,064. This marks the third consecutive year that the region boasts a population growth of 100,000 or more persons and pushes the average annual growth in the 1990s above 90,000. Last year's growth, also, virtually guarantees a Census 2000 count in North Central Texas exceeding 5,000,000 persons.

Five cities captured 30% of all the growth in North Central Texas last year. Plano retained its lead, adding 14,550 new residents in 1998 for a total population of 220,200. This one-year growth represents an all time high for Plano. The city of Fort Worth added 10,200 persons, going over the half million threshold in 1998 with 504,350 residents. Lewisville (74,700), McKinney (43,500) and Flower Mound (47,300) round out the top five, adding about 5,000 new residents each.

Eighty-one percent (81%) of the region's population growth in 1998, or more than 100,000 persons, occurred within the boundaries of four core counties. Collin again led all counties with 35,730 new residents added. This yields an average increase of more than eight percent (8%) per year throughout the decade in Collin County. Tarrant County was second in absolute growth in 1998, with 31,142 new persons, and has now added more than 200,000 persons since 1990. For the first time, Denton County jumped to third with 24,925 persons added and Dallas County followed with 19,208 new residents.

The counties beyond the urban core continue to gain in share of growth. These 12 ex-urban and rural counties added over 25,000 persons last year, with unincorporated areas accounting for 70% of this growth, or 17,500 persons. Johnson led these 12 counties in absolute growth with 4,831 new residents for a total county population of 118,677.

State Highway 121 Corridor cities continue to have the fastest growth rates in the region. The city of Frisco, which added 4,350 new residents in 1998, pushed their population

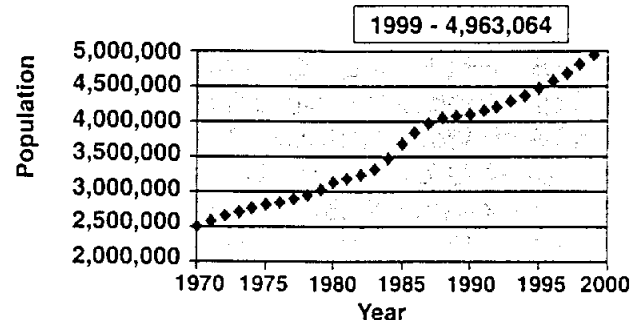
327 percent above the 1990 census count to 26,200 persons. Similarly, Flower Mound and Southlake tripled their 1990 totals. Four other cities doubled their 1990 population and all fall within the Corridor: Allen (39,000), Coppell (33,050), Corinth (9,150) and McKinney (43,500).

Construction in North Central Texas was up by more than 18 percent last year with 45,000 new homes added. More than 2,400 single-family homes were built in each month of 1998 and the multi-family industry rebounded by adding 16,100 new units, an increase of almost 50% over 1997. Further, the current inventory of multi-family units permitted or under construction exceeds 30,000 units.

Employment growth in North Central Texas has been the driving force behind the incredible population growth in the last part of this decade. Jobs were created at unprecedented rates in the last few years, peaking with more than 100,000 new jobs in 1997. However, in 1998, job growth slowed by nearly ten percent (10%) in the region. Yet, the multi-family industry is constructing units at a record pace in an attempt to keep up with the all of the migrants moving to North Texas.

Local analysts are watching these three interrelated trends of job, population and construction growth closely in 1999 to see where the next blip on the radar screen surfaces. Without a doubt, this region will reach five million by 2000. But, what else will the millennium bring?

NCTCOG Regional Population Growth 1990-1999



|                            | Final<br>Census<br>4/1/70 | Final<br>Census<br>4/1/80 | Final<br>Census<br>4/1/90 | Estimated<br>Population<br>1/1/95 | Revised<br>Population<br>1/1/98 | Estimated<br>Population<br>1/1/99 | Percent<br>Growth<br>1998-99 |
|----------------------------|---------------------------|---------------------------|---------------------------|-----------------------------------|---------------------------------|-----------------------------------|------------------------------|
| <b>Collin County</b>       | <b>66,920</b>             | <b>144,576</b>            | <b>264,036</b>            | <b>348,400</b>                    | <b>426,312</b>                  | <b>462,042</b>                    | <b>8.38%</b>                 |
| Allen*                     | 1,940                     | 8,314                     | 19,315                    | 26,900                            | 34,800                          | 39,000                            | 12.07%                       |
| Celina                     | 1,272                     | 1,520                     | 1,737                     | 1,750                             | 1,900                           | 1,900                             | 0.00%                        |
| Fairview                   | 463                       | 893                       | 1,554                     | 2,000                             | 2,700                           | 2,850                             | 5.56%                        |
| Farmersville               | 2,311                     | 2,360                     | 2,640                     | 2,650                             | 2,750                           | 2,800                             | 1.82%                        |
| Frisco*                    | 1,845                     | 3,499                     | 6,138                     | 13,850                            | 21,850                          | 26,200                            | 19.91%                       |
| Lucas                      | 540                       | 1,370                     | 2,205                     | 2,400                             | 2,900                           | 3,050                             | 5.17%                        |
| McKinney                   | 15,193                    | 16,256                    | 21,283                    | 28,400                            | 38,150                          | 43,500                            | 14.02%                       |
| Murphy                     | 261                       | 1,150                     | 1,547                     | 1,650                             | 2,250                           | 2,600                             | 15.56%                       |
| Parker*                    | 367                       | 1,098                     | 1,213                     | 1,450                             | 1,700                           | 1,750                             | 2.94%                        |
| Plano*                     | 17,872                    | 72,331                    | 127,885                   | 169,900                           | 205,650                         | 220,200                           | 7.08%                        |
| Princeton*                 | 1,105                     | 3,408                     | 2,448                     | 2,500                             | 2,750                           | 2,900                             | 5.45%                        |
| Prosper                    | 501                       | 675                       | 1,018                     | 1,200                             | 1,550                           | 1,650                             | 6.45%                        |
| Wylie                      | 2,675                     | 3,152                     | 8,716                     | 9,650                             | 11,600                          | 12,400                            | 6.90%                        |
| Remainder of Collin County | 17,785                    | 20,109                    | 30,019                    | 33,100                            | 37,450                          | 39,250                            | 4.81%                        |
| Split Cities               | 2,790                     | 8,441                     | 36,318                    | 51,000                            | 58,312                          | 61,992                            | 6.31%                        |
| <b>Dallas County</b>       | <b>1,327,696</b>          | <b>1,556,419</b>          | <b>1,852,810</b>          | <b>1,931,150</b>                  | <b>2,023,736</b>                | <b>2,042,944</b>                  | <b>0.95%</b>                 |
| Addison                    | 593                       | 5,553                     | 8,783                     | 10,200                            | 12,300                          | 12,400                            | 0.81%                        |
| Balch Springs              | 10,464                    | 13,746                    | 17,406                    | 18,300                            | 18,700                          | 18,750                            | 0.27%                        |
| Cedar Hill*                | 2,610                     | 6,849                     | 19,988                    | 24,450                            | 27,650                          | 29,600                            | 7.05%                        |
| Cockrell Hill              | 3,515                     | 3,262                     | 3,746                     | 3,800                             | 3,800                           | 3,800                             | 0.00%                        |
| Coppell                    | 1,728                     | 3,826                     | 16,881                    | 24,050                            | 29,850                          | 33,050                            | 10.72%                       |
| Dallas*                    | 844,401                   | 904,078                   | 1,007,618                 | 1,034,400                         | 1,065,200                       | 1,068,800                         | 0.34%                        |
| DeSoto                     | 6,617                     | 15,538                    | 30,544                    | 33,950                            | 36,050                          | 36,850                            | 2.22%                        |
| Duncanville*               | 14,105                    | 27,781                    | 35,008                    | 35,300                            | 36,150                          | 36,300                            | 0.41%                        |
| Farmers Branch             | 27,492                    | 24,863                    | 24,250                    | 24,500                            | 26,100                          | 26,900                            | 3.07%                        |
| Garland*                   | 81,437                    | 138,857                   | 180,635                   | 193,200                           | 201,200                         | 204,000                           | 1.39%                        |
| Glenn Heights              | 257                       | 1,033                     | 4,564                     | 4,650                             | 5,900                           | 6,400                             | 8.47%                        |
| Grand Prairie*             | 50,904                    | 71,462                    | 99,606                    | 104,350                           | 112,400                         | 115,150                           | 2.45%                        |
| Highland Park              | 10,133                    | 8,909                     | 8,739                     | 9,050                             | 9,400                           | 9,400                             | 0.00%                        |
| Hutchins                   | 1,715                     | 2,837                     | 2,719                     | 2,750                             | 2,750                           | 2,750                             | 0.00%                        |
| Irving                     | 97,260                    | 109,943                   | 155,037                   | 166,350                           | 182,500                         | 183,350                           | 0.47%                        |
| Lancaster                  | 10,522                    | 14,807                    | 22,117                    | 22,750                            | 23,300                          | 24,250                            | 4.08%                        |
| Mesquite                   | 55,131                    | 67,053                    | 101,484                   | 109,850                           | 117,950                         | 119,600                           | 1.40%                        |
| Richardson                 | 48,405                    | 72,496                    | 74,840                    | 78,750                            | 86,700                          | 89,200                            | 2.88%                        |
| Rowlett                    | 2,243                     | 7,522                     | 23,260                    | 32,350                            | 39,250                          | 41,250                            | 5.10%                        |
| Sachse                     | 777                       | 1,640                     | 5,346                     | 6,700                             | 7,350                           | 8,300                             | 12.93%                       |
| Seagoville                 | 4,390                     | 7,304                     | 8,969                     | 9,500                             | 10,350                          | 10,400                            | 0.48%                        |
| Sunnyvale                  | 995                       | 1,404                     | 2,228                     | 2,300                             | 2,450                           | 2,650                             | 8.16%                        |
| University Park            | 23,498                    | 22,254                    | 22,259                    | 23,000                            | 23,850                          | 23,900                            | 0.21%                        |
| Wilmer                     | 1,922                     | 2,367                     | 2,479                     | 2,500                             | 2,650                           | 2,650                             | 0.00%                        |
| Remainder of Dallas County | 18,941                    | 9,181                     | 6,197                     | 6,250                             | 6,400                           | 6,450                             | 0.78%                        |
| Split Cities               | 7,641                     | 11,854                    | (31,893)                  | (52,100)                          | (66,464)                        | (73,206)                          | 10.14%                       |
| <b>Denton County</b>       | <b>75,633</b>             | <b>143,126</b>            | <b>273,525</b>            | <b>320,400</b>                    | <b>375,990</b>                  | <b>400,915</b>                    | <b>6.63%</b>                 |
| Argyle                     | 443                       | 1,111                     | 1,575                     | 1,950                             | 2,050                           | 2,150                             | 4.88%                        |
| Aubrey                     | 731                       | 948                       | 1,138                     | 1,100                             | 1,150                           | 1,200                             | 4.35%                        |
| Carrollton                 | 13,855                    | 40,595                    | 82,169                    | 90,950                            | 97,950                          | 102,350                           | 4.49%                        |
| Copper Canyon              | NI                        | 465                       | 978                       | 1,150                             | 1,250                           | 1,300                             | 4.00%                        |
| Corinth                    | 461                       | 1,264                     | 3,944                     | 4,900                             | 7,300                           | 9,150                             | 25.34%                       |
| Denton                     | 39,874                    | 48,063                    | 66,270                    | 69,800                            | 73,200                          | 75,300                            | 2.87%                        |
| Double Oak                 | NI                        | 836                       | 1,664                     | 1,800                             | 2,150                           | 2,250                             | 4.65%                        |
| Flower Mound               | 1,685                     | 4,402                     | 15,527                    | 29,600                            | 42,500                          | 47,300                            | 11.29%                       |
| Hickory Creek              | 218                       | 1,422                     | 1,893                     | 2,000                             | 2,050                           | 2,050                             | 0.00%                        |
| Highland Village           | 516                       | 3,246                     | 7,027                     | 10,350                            | 11,700                          | 12,150                            | 3.85%                        |
| Justin                     | 741                       | 920                       | 1,234                     | 1,300                             | 1,450                           | 1,550                             | 6.90%                        |
| Krum                       | 454                       | 917                       | 1,542                     | 1,650                             | 1,800                           | 1,900                             | 5.56%                        |
| Lake Dallas                | 1,431                     | 3,177                     | 3,656                     | 4,150                             | 5,550                           | 5,900                             | 6.31%                        |
| Lewisville                 | 9,264                     | 24,273                    | 46,521                    | 53,350                            | 69,200                          | 74,700                            | 7.95%                        |
| Little Elm                 | 363                       | 926                       | 1,255                     | 1,150                             | 2,050                           | 2,200                             | 7.32%                        |
| Pilot Point                | 1,663                     | 2,211                     | 2,538                     | 2,800                             | 3,100                           | 3,250                             | 4.84%                        |
| Roanoke                    | 817                       | 910                       | 1,616                     | 1,900                             | 2,100                           | 2,150                             | 2.38%                        |
| Sanger*                    | 1,603                     | 2,754                     | 3,514                     | 4,100                             | 5,050                           | 5,200                             | 2.97%                        |
| Shady Shores               | 543                       | 813                       | 1,045                     | 1,350                             | 1,550                           | 1,650                             | 6.45%                        |
| The Colony                 | NI                        | 11,586                    | 22,113                    | 23,150                            | 24,400                          | 25,750                            | 5.53%                        |
| Trophy Club                | NI                        | NI                        | 3,922                     | 4,400                             | 5,850                           | 6,200                             | 5.98%                        |
| Remainder of Denton County | 12,826                    | 19,870                    | 28,072                    | 31,800                            | 36,400                          | 38,400                            | 5.49%                        |
| Split Cities               | (11,855)                  | (27,583)                  | (25,688)                  | (24,300)                          | (23,810)                        | (23,135)                          | -2.83%                       |
| <b>Ellis County</b>        | <b>46,638</b>             | <b>59,743</b>             | <b>85,167</b>             | <b>91,700</b>                     | <b>103,718</b>                  | <b>107,858</b>                    | <b>3.99%</b>                 |
| Ennis*                     | 11,046                    | 12,110                    | 13,869                    | 14,450                            | 15,200                          | 15,550                            | 2.30%                        |
| Ferris                     | 2,180                     | 2,228                     | 2,212                     | 2,200                             | 2,200                           | 2,200                             | 0.00%                        |
| Italy                      | 1,309                     | 1,306                     | 1,699                     | 1,750                             | 1,800                           | 1,800                             | 0.00%                        |
| Midlothian*                | 2,322                     | 3,219                     | 5,040                     | 5,800                             | 6,900                           | 7,250                             | 5.07%                        |
| Oak Leaf                   | NI                        | NI                        | 984                       | 1,000                             | 1,050                           | 1,200                             | 14.29%                       |
| Ovilla                     | 339                       | 1,067                     | 2,027                     | 2,550                             | 2,900                           | 3,050                             | 5.17%                        |
| Palmer                     | 601                       | 1,187                     | 1,659                     | 1,650                             | 1,800                           | 1,800                             | 0.00%                        |
| Red Oak                    | 767                       | 1,882                     | 3,124                     | 3,600                             | 5,000                           | 5,100                             | 2.00%                        |
| Waxahachie*                | 13,452                    | 14,624                    | 17,984                    | 19,100                            | 20,300                          | 20,700                            | 1.97%                        |
| Remainder of Ellis County  | 14,431                    | 21,926                    | 35,857                    | 38,900                            | 45,500                          | 47,850                            | 5.16%                        |
| Split Cities               | 191                       | 194                       | 712                       | 700                               | 1,068                           | 1,358                             | 27.15%                       |

|                                | Final<br>Census<br>4/1/70 | Final<br>Census<br>4/1/80 | Final<br>Census<br>4/1/90 | Estimated<br>Population<br>1/1/95 | Revised<br>Population<br>1/1/98 | Estimated<br>Population<br>1/1/99 | Percent<br>Growth<br>1998-99 |
|--------------------------------|---------------------------|---------------------------|---------------------------|-----------------------------------|---------------------------------|-----------------------------------|------------------------------|
| <b>Erath County</b>            | <b>18,141</b>             | <b>22,560</b>             | <b>27,991</b>             | <b>29,050</b>                     | <b>31,250</b>                   | <b>31,850</b>                     | <b>1.92%</b>                 |
| Dublin                         | 2,810                     | 2,723                     | 3,190                     | 3,250                             | 3,300                           | 3,400                             | 3.03%                        |
| Stephenville                   | 9,277                     | 11,881                    | 13,502                    | 13,700                            | 14,600                          | 14,650                            | 0.34%                        |
| Remainder of Erath County      | 6,054                     | 7,956                     | 11,299                    | 12,100                            | 13,350                          | 13,800                            | 3.37%                        |
| <b>Hood County</b>             | <b>6,368</b>              | <b>17,714</b>             | <b>28,981</b>             | <b>32,350</b>                     | <b>37,800</b>                   | <b>39,450</b>                     | <b>4.37%</b>                 |
| Granbury                       | 2,473                     | 3,332                     | 4,045                     | 4,250                             | 6,050                           | 6,500                             | 7.44%                        |
| Remainder of Hood County       | 3,895                     | 14,382                    | 24,936                    | 28,100                            | 31,750                          | 32,950                            | 3.78%                        |
| <b>Hunt County</b>             | <b>47,948</b>             | <b>55,248</b>             | <b>64,343</b>             | <b>65,400</b>                     | <b>69,700</b>                   | <b>71,500</b>                     | <b>2.58%</b>                 |
| Caddo Mills                    | 935                       | 1,060                     | 1,068                     | 1,100                             | 1,100                           | 1,150                             | 4.55%                        |
| Commerce                       | 9,534                     | 8,136                     | 6,825                     | 7,000                             | 7,650                           | 7,750                             | 1.31%                        |
| Greenville                     | 22,043                    | 22,161                    | 23,071                    | 23,250                            | 24,400                          | 24,600                            | 0.82%                        |
| Quinian                        | 844                       | 1,002                     | 1,360                     | 1,450                             | 1,550                           | 1,550                             | 0.00%                        |
| Wolfe City                     | 1,433                     | 1,594                     | 1,505                     | 1,550                             | 1,600                           | 1,600                             | 0.00%                        |
| Remainder of Hunt County       | 13,159                    | 21,295                    | 30,514                    | 31,050                            | 33,400                          | 34,850                            | 4.34%                        |
| <b>Johnson County</b>          | <b>45,769</b>             | <b>67,649</b>             | <b>97,165</b>             | <b>103,750</b>                    | <b>113,846</b>                  | <b>118,677</b>                    | <b>4.24%</b>                 |
| Alvarado                       | 2,129                     | 2,701                     | 2,918                     | 3,000                             | 3,200                           | 3,250                             | 1.56%                        |
| Burleson                       | 7,713                     | 11,734                    | 16,113                    | 17,950                            | 19,450                          | 20,400                            | 4.88%                        |
| Cleburne                       | 16,015                    | 19,218                    | 22,205                    | 22,700                            | 24,700                          | 25,000                            | 1.21%                        |
| Grandview                      | 935                       | 1,205                     | 1,245                     | 1,250                             | 1,300                           | 1,300                             | 0.00%                        |
| Joshua*                        | 924                       | 1,470                     | 3,821                     | 4,300                             | 5,400                           | 5,450                             | 0.93%                        |
| Keene                          | 2,440                     | 3,013                     | 3,944                     | 4,450                             | 4,500                           | 4,550                             | 1.11%                        |
| Venus                          | 414                       | 518                       | 977                       | 1,600                             | 1,700                           | 1,800                             | 5.88%                        |
| Remainder of Johnson County    | 16,133                    | 28,891                    | 47,285                    | 50,950                            | 56,450                          | 59,900                            | 6.11%                        |
| Split Cities                   | (934)                     | (1,101)                   | (1,343)                   | (2,450)                           | (2,854)                         | (2,973)                           | 4.17%                        |
| <b>Kaufman County</b>          | <b>32,392</b>             | <b>39,015</b>             | <b>52,220</b>             | <b>56,750</b>                     | <b>62,779</b>                   | <b>65,880</b>                     | <b>4.94%</b>                 |
| Combine                        | 249                       | 698                       | 1,329                     | 1,450                             | 1,550                           | 1,550                             | 0.00%                        |
| Crandall                       | 774                       | 831                       | 1,652                     | 2,100                             | 2,350                           | 2,350                             | 0.00%                        |
| Forney                         | 1,745                     | 2,483                     | 4,070                     | 4,450                             | 4,950                           | 5,200                             | 5.05%                        |
| Kaufman*                       | 4,012                     | 4,658                     | 5,251                     | 5,500                             | 5,700                           | 5,850                             | 2.63%                        |
| Kemp                           | 999                       | 1,035                     | 1,184                     | 1,200                             | 1,200                           | 1,200                             | 0.00%                        |
| Mabank                         | 1,239                     | 1,443                     | 1,458                     | 1,550                             | 1,750                           | 1,750                             | 0.00%                        |
| Terrell                        | 14,182                    | 13,225                    | 12,490                    | 12,650                            | 12,950                          | 13,200                            | 1.93%                        |
| Remainder of Kaufman County    | 9,320                     | 14,779                    | 25,494                    | 28,300                            | 32,800                          | 35,250                            | 7.47%                        |
| Split Cities                   | (128)                     | (137)                     | (708)                     | (450)                             | (471)                           | (470)                             | -0.21%                       |
| <b>Navarro County</b>          | <b>31,150</b>             | <b>35,323</b>             | <b>39,926</b>             | <b>40,300</b>                     | <b>40,650</b>                   | <b>41,100</b>                     | <b>1.11%</b>                 |
| Corsicana                      | 19,972                    | 21,712                    | 22,911                    | 23,000                            | 23,050                          | 23,300                            | 1.08%                        |
| Kerens                         | 1,446                     | 1,582                     | 1,702                     | 1,700                             | 1,700                           | 1,750                             | 2.94%                        |
| Remainder of Navarro County    | 9,732                     | 12,029                    | 15,313                    | 15,600                            | 15,900                          | 16,050                            | 0.94%                        |
| <b>Palo Pinto County</b>       | <b>28,962</b>             | <b>24,062</b>             | <b>25,055</b>             | <b>25,550</b>                     | <b>25,731</b>                   | <b>25,980</b>                     | <b>0.97%</b>                 |
| Mineral Wells*                 | 18,411                    | 14,468                    | 14,935                    | 14,850                            | 15,650                          | 15,700                            | 0.32%                        |
| Remainder of Palo Pinto County | 10,586                    | 9,631                     | 10,602                    | 10,750                            | 11,250                          | 11,450                            | 1.78%                        |
| Split Cities                   | (35)                      | (37)                      | (482)                     | (50)                              | (1,169)                         | (1,170)                           | 0.09%                        |
| <b>Parker County</b>           | <b>33,888</b>             | <b>44,609</b>             | <b>64,785</b>             | <b>73,550</b>                     | <b>84,911</b>                   | <b>89,047</b>                     | <b>4.87%</b>                 |
| Aledo                          | 620                       | 1,027                     | 1,169                     | 1,200                             | 1,450                           | 1,500                             | 3.45%                        |
| Hudson Oaks                    | NI                        | 309                       | 711                       | 1,150                             | 1,250                           | 1,250                             | 0.00%                        |
| Reno                           | 688                       | 1,174                     | 2,322                     | 2,450                             | 2,700                           | 2,800                             | 3.70%                        |
| Springtown                     | 1,194                     | 1,658                     | 1,740                     | 1,800                             | 2,050                           | 2,100                             | 2.44%                        |
| Weatherford                    | 11,750                    | 12,049                    | 14,804                    | 16,550                            | 18,900                          | 19,500                            | 3.17%                        |
| Willow Park                    | 230                       | 1,113                     | 2,328                     | 3,050                             | 3,400                           | 3,550                             | 4.41%                        |
| Remainder of Parker County     | 18,617                    | 26,349                    | 40,026                    | 46,100                            | 52,750                          | 55,950                            | 6.07%                        |
| Split Cities                   | 789                       | 930                       | 1,685                     | 1,250                             | 2,411                           | 2,397                             | -0.58%                       |
| <b>Rockwall County</b>         | <b>7,046</b>              | <b>14,528</b>             | <b>25,604</b>             | <b>31,050</b>                     | <b>36,781</b>                   | <b>39,316</b>                     | <b>6.89%</b>                 |
| Heath                          | 520                       | 1,459                     | 2,108                     | 2,750                             | 3,350                           | 3,650                             | 8.96%                        |
| Rockwall                       | 3,121                     | 5,939                     | 10,486                    | 12,200                            | 14,600                          | 15,850                            | 8.56%                        |
| Royse City                     | 1,535                     | 1,566                     | 2,206                     | 2,650                             | 2,900                           | 2,950                             | 1.72%                        |
| Remainder of Rockwall County   | 1,605                     | 4,567                     | 7,525                     | 8,700                             | 9,900                           | 10,450                            | 5.56%                        |
| Split Cities                   | 265                       | 997                       | 3,279                     | 4,750                             | 6,031                           | 6,416                             | 6.38%                        |
| <b>Somervell County</b>        | <b>2,793</b>              | <b>4,154</b>              | <b>5,360</b>              | <b>5,600</b>                      | <b>6,200</b>                    | <b>6,350</b>                      | <b>2.42%</b>                 |
| Glen Rose                      | 1,554                     | 2,075                     | 1,949                     | 1,950                             | 2,000                           | 2,000                             | 0.00%                        |
| Remainder of Somervell County  | 1,239                     | 2,079                     | 3,411                     | 3,650                             | 4,200                           | 4,350                             | 3.57%                        |
| <b>Tarrant County</b>          | <b>715,587</b>            | <b>860,880</b>            | <b>1,170,103</b>          | <b>1,258,450</b>                  | <b>1,345,413</b>                | <b>1,376,555</b>                  | <b>2.31%</b>                 |
| Arlington*                     | 90,229                    | 160,113                   | 261,717                   | 281,150                           | 304,950                         | 309,250                           | 1.41%                        |
| Azle                           | 4,493                     | 5,822                     | 8,868                     | 9,300                             | 9,500                           | 9,600                             | 1.05%                        |
| Bedford                        | 10,049                    | 20,821                    | 43,762                    | 45,900                            | 48,450                          | 48,900                            | 0.93%                        |
| Benbrook                       | 8,169                     | 13,579                    | 19,564                    | 20,250                            | 21,500                          | 21,600                            | 0.47%                        |
| Blue Mound                     | 1,283                     | 2,169                     | 2,133                     | 2,400                             | 2,450                           | 2,450                             | 0.00%                        |
| Colleyville                    | 3,342                     | 6,700                     | 12,724                    | 16,200                            | 18,600                          | 19,250                            | 3.49%                        |
| Crowley                        | 2,662                     | 5,852                     | 6,974                     | 7,150                             | 7,450                           | 7,650                             | 2.68%                        |
| Dalworthington Grdns           | 757                       | 1,100                     | 1,758                     | 2,050                             | 2,150                           | 2,200                             | 2.33%                        |
| Edgecliff Village              | 1,143                     | 2,695                     | 2,715                     | 2,750                             | 2,750                           | 2,750                             | 0.00%                        |
| Eules                          | 19,316                    | 24,002                    | 38,149                    | 39,900                            | 42,800                          | 44,700                            | 4.44%                        |
| Everman                        | 4,570                     | 5,387                     | 5,672                     | 5,750                             | 5,700                           | 5,700                             | 0.00%                        |
| Forest Hill                    | 8,236                     | 11,684                    | 11,482                    | 11,550                            | 11,550                          | 11,550                            | 0.00%                        |
| Fort Worth                     | 393,455                   | 385,164                   | 447,619                   | 473,600                           | 494,150                         | 504,350                           | 2.06%                        |

|  | Final<br>Census<br>4/1/70 | Final<br>Census<br>4/1/80 | Final<br>Census<br>4/1/90 | Estimated<br>Population<br>1/1/95 | Revised<br>Population<br>1/1/98 | Estimated<br>Population<br>1/1/99 | Percent<br>Growth<br>1998-99 |
|--|---------------------------|---------------------------|---------------------------|-----------------------------------|---------------------------------|-----------------------------------|------------------------------|
| Grapevine*   | 7,049                     | 11,801                    | 29,198                    | 33,100                            | 37,150                          | 38,750                            | 4.31%                        |
| Haltom City  | 28,127                    | 29,014                    | 32,856                    | 33,500                            | 35,350                          | 36,200                            | 2.40%                        |
| Haslet   | 276                       | 262                       | 795                       | 1,000                             | 1,050                           | 1,150                             | 9.52%                        |
| Hurst  | 27,215                    | 31,420                    | 33,574                    | 35,650                            | 36,300                          | 36,550                            | 0.69%                        |
| Keller   | 1,474                     | 4,156                     | 13,683                    | 18,250                            | 22,650                          | 24,350                            | 7.51%                        |
| Kennedale  | 3,076                     | 2,594                     | 4,096                     | 4,850                             | 5,400                           | 5,700                             | 5.56%                        |
| Lake Worth   | 4,958                     | 4,394                     | 4,591                     | 4,650                             | 4,600                           | 4,600                             | 0.00%                        |
| Mansfield*   | 3,658                     | 8,102                     | 15,615                    | 19,850                            | 23,800                          | 25,600                            | 7.56%                        |
| N. Richland Hills  | 16,514                    | 30,592                    | 45,895                    | 50,650                            | 53,100                          | 54,850                            | 3.30%                        |
| Pantego  | 1,779                     | 2,431                     | 2,371                     | 2,400                             | 2,400                           | 2,400                             | 0.00%                        |
| Pelican Bay  | NI                        | NI                        | 1,271                     | 1,300                             | 1,500                           | 1,500                             | 0.00%                        |
| Richland Hills   | 8,865                     | 7,977                     | 7,978                     | 8,150                             | 8,500                           | 8,750                             | 2.94%                        |
| River Oaks   | 8,193                     | 6,890                     | 6,580                     | 6,600                             | 6,600                           | 6,600                             | 0.00%                        |
| Saginaw  | 2,382                     | 5,736                     | 8,551                     | 9,400                             | 11,000                          | 11,750                            | 6.82%                        |
| Sansom Park  | 4,771                     | 3,921                     | 3,928                     | 3,900                             | 3,950                           | 3,950                             | 0.00%                        |
| Southlake*   | 2,031                     | 2,808                     | 7,082                     | 13,350                            | 19,250                          | 21,050                            | 9.35%                        |
| Watauga  | 3,778                     | 10,284                    | 20,009                    | 21,100                            | 22,000                          | 22,000                            | 0.00%                        |
| Westworth Village  | 4,578                     | 3,651                     | 2,350                     | 1,850                             | 1,900                           | 1,950                             | 2.63%                        |
| White Settlement   | 13,449                    | 13,508                    | 15,472                    | 15,400                            | 15,500                          | 15,500                            | 0.00%                        |
| Remainder of Tarrant County  | 24,110                    | 29,854                    | 33,232                    | 34,050                            | 34,500                          | 34,650                            | 0.43%                        |
| Split Cities   | 1,600                     | 6,397                     | 17,839                    | 21,500                            | 26,913                          | 28,755                            | 6.84%                        |
| <b>Wise County</b>   | <b>19,687</b>             | <b>26,575</b>             | <b>34,679</b>             | <b>36,850</b>                     | <b>41,400</b>                   | <b>43,600</b>                     | <b>5.31%</b>                 |
| Boyd   | 695                       | 889                       | 1,041                     | 1,100                             | 1,100                           | 1,150                             | 4.55%                        |
| Bridgeport   | 3,614                     | 3,737                     | 3,581                     | 3,600                             | 3,700                           | 3,700                             | 0.00%                        |
| Decatur*   | 3,240                     | 4,104                     | 4,245                     | 4,400                             | 4,550                           | 4,800                             | 5.49%                        |
| Remainder of Wise County   | 12,138                    | 17,845                    | 25,812                    | 27,750                            | 32,050                          | 33,950                            | 5.93%                        |
| <b>Nine County Urban Area</b><br>(Collin, Dallas, Denton, Ellis<br>Johnson, Kaufman, Parker,<br>Rockwall, Tarrant) | <b>2,351,569</b>          | <b>2,930,545</b>          | <b>3,885,415</b>          | <b>4,215,200</b>                  | <b>4,573,486</b>                | <b>4,703,234</b>                  | <b>2.84%</b>                 |
| <b>NCTCOG Region (16 counties)</b>   | <b>2,508,442</b>          | <b>3,119,806</b>          | <b>4,111,750</b>          | <b>4,450,300</b>                  | <b>4,826,217</b>                | <b>4,963,064</b>                  | <b>2.84%</b>                 |

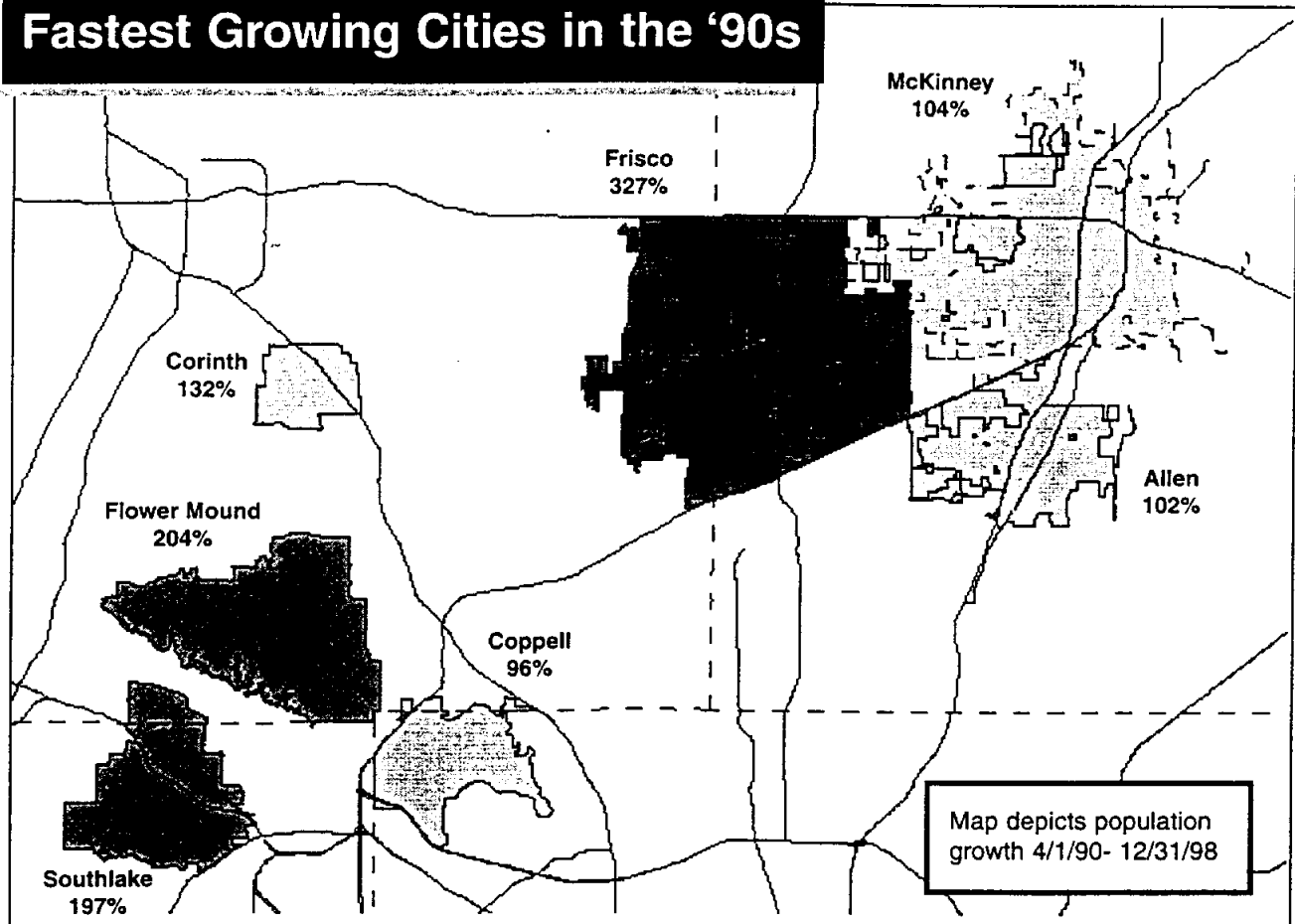
\* 1990 population totals have been officially changed by the Census Bureau.

| <b>SPLIT CITY TOTALS</b>    |                             |            |                              |                               |            |       |
|-----------------------------|-----------------------------|------------|------------------------------|-------------------------------|------------|-------|
| Added to                    | Split Cities                | Population | Added to                     | Split Cities                  | Population |       |
| <b><u>Collin County</u></b> | Dallas                      | 45,533     | <b><u>Ellis County</u></b>   | Cedar Hill                    | 222        |       |
|                             | Garland                     | 15         |                              | Glenn Heights                 | 1,277      |       |
|                             | Richardson                  | 19,246     |                              | Grand Prairie                 | 4          |       |
|                             | Royse City                  | 198        |                              | Mansfield                     | 158        |       |
|                             | Sachse                      | 1,288      |                              |                               |            |       |
| <b><u>Dallas County</u></b> | Carrollton                  | 46,541     | <b><u>Johnson County</u></b> | Mansfield                     | 390        |       |
|                             | Combine                     | 449        |                              |                               |            |       |
|                             | Grapevine                   | 6          | <b><u>Kaufman County</u></b> | Dallas                        | 8          |       |
|                             | Lewisville                  | 1,711      |                              | Seagoville                    | 6          |       |
|                             | Ovilla                      | 303        |                              |                               |            |       |
| <b><u>Denton County</u></b> | Wylie                       | 171        | <b><u>Parker County</u></b>  | Azle                          | 1,228      |       |
|                             |                             |            |                              | Mineral Wells                 | 1,170      |       |
|                             | <b><u>Dallas County</u></b> | Dallas     | 20,765                       | <b><u>Rockwall County</u></b> | Dallas     | 77    |
|                             |                             | Coppell    | 6                            |                               | Garland    | 0     |
|                             |                             | Fort Worth | 3                            |                               | Rowlett    | 6,336 |
| Frisco                      |                             | 1,646      | Wylie                        |                               | 201        |       |
| Plano                       |                             | 2,269      |                              |                               |            |       |
| <b><u>Dallas County</u></b> | Southlake                   | 428        | <b><u>Tarrant County</u></b> | Burleson                      | 3,363      |       |
|                             |                             |            |                              | Grand Prairie                 | 27,605     |       |

For technical questions, contact *Angi Young*, Research and Information Services, NCTCOG. To order copies of this and other COG publications, contact *Alice Tate*, Regional Information Center, NCTCOG, 616 Six Flags Drive, Suite 200, P. O. Box 5888, Arlington, Texas 76005-5888, (817) 640-3300.



## Fastest Growing Cities in the '90s



## Population Estimates Methodology:

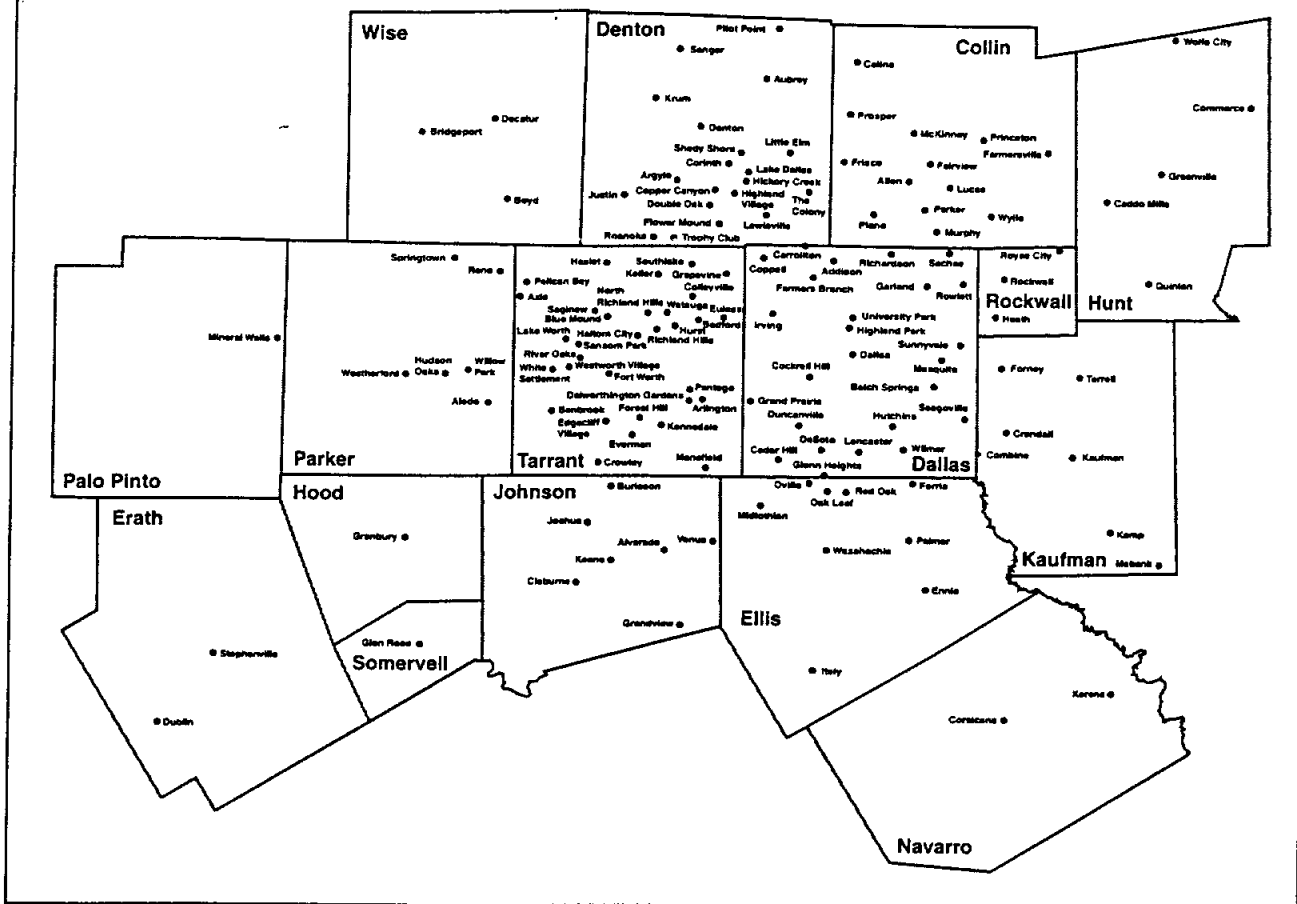
NCTCOG's population estimates are based on current housing inventories for each city in the NCTCOG region with a population of 1,000 or more. The figures are reviewed at the regional level for consistency with other indicators of regional population such as labor force estimates and vital statistics.

Cities complete a building permit form that provides NCTCOG with information on building completions, demolitions, annexations and other changes in housing stock that occurred throughout the prior year. The reported housing units by type (single family, multi family, other) are added to the 1990 Census housing stock figures to develop estimates of current year housing stock. Persons per household figures and occupancy rates were adjusted slightly in order to account for national trends as well as regional and

local rates observed from secondary data sources and surveys. These rates were used in conjunction with building permit data to produce city level population estimates. Final population for January 1, 1999 also includes estimates of persons living in group quarters (nursing homes, dormitories, etc.). All figures are reviewed by each city prior to publication. County level estimates are adjusted for cities that are in more than one county. Remainder of county totals are estimated based upon secondary resources and have been adjusted to reflect annexations.

Revised population estimates require prior year adjustments through methodological changes to ensure consistency. The percent growth column provides a convenient indicator of the annual growth for each city and county.

# Map of the North Central Texas Region (All Cities over 1,000)



North Central Texas Council of Governments  
 P. O. Box 5888  
 Arlington, TX 76005-5888

Bulk Rate  
 U.S. POSTAGE  
 PAID  
 Arlington, Texas  
 Permit 90

# NCTCOG 1998 Population by Census Tract



North Central Texas Council of Governments • Research and Information Services

The North Central Texas Council of Governments (NCTCOG) 1998 Population by Census Tract is part of the Research and Information Services Department's Annual Population Estimates program. The tract estimates cover 810 census tracts that are located completely within the Metropolitan Planning Area (MPA). The MPA is designated for regional transportation planning and includes all of Collin, Dallas, Denton, Rockwall and Tarrant counties as well as portions of Ellis, Johnson, Kaufman and Parker.

The MPA is now home to 4,403,750 persons, growing by almost as much in the last three years (314,150), as it did in the first five years of the decade (321,350). The average annual growth of nearly 105,000 per year since 1995 exceeds the totals achieved in the 1980s and is driven by unprecedented economic expansion in North Central Texas.

Census tract data allows us to look beyond city and county boundaries to market-defined areas of development. At this level of analysis, the State Highway (SH) 121 corridor reigns as the dominant residential growth market throughout the 1990s. This corridor, which crosses four counties and 14 cities, emerged as the fastest growing sector in our region in the first half of this decade with 103,010 new residents. In the last three years, another 113,618 persons were added to this area, for a total 1990s increase of 216,628 or 58% of the MPA total.

The power of the SH 121 Corridor has contributed to the emergence of the SH 114 Corridor in the last three years. Jutting northwest from 121 and sitting strategically between DFW and Alliance Airports, the 114 corridor combines with 121 to capture almost 40% of all the growth in the MPA from 1995 through 1997 (119,791 persons). Not surprisingly, then, eight of the top ten census tracts in absolute growth are included in the new SH 121/114 Corridor that now boasts 639,231 residents.

The location of the 114 Corridor and portions of 121 in Denton explains this county's increase in share of population growth to 17 percent of the MPA total in the last three years. This is a three percent jump over its' share the first half of the 1990s, taken fairly evenly from the surrounding counties.

The NCTCOG tract analysis also gives us an opportunity to look at interesting growth areas within the region that are sometimes lost, such as the neighborhood in and around the Dallas Central Business District (CBD). Central Dallas population is so dense that the census tracts in this area are very small in comparison to the rest of the region. However, when central area tracts are combined to achieve a more normal land mass, they take on the character of some of the region's highest growth tracts.

The expanded Dallas CBD includes 12 census tracts and is home to 11,500 persons on 2,265 acres of land. This is an area that is less than half the size of an average census tract in the MPA and one-fourth the average size of the top ten growth tracts. However, despite this smaller size, the expanded CBD has grown at a ratio equal to that of the top ten tracts. Average tracts in this region have grown by one person per 10 acres since 1990. The ten fastest growing tracts and the expanded CBD area have each grown by more than ten times that rate or one person per one acre. In absolute growth, the CBD tract ranks 28th in the MPA.

## The "Downtown" Census Tract



|            | Avg. MPA Tract | Avg. Top 10 Tract | "Downtown" Tract |
|------------|----------------|-------------------|------------------|
| Acres      | 5,447          | 9,518             | 2,265            |
| 95-97 Pop. | 393            | 5,581             | 2,333            |
| Total 1998 | 5,398          | 17,193            | 11,500           |
| Density    | 1              | 1.8               | 5                |

| 1990 Tract | 1990 Population | 1995 Population | 1998 Population |
|------------|-----------------|-----------------|-----------------|
| 1.00       | 3,274           | 3,287           | 3,537           |
| 2.01       | 2,486           | 2,492           | 2,490           |
| 2.02       | 3,291           | 3,305           | 3,308           |
| 3.00       | 3,183           | 3,202           | 3,210           |
| 4.01       | 3,744           | 3,775           | 3,813           |
| 4.03       | 5,415           | 5,433           | 5,442           |
| 4.04       | 4,109           | 4,147           | 4,163           |
| 4.05       | 2,312           | 2,337           | 2,418           |
| 5.00       | 4,911           | 4,963           | 5,005           |
| 6.01       | 6,499           | 6,812           | 6,849           |
| 6.03       | 3,903           | 3,943           | 3,993           |
| 6.04       | 3,962           | 3,998           | 4,052           |
| 7.01       | 2,086           | 2,110           | 2,621           |
| 7.02       | 2,909           | 3,206           | 3,386           |
| 8.00       | 4,616           | 4,655           | 4,698           |
| 9.00       | 5,248           | 5,301           | 5,306           |
| 10.01      | 1,817           | 1,827           | 1,830           |
| 10.02      | 2,747           | 2,763           | 2,775           |
| 11.01      | 3,852           | 3,677           | 3,691           |
| 11.02      | 2,014           | 2,029           | 2,028           |
| 12.01      | 3,842           | 3,855           | 3,864           |
| 12.02      | 3,105           | 3,132           | 3,142           |
| 13.01      | 2,522           | 2,561           | 2,569           |
| 13.02      | 3,215           | 3,244           | 3,258           |
| 14.00      | 4,132           | 4,191           | 4,205           |
| 15.02      | 3,849           | 3,888           | 3,896           |
| 15.03      | 3,982           | 4,026           | 4,058           |
| 15.04      | 3,027           | 3,058           | 3,082           |
| 16.00      | 2,716           | 2,816           | 2,828           |
| 17.01      | 1               | 1               | 38              |
| 17.02      | 433             | 794             | 1,353           |
| 18.00      | 1,460           | 1,533           | 1,577           |
| 19.00      | 830             | 833             | 1,284           |
| 20.00      | 6,246           | 6,310           | 6,347           |
| 21.00      | 0               | 0               | 0               |
| 22.01      | 915             | 917             | 918             |
| 22.02      | 398             | 402             | 1,177           |
| 24.00      | 3,803           | 3,821           | 3,827           |
| 25.00      | 5,883           | 5,909           | 5,933           |
| 27.01      | 4,683           | 4,722           | 4,734           |
| 27.02      | 2,168           | 2,176           | 2,187           |
| 28.00      | 418             | 421             | 422             |
| 29.00      | 1,051           | 1,062           | 1,063           |
| 31.01      | 2,841           | 2,843           | 2,846           |
| 31.02      | 92              | 92              | 92              |
| 32.01      | 602             | 601             | 602             |
| 33.00      | 1,570           | 1,577           | 1,579           |
| 34.00      | 1,665           | 1,681           | 1,683           |
| 35.00      | 1,883           | 1,901           | 1,906           |
| 36.00      | 1,010           | 1,015           | 1,022           |
| 37.00      | 4,194           | 4,210           | 4,211           |
| 38.00      | 3,018           | 3,085           | 3,093           |
| 39.01      | 2,170           | 2,185           | 2,203           |
| 39.02      | 2,423           | 2,436           | 2,435           |
| 40.00      | 1,709           | 1,719           | 1,720           |
| 41.00      | 1,538           | 1,545           | 1,540           |
| 42.00      | 8,050           | 8,107           | 8,133           |
| 43.00      | 4,829           | 4,869           | 4,875           |
| 44.00      | 3,248           | 3,261           | 3,273           |
| 45.00      | 5,041           | 5,065           | 5,109           |
| 46.00      | 2,307           | 2,321           | 2,326           |
| 47.00      | 3,358           | 3,381           | 3,400           |
| 48.00      | 3,756           | 3,791           | 3,833           |
| 49.00      | 4,152           | 4,164           | 4,155           |
| 50.00      | 4,023           | 4,031           | 4,045           |
| 51.00      | 2,775           | 2,780           | 2,788           |
| 52.00      | 4,153           | 4,170           | 4,181           |
| 53.00      | 6,205           | 6,221           | 6,237           |
| 54.00      | 5,401           | 5,414           | 5,407           |

| 1990 Tract | 1990 Population | 1995 Population | 1998 Population |
|------------|-----------------|-----------------|-----------------|
| 55.00      | 4,295           | 4,308           | 4,306           |
| 56.00      | 6,139           | 6,156           | 6,162           |
| 57.00      | 4,913           | 4,921           | 4,916           |
| 59.01      | 6,173           | 6,184           | 6,186           |
| 59.02      | 4,445           | 4,462           | 4,463           |
| 60.01      | 3,197           | 3,213           | 3,220           |
| 60.02      | 4,027           | 4,065           | 4,070           |
| 61.00      | 4,248           | 4,276           | 4,291           |
| 62.00      | 4,464           | 4,483           | 4,489           |
| 63.01      | 4,569           | 4,580           | 4,595           |
| 63.02      | 3,300           | 3,306           | 3,308           |
| 64.00      | 6,938           | 6,967           | 6,974           |
| 65.01      | 3,281           | 3,291           | 3,303           |
| 65.02      | 3,159           | 3,164           | 3,190           |
| 67.00      | 6,101           | 6,130           | 6,146           |
| 68.00      | 5,251           | 5,295           | 5,288           |
| 69.00      | 2,612           | 2,634           | 2,637           |
| 71.01      | 1,996           | 2,010           | 2,014           |
| 71.02      | 5,773           | 5,796           | 5,797           |
| 72.01      | 4,935           | 4,988           | 5,020           |
| 72.02      | 4,930           | 4,983           | 5,012           |
| 73.01      | 1,985           | 1,990           | 1,994           |
| 73.02      | 3,606           | 3,621           | 3,747           |
| 74.00      | 1,395           | 1,406           | 1,436           |
| 75.01      | 622             | 627             | 6,48            |
| 75.02      | 381             | 388             | 389             |
| 76.01      | 1,987           | 1,996           | 2,002           |
| 76.02      | 814             | 816             | 817             |
| 76.03      | 917             | 919             | 924             |
| 76.04      | 2,858           | 2,902           | 3,004           |
| 77.00      | 4,961           | 5,049           | 5,191           |
| 78.01      | 1,996           | 2,003           | 2,046           |
| 78.04      | 4,343           | 4,372           | 4,887           |
| 78.05      | 3,029           | 3,100           | 3,136           |
| 78.06      | 5,313           | 5,370           | 5,415           |
| 78.09      | 2,202           | 2,215           | 2,226           |
| 78.10      | 4,910           | 4,941           | 4,967           |
| 78.11      | 4,048           | 4,094           | 4,125           |
| 78.12      | 3,533           | 3,545           | 3,543           |
| 78.13      | 6,774           | 6,811           | 6,879           |
| 78.14      | 4,491           | 4,543           | 4,762           |
| 78.15      | 3,897           | 3,941           | 3,977           |
| 78.16      | 6,038           | 6,109           | 6,152           |
| 78.17      | 7,133           | 7,217           | 7,264           |
| 79.02      | 5,488           | 5,507           | 5,521           |
| 79.03      | 2,574           | 2,590           | 2,602           |
| 79.05      | 4,094           | 4,267           | 4,330           |
| 79.06      | 1,460           | 1,489           | 1,506           |
| 79.07      | 3,791           | 3,836           | 3,840           |
| 79.08      | 5,447           | 5,512           | 5,528           |
| 80.00      | 6,015           | 6,026           | 6,029           |
| 81.00      | 5,260           | 5,461           | 5,541           |
| 82.00      | 3,797           | 3,816           | 3,874           |
| 83.00      | 1,333           | 1,336           | 1,333           |
| 84.00      | 5,470           | 5,488           | 5,488           |
| 85.00      | 3,356           | 3,383           | 3,410           |
| 86.01      | 1,107           | 1,117           | 1,122           |
| 86.02      | 2,588           | 2,608           | 2,601           |
| 87.01      | 5,189           | 5,222           | 5,764           |
| 87.03      | 2,993           | 2,999           | 3,012           |
| 87.04      | 5,153           | 5,191           | 5,213           |
| 87.05      | 1,924           | 1,925           | 1,934           |
| 88.01      | 2,862           | 2,869           | 2,869           |
| 88.02      | 6,071           | 6,094           | 6,096           |
| 89.00      | 4,696           | 4,725           | 4,734           |
| 90.01      | 1,169           | 1,177           | 1,177           |
| 90.02      | 4,343           | 4,359           | 4,373           |
| 91.01      | 5,058           | 5,094           | 5,108           |
| 91.02      | 7,832           | 7,856           | 7,866           |

| 1990 Tract | 1990 Population | 1995 Population | 1998 Population |
|------------|-----------------|-----------------|-----------------|
| 92.01      | 4,830           | 4,838           | 4,830           |
| 92.02      | 4,397           | 4,429           | 4,434           |
| 93.01      | 3,194           | 3,200           | 3,206           |
| 93.03      | 4,317           | 4,324           | 4,331           |
| 93.04      | 5,110           | 5,145           | 5,153           |
| 94.01      | 3,161           | 3,170           | 3,164           |
| 94.02      | 2,209           | 2,215           | 2,248           |
| 95.00      | 2,274           | 2,278           | 2,279           |
| 96.03      | 4,744           | 4,762           | 4,768           |
| 96.04      | 4,045           | 4,087           | 4,101           |
| 96.05      | 2,774           | 2,791           | 2,799           |
| 96.06      | 5,843           | 5,893           | 5,942           |
| 96.07      | 3,114           | 3,122           | 3,129           |
| 96.08      | 4,752           | 4,781           | 4,803           |
| 96.09      | 2,982           | 2,988           | 2,985           |
| 97.01      | 3,564           | 3,576           | 3,575           |
| 97.02      | 2,994           | 3,003           | 3,003           |
| 98.01      | 7,961           | 8,042           | 8,058           |
| 98.02      | 4,600           | 4,629           | 4,680           |
| 99.00      | 1,451           | 1,450           | 1,453           |
| 100.00     | 3,265           | 3,269           | 3,314           |
| 101.01     | 4,242           | 4,247           | 4,269           |
| 101.02     | 3,649           | 3,653           | 3,737           |
| 102.00     | 1,756           | 1,769           | 1,772           |
| 103.00     | 433             | 437             | 438             |
| 104.00     | 2,122           | 2,150           | 2,156           |
| 105.00     | 2,575           | 2,598           | 2,602           |
| 106.00     | 7,743           | 7,796           | 7,996           |
| 107.01     | 2,901           | 2,908           | 2,897           |
| 107.02     | 5,394           | 5,425           | 5,691           |
| 108.01     | 5,816           | 5,851           | 5,850           |
| 108.02     | 5,806           | 5,851           | 5,862           |
| 108.03     | 6,529           | 6,566           | 6,587           |
| 109.00     | 8,385           | 8,472           | 9,126           |
| 110.01     | 6,887           | 6,954           | 6,963           |
| 110.02     | 3,216           | 3,225           | 3,226           |
| 111.01     | 4,153           | 4,171           | 4,224           |
| 111.03     | 3,518           | 3,526           | 3,526           |
| 111.04     | 3,958           | 3,975           | 3,994           |
| 111.05     | 4,587           | 4,621           | 4,632           |
| 112.00     | 3,465           | 3,476           | 3,475           |
| 113.00     | 5,187           | 5,202           | 5,201           |
| 114.01     | 3,822           | 3,845           | 3,862           |
| 114.02     | 917             | 953             | 955             |
| 115.00     | 4,967           | 5,015           | 5,018           |
| 116.01     | 4,310           | 4,327           | 4,339           |
| 116.02     | 3,440           | 3,447           | 3,454           |
| 117.00     | 8,640           | 8,676           | 8,689           |
| 118.00     | 6,836           | 6,910           | 7,153           |
| 119.00     | 7,319           | 7,361           | 7,488           |
| 120.00     | 5,395           | 5,432           | 5,447           |
| 121.00     | 2,928           | 2,955           | 3,156           |
| 122.02     | 8,875           | 8,932           | 9,031           |
| 122.03     | 4,589           | 4,630           | 4,652           |
| 122.04     | 5,143           | 5,168           | 5,174           |
| 122.05     | 7,313           | 7,382           | 7,416           |
| 123.00     | 8,002           | 8,076           | 8,128           |
| 124.00     | 4,847           | 4,868           | 4,876           |
| 125.00     | 6,299           | 6,315           | 6,318           |
| 126.01     | 4,577           | 4,748           | 4,744           |
| 126.02     | 6,216           | 6,262           | 6,292           |
| 127.00     | 7,291           | 7,319           | 7,320           |
| 128.00     | 8,948           | 8,968           | 8,984           |
| 129.00     | 4,436           | 4,451           | 4,467           |
| 130.04     | 5,705           | 5,721           | 5,733           |
| 130.05     | 5,138           | 5,199           | 5,215           |
| 130.06     | 6,404           | 6,475           | 6,517           |
| 130.07     | 2,946           | 2,962           | 2,962           |
| 130.08     | 3,101           | 3,114           | 3,113           |

| 1990 Tract | 1990 Population | 1995 Population | 1998 Population |
|------------|-----------------|-----------------|-----------------|
| 201.98     | 94              | 95              | 98              |
| 202.00     | 10,653          | 12,116          | 13,361          |
| 202.98     | 130             | 130             | 130             |
| 203.01     | 4,866           | 5,310           | 6,063           |
| 203.02     | 12,835          | 14,456          | 16,931          |
| 203.98     | 0               | 0               | 0               |
| 204.01     | 2,545           | 2,707           | 2,849           |
| 204.02     | 4,005           | 4,320           | 4,416           |
| 204.03     | 3,622           | 3,841           | 3,693           |
| 205.01     | 6,175           | 6,487           | 7,478           |
| 205.02     | 7,215           | 7,701           | 8,252           |
| 206.01     | 4,108           | 4,250           | 4,335           |
| 206.02     | 6,073           | 6,433           | 6,753           |
| 207.00     | 3,357           | 3,481           | 3,506           |
| 208.00     | 3,157           | 3,217           | 3,601           |
| 209.00     | 3,296           | 3,453           | 3,456           |
| 210.00     | 5,739           | 5,944           | 5,975           |
| 211.00     | 2,591           | 2,700           | 2,773           |
| 212.00     | 4,818           | 5,522           | 5,866           |
| 213.01     | 2,077           | 2,191           | 2,192           |
| 213.02     | 7,643           | 8,215           | 8,747           |
| 214.01     | 5,547           | 6,047           | 6,871           |
| 214.02     | 4,332           | 5,295           | 7,860           |
| 214.03     | 5,645           | 6,221           | 7,585           |
| 215.02     | 3,479           | 3,590           | 3,861           |
| 215.04     | 7,012           | 9,370           | 10,546          |
| 215.05     | 3,323           | 4,049           | 5,365           |
| 215.06     | 8,888           | 7,056           | 7,556           |
| 215.07     | 16,865          | 18,282          | 19,863          |
| 216.01     | 4,564           | 4,696           | 5,849           |
| 216.03     | 4,757           | 6,984           | 7,896           |
| 216.04     | 5,247           | 6,709           | 8,959           |
| 216.05     | 4,274           | 4,871           | 6,129           |
| 216.06     | 7,328           | 7,917           | 8,241           |
| 216.07     | 8,066           | 8,527           | 9,067           |
| 216.08     | 8,508           | 8,322           | 8,603           |
| 216.09     | 9,506           | 11,595          | 12,717          |
| 216.10     | 6,870           | 8,774           | 9,394           |
| 216.11     | 3,998           | 4,950           | 5,200           |
| 217.03     | 7,084           | 7,880           | 10,053          |
| 217.05     | 1,926           | 3,235           | 3,740           |
| 217.06     | 5,428           | 8,398           | 10,506          |
| 217.07     | 5,625           | 7,294           | 10,319          |
| 217.08     | 1,302           | 2,494           | 6,512           |
| 217.09     | 2,955           | 11,251          | 14,504          |
| 217.10     | 6,253           | 9,251           | 15,600          |
| 217.11     | 8,082           | 6,289           | 7,250           |
| 217.12     | 6,529           | 7,643           | 10,478          |
| 217.13     | 7,961           | 8,072           | 9,004           |
| 301.00     | 3,806           | 4,190           | 4,702           |
| 302.00     | 5,897           | 6,272           | 7,035           |
| 303.00     | 4,798           | 5,221           | 5,926           |
| 304.00     | 5,541           | 9,051           | 12,030          |
| 305.00     | 2,683           | 8,691           | 17,897          |
| 308.00     | 3,703           | 7,782           | 11,847          |
| 307.00     | 7,148           | 7,401           | 8,124           |
| 308.00     | 4,101           | 4,584           | 6,381           |
| 309.00     | 5,285           | 5,202           | 5,825           |
| 310.00     | 8,546           | 9,275           | 10,337          |
| 311.00     | 5,613           | 5,913           | 6,434           |
| 312.00     | 3,238           | 3,585           | 3,982           |
| 313.02     | 9,014           | 10,890          | 13,680          |
| 313.03     | 3,619           | 4,591           | 5,249           |
| 313.04     | 6,429           | 6,689           | 7,804           |
| 314.01     | 3,664           | 4,606           | 7,436           |
| 314.02     | 5,968           | 10,813          | 14,422          |
| 315.01     | 7,380           | 9,949           | 11,044          |
| 315.02     | 7,052           | 8,119           | 10,935          |
| 316.01     | 7,934           | 9,210           | 10,752          |

| 1990 Tract | 1990 Population | 1995 Population | 1998 Population |
|------------|-----------------|-----------------|-----------------|
| 316.03     | 0               | 0               | 0               |
| 316.05     | 0               | 0               | 0               |
| 316.08     | 8,116           | 8,508           | 8,974           |
| 316.09     | 7,574           | 7,971           | 8,277           |
| 316.10     | 7,698           | 7,800           | 7,996           |
| 316.11     | 3,225           | 3,767           | 3,876           |
| 316.12     | 6,135           | 6,753           | 6,922           |
| 316.13     | 6,583           | 6,659           | 6,974           |
| 316.14     | 6,505           | 10,823          | 13,927          |
| 316.15     | 8,532           | 11,591          | 12,445          |
| 316.16     | 6,373           | 9,907           | 15,602          |
| 316.17     | 4,567           | 7,334           | 9,881           |
| 316.18     | 4,223           | 12,197          | 19,852          |
| 316.19     | 4,013           | 13,173          | 19,776          |
| 316.20     | 3,039           | 6,295           | 7,585           |
| 316.21     | 4,684           | 5,564           | 6,409           |
| 317.02     | 6,120           | 8,604           | 9,682           |
| 317.98     | 20,109          | 30,767          | 34,314          |
| 318.02     | 4,571           | 4,652           | 6,238           |
| 318.03     | 4,897           | 5,242           | 6,406           |
| 318.98     | 7,160           | 7,830           | 8,117           |
| 319.00     | 3,202           | 3,405           | 3,650           |
| 320.03     | 4,832           | 4,948           | 5,172           |
| 320.04     | 6,204           | 6,305           | 6,516           |
| 320.05     | 3,015           | 3,194           | 3,688           |
| 320.07     | 5,032           | 5,097           | 6,254           |
| 320.08     | 3,942           | 4,355           | 4,445           |
| 320.98     | 2,466           | 3,945           | 5,000           |
| 401.00     | 3,073           | 3,701           | 4,746           |
| 402.00     | 2,140           | 2,498           | 3,001           |
| 403.01     | 3,287           | 4,621           | 5,815           |
| 403.02     | 5,445           | 6,278           | 7,420           |
| 404.00     | 4,318           | 4,989           | 5,614           |
| 405.00     | 7,341           | 8,584           | 10,253          |
| 502.00     | 6,803           | 8,415           | 9,567           |
| 508.00     | 4,893           | 6,303           | 7,130           |
| 601.00     | 9,498           | 9,846           | 10,988          |
| 602.01     | 7,658           | 8,600           | 10,252          |
| 602.02     | 7,064           | 7,781           | 9,683           |
| 602.03     | 5,874           | 6,356           | 7,300           |
| 603.00     | 2,976           | 3,111           | 3,272           |
| 604.00     | 3,473           | 3,632           | 3,790           |
| 605.00     | 2,552           | 2,673           | 2,789           |
| 606.00     | 6,125           | 6,509           | 7,107           |
| 607.00     | 4,747           | 5,242           | 6,143           |
| 608.00     | 5,434           | 5,990           | 7,084           |
| 614.00     | 5,855           | 6,131           | 6,610           |
| 615.00     | 4,169           | 4,363           | 4,578           |
| 616.00     | 4,682           | 4,921           | 5,192           |
| 1001.01    | 4,718           | 4,852           | 4,905           |
| 1001.02    | 4,275           | 4,375           | 4,405           |
| 1002.01    | 3,461           | 3,620           | 3,652           |
| 1002.02    | 5,192           | 5,324           | 5,384           |
| 1003.00    | 4,097           | 4,276           | 4,309           |
| 1004.00    | 6,652           | 6,856           | 6,915           |
| 1005.01    | 5,981           | 6,219           | 6,257           |
| 1005.02    | 6,346           | 6,517           | 6,572           |
| 1006.01    | 1,810           | 1,872           | 1,889           |
| 1006.02    | 2,877           | 2,967           | 3,034           |
| 1007.00    | 3,959           | 4,065           | 4,093           |
| 1008.00    | 5,717           | 5,926           | 5,960           |
| 1009.00    | 2,309           | 2,364           | 2,377           |
| 1010.00    | 3,617           | 3,665           | 3,824           |
| 1011.00    | 1,757           | 1,782           | 1,867           |
| 1012.01    | 1,261           | 1,296           | 1,306           |
| 1012.02    | 3,701           | 3,803           | 3,833           |
| 1013.01    | 4,477           | 4,625           | 4,659           |
| 1013.02    | 3,169           | 3,242           | 3,275           |
| 1014.01    | 4,207           | 4,361           | 4,400           |

| 1990 Tract | 1990 Population | 1995 Population | 1998 Population |
|------------|-----------------|-----------------|-----------------|
| 1014.02    | 2,583           | 2,625           | 2,648           |
| 1014.03    | 4,036           | 4,198           | 4,244           |
| 1015.00    | 3,641           | 3,730           | 3,777           |
| 1016.00    | 1,340           | 1,372           | 1,451           |
| 1017.00    | 2,796           | 2,840           | 2,900           |
| 1018.00    | 489             | 820             | 1,067           |
| 1019.00    | 574             | 596             | 608             |
| 1020.00    | 1,151           | 1,201           | 1,216           |
| 1021.00    | 5,356           | 5,576           | 5,619           |
| 1022.01    | 3,533           | 3,627           | 3,668           |
| 1022.02    | 3,017           | 3,148           | 3,180           |
| 1023.01    | 3,128           | 3,249           | 3,274           |
| 1023.02    | 4,996           | 5,094           | 5,135           |
| 1024.01    | 3,870           | 4,021           | 4,079           |
| 1024.02    | 3,986           | 4,091           | 4,119           |
| 1025.00    | 3,931           | 4,084           | 4,114           |
| 1026.00    | 6,254           | 6,437           | 6,503           |
| 1027.00    | 3,706           | 3,838           | 3,875           |
| 1028.00    | 1,322           | 1,363           | 1,376           |
| 1029.00    | 1,497           | 1,539           | 1,606           |
| 1030.00    | 1,655           | 1,751           | 1,813           |
| 1031.00    | 870             | 892             | 1,218           |
| 1032.00    | 464             | 482             | 483             |
| 1033.00    | 1,402           | 1,432           | 1,447           |
| 1034.00    | 1,005           | 1,024           | 1,032           |
| 1035.00    | 5,476           | 5,640           | 5,724           |
| 1036.01    | 2,791           | 3,035           | 3,067           |
| 1036.02    | 2,067           | 2,127           | 2,155           |
| 1037.01    | 3,622           | 3,878           | 3,939           |
| 1037.02    | 2,583           | 2,623           | 2,641           |
| 1038.00    | 3,599           | 3,755           | 3,783           |
| 1039.00    | 2,435           | 2,509           | 2,532           |
| 1040.00    | 1,961           | 2,012           | 2,050           |
| 1041.00    | 4,323           | 4,465           | 4,502           |
| 1042.01    | 5,663           | 5,834           | 6,093           |
| 1042.02    | 3,233           | 3,311           | 3,338           |
| 1043.00    | 5,045           | 5,219           | 5,262           |
| 1044.00    | 5,192           | 5,300           | 5,353           |
| 1045.01    | 7,376           | 7,623           | 7,678           |
| 1045.02    | 2,768           | 2,844           | 2,865           |
| 1045.03    | 2,863           | 2,950           | 2,979           |
| 1046.01    | 3,356           | 3,575           | 3,602           |
| 1046.02    | 3,841           | 3,906           | 3,942           |
| 1046.03    | 2,940           | 3,052           | 3,079           |
| 1046.04    | 2,323           | 2,356           | 2,387           |
| 1046.05    | 4,336           | 4,460           | 4,501           |
| 1047.00    | 5,980           | 6,093           | 6,144           |
| 1048.01    | 6,728           | 6,911           | 6,993           |
| 1048.02    | 4,704           | 4,824           | 4,887           |
| 1049.00    | 2,224           | 2,270           | 2,295           |
| 1050.01    | 5,057           | 5,178           | 5,232           |
| 1050.05    | 1,521           | 1,884           | 2,269           |
| 1050.06    | 1,177           | 1,189           | 1,226           |
| 1051.00    | 4,010           | 4,196           | 4,230           |
| 1052.01    | 4,196           | 4,389           | 4,425           |
| 1052.02    | 7,937           | 8,387           | 8,448           |
| 1052.03    | 2,054           | 2,104           | 2,125           |
| 1053.00    | 782             | 815             | 819             |
| 1054.03    | 3,390           | 3,494           | 4,146           |
| 1054.04    | 3,523           | 3,606           | 3,924           |
| 1054.05    | 3,421           | 3,585           | 4,308           |
| 1054.06    | 1,906           | 2,141           | 2,314           |
| 1055.02    | 5,730           | 5,873           | 5,918           |
| 1055.03    | 5,564           | 5,653           | 5,734           |
| 1055.05    | 4,379           | 4,533           | 4,572           |
| 1055.06    | 4,137           | 4,453           | 4,473           |
| 1055.07    | 1,001           | 1,790           | 2,383           |
| 1055.08    | 2,479           | 2,859           | 3,036           |
| 1055.09    | 10,535          | 10,853          | 10,962          |

| 1990<br>Tract | 1990<br>Population | 1995<br>Population | 1998<br>Population |
|---------------|--------------------|--------------------|--------------------|
| 130.09        | 4,756              | 4,789              | 4,798              |
| 131.01        | 2,648              | 2,654              | 2,652              |
| 131.02        | 1,793              | 1,799              | 1,796              |
| 131.03        | 6,570              | 6,638              | 6,652              |
| 132.00        | 2,464              | 2,479              | 2,544              |
| 133.00        | 1,826              | 1,828              | 1,827              |
| 134.01        | 891                | 893                | 903                |
| 134.02        | 1,006              | 1,009              | 1,006              |
| 135.00        | 2,377              | 2,384              | 2,384              |
| 136.05        | 5,803              | 5,819              | 5,825              |
| 136.06        | 5,137              | 5,166              | 5,166              |
| 136.07        | 3,544              | 3,555              | 3,564              |
| 136.08        | 2,547              | 2,580              | 2,611              |
| 136.09        | 3,959              | 3,987              | 4,011              |
| 136.10        | 4,409              | 4,443              | 4,451              |
| 136.11        | 1,307              | 1,626              | 1,632              |
| 136.12        | 5,119              | 5,612              | 5,637              |
| 136.13        | 5,367              | 5,595              | 6,364              |
| 136.14        | 4,610              | 5,087              | 6,328              |
| 136.15        | 5,024              | 5,083              | 5,097              |
| 136.16        | 2,022              | 2,061              | 2,067              |
| 136.17        | 3,216              | 3,226              | 3,217              |
| 136.18        | 2,412              | 2,419              | 2,428              |
| 136.19        | 5,851              | 5,858              | 5,858              |
| 137.01        | 5,024              | 5,077              | 5,147              |
| 137.02        | 8,191              | 8,469              | 8,733              |
| 137.04        | 2,612              | 4,121              | 5,656              |
| 137.05        | 1                  | 1                  | 1                  |
| 137.07        | 9,620              | 11,333             | 11,691             |
| 137.08        | 7,440              | 7,712              | 8,038              |
| 137.09        | 7,147              | 8,145              | 8,947              |
| 137.10        | 7,449              | 7,657              | 8,506              |
| 138.01        | 4,530              | 4,627              | 6,198              |
| 138.02        | 8,480              | 8,646              | 8,673              |
| 139.00        | 6,845              | 6,857              | 6,827              |
| 140.01        | 3,561              | 3,579              | 3,601              |
| 140.02        | 325                | 345                | 275                |
| 141.01        | 690                | 1,499              | 1,727              |
| 141.03        | 2,587              | 2,667              | 3,151              |
| 141.05        | 582                | 752                | 1,454              |
| 141.07        | 8,448              | 9,718              | 11,884             |
| 141.08        | 5,055              | 9,393              | 10,990             |
| 141.09        | 3,486              | 5,508              | 7,888              |
| 141.10        | 2,579              | 3,112              | 5,554              |
| 141.11        | 3,491              | 7,290              | 9,504              |
| 141.12        | 4,154              | 4,267              | 4,542              |
| 141.13        | 3,962              | 4,066              | 4,328              |
| 141.14        | 2,291              | 2,362              | 2,522              |
| 141.15        | 6,362              | 6,429              | 6,538              |
| 141.16        | 4,048              | 4,155              | 4,413              |
| 141.97        | 9                  | 9                  | 9                  |
| 141.98        | 2,645              | 4,101              | 4,556              |
| 142.01        | 1,714              | 1,736              | 1,795              |
| 142.02        | 5,593              | 5,672              | 5,855              |
| 143.02        | 6,390              | 6,459              | 6,599              |
| 143.03        | 7,960              | 8,117              | 8,481              |
| 143.04        | 4,573              | 6,568              | 7,598              |
| 143.05        | 6,520              | 6,672              | 7,034              |
| 143.06        | 4,792              | 4,835              | 4,900              |
| 144.02        | 7,229              | 7,340              | 7,588              |
| 144.03        | 3,678              | 3,774              | 4,014              |
| 144.04        | 6,763              | 7,186              | 7,608              |
| 145.00        | 7,004              | 7,091              | 7,307              |
| 146.00        | 8,100              | 8,235              | 8,549              |
| 147.00        | 8,248              | 8,457              | 8,801              |
| 148.01        | 1,141              | 1,143              | 1,162              |
| 148.02        | 1,308              | 1,346              | 1,383              |
| 149.00        | 4,229              | 4,311              | 4,495              |
| 150.00        | 6,656              | 6,789              | 6,979              |

| 1990<br>Tract | 1990<br>Population | 1995<br>Population | 1998<br>Population |
|---------------|--------------------|--------------------|--------------------|
| 151.00        | 6,309              | 6,376              | 6,542              |
| 152.02        | 2,929              | 2,977              | 3,076              |
| 152.03        | 7,100              | 7,202              | 7,431              |
| 152.04        | 6,528              | 6,808              | 6,884              |
| 153.01        | 4,036              | 4,035              | 3,417              |
| 153.02        | 7,317              | 7,384              | 7,539              |
| 154.01        | 4,701              | 4,678              | 4,752              |
| 154.02        | 6,187              | 6,238              | 6,184              |
| 155.00        | 3,358              | 3,353              | 3,387              |
| 156.00        | 4,067              | 4,071              | 4,108              |
| 157.00        | 2,429              | 2,432              | 2,432              |
| 158.00        | 2,313              | 2,315              | 2,286              |
| 159.00        | 2,757              | 2,784              | 2,782              |
| 160.00        | 6,116              | 6,241              | 6,247              |
| 161.00        | 2,362              | 2,350              | 2,363              |
| 162.00        | 8,101              | 8,148              | 8,127              |
| 163.00        | 5,605              | 5,665              | 5,719              |
| 164.01        | 3,247              | 3,610              | 3,818              |
| 164.02        | 9,724              | 9,681              | 9,721              |
| 164.03        | 7,944              | 8,956              | 9,468              |
| 164.04        | 2394               | 3,021              | 4,058              |
| 164.05        | 7,013              | 7,075              | 7,484              |
| 165.01        | 4,953              | 5,177              | 5,294              |
| 165.02        | 5,938              | 5,960              | 6,056              |
| 165.05        | 7,729              | 9,789              | 11,230             |
| 165.08        | 8,635              | 8,595              | 8,761              |
| 165.09        | 4,852              | 4,851              | 4,922              |
| 165.10        | 5,144              | 5,307              | 5,325              |
| 165.11        | 3,596              | 3,606              | 3,701              |
| 165.12        | 7,255              | 7,221              | 7,356              |
| 165.13        | 4,564              | 4,893              | 5,039              |
| 166.04        | 11,237             | 13,417             | 15,341             |
| 166.05        | 2,290              | 2,315              | 2,334              |
| 166.06        | 5,334              | 5,616              | 6,054              |
| 166.07        | 3,276              | 3,316              | 3,345              |
| 166.08        | 6,808              | 7,354              | 7,776              |
| 166.09        | 7,533              | 7,850              | 8,305              |
| 166.10        | 4,493              | 4,536              | 4,794              |
| 166.11        | 3,472              | 4,074              | 4,513              |
| 166.12        | 5,083              | 6,897              | 7,429              |
| 166.13        | 6,130              | 6,273              | 7,854              |
| 167.01        | 6,104              | 6,117              | 6,135              |
| 167.02        | 11,870             | 12,183             | 12,286             |
| 168.01        | 8,479              | 8,720              | 9,439              |
| 168.02        | 2,154              | 2,215              | 2,231              |
| 169.01        | 4,209              | 4,223              | 4,220              |
| 169.02        | 2,854              | 2,866              | 2,893              |
| 169.03        | 3,568              | 3,590              | 3,761              |
| 169.04        | 395                | 401                | 406                |
| 170.01        | 6,066              | 6,182              | 6,739              |
| 170.02        | 10,260             | 10,762             | 10,990             |
| 171.00        | 6,266              | 6,322              | 6,564              |
| 172.01        | 4,789              | 4,866              | 5,057              |
| 172.02        | 5,489              | 6,160              | 6,354              |
| 173.01        | 4,662              | 4,704              | 4,789              |
| 173.02        | 10,405             | 15,832             | 18,839             |
| 174.00        | 5,580              | 5,860              | 5,949              |
| 175.00        | 2,659              | 2,757              | 2,812              |
| 176.01        | 9,231              | 9,491              | 9,939              |
| 176.02        | 3,262              | 3,276              | 3,320              |
| 177.01        | 8,994              | 9,141              | 9,391              |
| 177.02        | 5,544              | 6,112              | 6,520              |
| 178.04        | 5,358              | 5,406              | 5,593              |
| 178.05        | 5,582              | 5,637              | 6,281              |
| 178.06        | 4,493              | 4,528              | 4,712              |
| 178.07        | 5,132              | 5,185              | 5,361              |
| 178.08        | 3,529              | 3,729              | 3,799              |
| 178.09        | 7,144              | 7,473              | 7,577              |
| 178.10        | 9,026              | 9,664              | 9,990              |

| 1990<br>Tract | 1990<br>Population | 1995<br>Population | 1998<br>Population |
|---------------|--------------------|--------------------|--------------------|
| 179.00        | 4,896              | 4,716              | 4,790              |
| 180.00        | 9,104              | 9,220              | 9,406              |
| 181.04        | 3,467              | 3,634              | 3,877              |
| 181.05        | 5,297              | 5,348              | 5,410              |
| 181.06        | 6,418              | 7,379              | 7,747              |
| 181.07        | 9,298              | 11,269             | 12,007             |
| 181.08        | 8,722              | 13,415             | 16,210             |
| 181.10        | 4,857              | 4,999              | 5,118              |
| 181.11        | 5,193              | 5,241              | 5,322              |
| 181.12        | 8,982              | 9,110              | 9,247              |
| 181.13        | 11,588             | 11,922             | 12,186             |
| 181.15        | 10,358             | 11,102             | 11,420             |
| 181.16        | 5,940              | 7,864              | 8,889              |
| 181.17        | 6,000              | 7,114              | 8,448              |
| 181.18        | 4,729              | 5,166              | 5,503              |
| 181.19        | 4,219              | 5,069              | 5,536              |
| 182.01        | 7,854              | 8,478              | 9,226              |
| 182.02        | 6,848              | 7,074              | 7,174              |
| 183.00        | 5,726              | 5,859              | 5,933              |
| 184.01        | 4,220              | 4,456              | 4,524              |
| 184.02        | 3,814              | 3,867              | 3,918              |
| 184.03        | 2,478              | 2,859              | 2,916              |
| 185.01        | 3,021              | 3,086              | 3,123              |
| 185.03        | 3,846              | 3,890              | 3,884              |
| 185.04        | 3,955              | 4,002              | 4,033              |
| 186.00        | 3,345              | 3,370              | 3,407              |
| 187.00        | 5,339              | 5,550              | 5,635              |
| 188.01        | 3,818              | 3,835              | 3,872              |
| 188.02        | 767                | 801                | 808                |
| 189.00        | 4,784              | 4,896              | 4,982              |
| 190.04        | 5,849              | 5,966              | 6,038              |
| 190.07        | 9,900              | 10,267             | 10,391             |
| 190.08        | 11,482             | 12,827             | 12,962             |
| 190.09        | 10,675             | 13,124             | 15,413             |
| 190.10        | 6,843              | 6,739              | 6,870              |
| 190.12        | 4,787              | 4,982              | 6,457              |
| 190.13        | 4,501              | 5,179              | 5,321              |
| 190.14        | 6,217              | 6,366              | 6,439              |
| 190.15        | 6,895              | 7,151              | 7,256              |
| 190.16        | 2,559              | 2,582              | 2,587              |
| 190.17        | 7,157              | 7,221              | 7,569              |
| 190.18        | 4,597              | 4,627              | 4,644              |
| 190.19        | 5,989              | 6,062              | 6,116              |
| 190.20        | 4,555              | 4,995              | 5,073              |
| 190.21        | 6,689              | 6,914              | 7,011              |
| 190.22        | 7,124              | 7,151              | 7,193              |
| 190.23        | 4,942              | 4,990              | 5,050              |
| 190.24        | 4,403              | 4,434              | 4,479              |
| 191.00        | 5,021              | 5,082              | 5,197              |
| 192.02        | 4,209              | 4,312              | 4,478              |
| 192.03        | 4,045              | 4,086              | 4,139              |
| 192.04        | 6,757              | 6,962              | 7,295              |
| 192.05        | 3,428              | 3,439              | 3,448              |
| 192.06        | 4,411              | 4,450              | 4,490              |
| 192.08        | 5,389              | 5,440              | 5,473              |
| 192.09        | 5,750              | 5,818              | 5,897              |
| 192.10        | 4,027              | 4,192              | 4,197              |
| 192.11        | 4,666              | 4,758              | 5,456              |
| 193.01        | 2,463              | 2,548              | 2,801              |
| 193.02        | 5,991              | 6,161              | 6,079              |
| 194.00        | 3,578              | 3,715              | 3,829              |
| 195.01        | 6,002              | 6,218              | 6,659              |
| 195.02        | 4,231              | 4,368              | 4,511              |
| 196.00        | 2,304              | 2,429              | 2,561              |
| 197.00        | 2,148              | 2,218              | 2,317              |
| 198.00        | 4,236              | 4,363              | 4,480              |
| 199.00        | 3,746              | 3,798              | 3,788              |
| 201.01        | 7,502              | 8,313              | 9,284              |
| 201.02        | 4,094              | 4,394              | 4,968              |

| 1990 Tract | 1990 Population | 1995 Population | 1998 Population |
|------------|-----------------|-----------------|-----------------|
| 1055.10    | 3,083           | 3,349           | 3,450           |
| 1056.00    | 4,640           | 4,710           | 4,747           |
| 1057.01    | 3,479           | 3,557           | 3,588           |
| 1057.03    | 3,613           | 3,741           | 3,767           |
| 1057.04    | 5,865           | 6,414           | 6,476           |
| 1058.00    | 3,818           | 3,894           | 3,929           |
| 1059.00    | 6,724           | 6,922           | 7,050           |
| 1060.01    | 6,766           | 6,980           | 7,038           |
| 1060.02    | 3,631           | 3,701           | 3,738           |
| 1060.04    | 2,136           | 2,183           | 2,206           |
| 1060.05    | 515             | 527             | 556             |
| 1061.01    | 1,473           | 1,510           | 1,528           |
| 1061.02    | 1,887           | 1,959           | 1,979           |
| 1062.01    | 4,056           | 4,114           | 4,151           |
| 1062.02    | 4,250           | 4,371           | 4,422           |
| 1063.00    | 2,601           | 2,709           | 2,764           |
| 1064.00    | 1,637           | 1,672           | 1,684           |
| 1065.02    | 2,658           | 2,759           | 2,783           |
| 1065.03    | 4,901           | 5,025           | 5,066           |
| 1065.06    | 8,464           | 8,914           | 8,986           |
| 1065.07    | 2,002           | 2,100           | 2,115           |
| 1065.08    | 4,301           | 4,537           | 5,326           |
| 1065.09    | 2,258           | 2,417           | 2,473           |
| 1065.10    | 1,320           | 1,975           | 2,766           |
| 1065.11    | 3,588           | 3,860           | 4,009           |
| 1065.12    | 3,126           | 3,426           | 3,507           |
| 1065.13    | 2,789           | 2,898           | 2,913           |
| 1065.14    | 3,020           | 3,363           | 3,399           |
| 1066.00    | 646             | 966             | 1,662           |
| 1067.00    | 1,383           | 1,557           | 1,619           |
| 1101.01    | 5,122           | 5,261           | 5,447           |
| 1101.02    | 4,093           | 4,174           | 4,160           |
| 1102.01    | 7,985           | 8,277           | 9,600           |
| 1102.02    | 3,302           | 3,293           | 3,412           |
| 1103.00    | 8,433           | 8,532           | 8,597           |
| 1104.01    | 4,926           | 4,986           | 5,004           |
| 1104.02    | 3,911           | 3,906           | 3,929           |
| 1105.00    | 6,650           | 6,649           | 6,649           |
| 1106.01    | 2,350           | 1,849           | 1,923           |
| 1106.02    | 678             | 710             | 720             |
| 1107.01    | 7,036           | 7,001           | 7,035           |
| 1107.02    | 8,446           | 8,433           | 8,487           |
| 1108.01    | 4,559           | 5,599           | 5,962           |
| 1108.04    | 2,369           | 2,575           | 3,123           |
| 1109.01    | 3,416           | 3,528           | 3,769           |
| 1109.03    | 1,539           | 1,671           | 1,748           |
| 1109.04    | 607             | 618             | 645             |
| 1109.05    | 4,022           | 4,215           | 4,458           |
| 1109.06    | 4,627           | 4,743           | 5,049           |
| 1109.07    | 3,194           | 3,298           | 3,531           |
| 1110.03    | 2,602           | 2,634           | 2,636           |
| 1110.05    | 3,753           | 4,177           | 4,381           |
| 1110.06    | 5,242           | 6,306           | 7,163           |
| 1110.07    | 6,080           | 7,002           | 7,624           |
| 1110.08    | 2,732           | 2,793           | 2,824           |
| 1110.09    | 1,547           | 1,895           | 2,085           |
| 1110.10    | 1,217           | 1,265           | 1,282           |
| 1111.01    | 6,563           | 6,579           | 6,595           |
| 1111.02    | 5,121           | 5,163           | 5,162           |
| 1112.01    | 4,873           | 5,085           | 5,173           |
| 1112.02    | 5,653           | 5,727           | 5,693           |
| 1113.01    | 4,949           | 5,119           | 5,222           |
| 1113.03    | 1,788           | 3,562           | 5,300           |
| 1113.04    | 3,570           | 4,671           | 5,165           |
| 1113.05    | 5,634           | 6,506           | 7,167           |
| 1113.06    | 2,587           | 3,121           | 3,301           |
| 1114.01    | 3,637           | 5,595           | 6,490           |
| 1114.02    | 4,228           | 4,938           | 5,254           |
| 1114.03    | 7,848           | 8,408           | 8,896           |

| 1990 Tract | 1990 Population | 1995 Population | 1998 Population |
|------------|-----------------|-----------------|-----------------|
| 1115.05    | 4,207           | 4,245           | 4,454           |
| 1115.06    | 6,051           | 6,103           | 6,354           |
| 1115.11    | 3,406           | 4,344           | 5,147           |
| 1115.12    | 6,443           | 7,556           | 9,529           |
| 1115.13    | 2,077           | 2,797           | 2,899           |
| 1115.14    | 4,861           | 5,634           | 5,914           |
| 1115.15    | 6,812           | 8,561           | 9,648           |
| 1115.16    | 3,655           | 5,658           | 6,359           |
| 1115.17    | 5,362           | 7,284           | 8,453           |
| 1115.18    | 1,475           | 2,154           | 3,878           |
| 1115.19    | 1,078           | 1,090           | 1,326           |
| 1115.21    | 6,555           | 6,599           | 6,926           |
| 1115.22    | 6,918           | 6,948           | 7,218           |
| 1115.23    | 4,693           | 4,759           | 5,291           |
| 1115.24    | 5,893           | 6,010           | 6,317           |
| 1115.25    | 5,495           | 5,701           | 5,969           |
| 1115.26    | 4,525           | 4,570           | 4,752           |
| 1115.27    | 6,733           | 6,821           | 7,201           |
| 1115.28    | 7,004           | 8,203           | 8,669           |
| 1115.29    | 3,829           | 3,847           | 3,983           |
| 1115.30    | 5,782           | 6,399           | 6,847           |
| 1115.31    | 4,636           | 4,920           | 5,218           |
| 1115.32    | 3,408           | 3,656           | 3,987           |
| 1115.33    | 4,192           | 4,632           | 4,914           |
| 1115.34    | 5,507           | 5,682           | 5,969           |
| 1115.35    | 478             | 813             | 1,179           |
| 1130.01    | 3,098           | 3,272           | 3,630           |
| 1130.02    | 4,671           | 4,944           | 5,239           |
| 1131.01    | 2,368           | 2,653           | 5,235           |
| 1131.02    | 4,730           | 4,816           | 5,147           |
| 1131.03    | 5,499           | 5,685           | 6,023           |
| 1131.04    | 2,504           | 2,934           | 3,221           |
| 1131.05    | 7,111           | 7,657           | 8,209           |
| 1131.06    | 8,176           | 8,314           | 8,926           |
| 1131.07    | 2,685           | 2,734           | 2,833           |
| 1131.08    | 4,308           | 4,517           | 4,689           |
| 1132.05    | 7,307           | 7,561           | 7,923           |
| 1132.06    | 4,474           | 4,495           | 4,569           |
| 1132.07    | 3,285           | 4,282           | 4,439           |
| 1132.08    | 8,338           | 9,030           | 9,239           |
| 1132.09    | 9,189           | 9,364           | 9,557           |
| 1132.10    | 3,842           | 5,047           | 5,511           |
| 1132.11    | 8,421           | 8,859           | 9,398           |
| 1133.01    | 4,384           | 4,456           | 4,529           |
| 1133.02    | 4,002           | 4,073           | 4,342           |
| 1134.03    | 3,003           | 3,038           | 3,047           |
| 1134.04    | 5,455           | 5,590           | 5,615           |
| 1134.05    | 4,538           | 4,800           | 4,892           |
| 1134.07    | 3,641           | 4,053           | 4,079           |
| 1134.08    | 5,567           | 5,619           | 5,624           |
| 1135.04    | 7,276           | 7,499           | 7,818           |
| 1135.05    | 6,803           | 7,456           | 7,766           |
| 1135.06    | 8,765           | 8,968           | 8,996           |
| 1135.07    | 6,210           | 6,640           | 7,413           |
| 1135.08    | 8,923           | 9,114           | 10,655          |
| 1136.07    | 4,233           | 4,303           | 4,344           |
| 1136.09    | 16,320          | 20,391          | 22,680          |
| 1136.10    | 4,811           | 5,708           | 6,417           |
| 1136.11    | 3,303           | 3,897           | 4,266           |
| 1136.12    | 4,305           | 4,398           | 4,569           |
| 1136.13    | 4,727           | 4,849           | 4,907           |
| 1136.14    | 7,828           | 8,453           | 9,023           |
| 1136.15    | 7,697           | 8,109           | 8,277           |
| 1136.16    | 6,542           | 7,021           | 7,926           |
| 1136.17    | 7,486           | 7,720           | 7,870           |
| 1136.18    | 6,263           | 6,489           | 6,969           |
| 1136.19    | 4,672           | 4,891           | 5,028           |
| 1137.02    | 7,018           | 8,376           | 9,419           |
| 1137.03    | 4,567           | 4,880           | 5,119           |

| 1990 Tract | 1990 Population | 1995 Population | 1998 Population |
|------------|-----------------|-----------------|-----------------|
| 1137.04    | 9,335           | 10,609          | 11,618          |
| 1138.01    | 4,684           | 8,394           | 11,507          |
| 1138.03    | 4,563           | 4,921           | 5,361           |
| 1138.04    | 10,896          | 11,922          | 12,193          |
| 1138.05    | 8,091           | 8,138           | 8,317           |
| 1139.01    | 5,380           | 11,048          | 16,313          |
| 1139.02    | 9,839           | 11,648          | 13,510          |
| 1139.03    | 6,038           | 8,283           | 9,418           |
| 1139.04    | 4,078           | 5,509           | 7,632           |
| 1139.05    | 7,471           | 8,494           | 9,512           |
| 1140.01    | 3,112           | 3,315           | 3,523           |
| 1140.03    | 2,221           | 2,852           | 3,599           |
| 1140.04    | 8,430           | 8,888           | 9,841           |
| 1141.01    | 1,526           | 1,754           | 1,829           |
| 1141.02    | 4,701           | 4,841           | 4,908           |
| 1142.02    | 5,402           | 5,612           | 5,695           |
| 1142.03    | 4,868           | 5,045           | 5,261           |
| 1142.04    | 3,934           | 4,159           | 4,359           |
| 1142.05    | 3,477           | 3,597           | 3,672           |
| 1216.01    | 6,435           | 7,285           | 7,606           |
| 1216.04    | 5,803           | 5,853           | 6,106           |
| 1216.05    | 2,981           | 3,004           | 3,116           |
| 1216.06    | 2,577           | 2,617           | 2,764           |
| 1216.08    | 5,566           | 5,972           | 6,219           |
| 1216.09    | 5,389           | 5,647           | 5,863           |
| 1216.10    | 2,566           | 2,646           | 2,820           |
| 1216.11    | 3,785           | 4,652           | 4,863           |
| 1217.01    | 7,717           | 7,782           | 8,235           |
| 1217.02    | 4,112           | 4,153           | 4,395           |
| 1218.00    | 215             | 216             | 225             |
| 1219.01    | 6,572           | 6,646           | 7,112           |
| 1219.02    | 6,671           | 6,691           | 7,117           |
| 1220.00    | 6,967           | 7,013           | 7,349           |
| 1221.00    | 5,423           | 5,446           | 5,651           |
| 1222.00    | 1,671           | 1,690           | 1,782           |
| 1223.00    | 3,347           | 3,375           | 3,577           |
| 1224.00    | 5,555           | 6,097           | 6,761           |
| 1225.00    | 3,650           | 3,736           | 3,921           |
| 1226.00    | 4,127           | 4,159           | 4,340           |
| 1227.00    | 4,712           | 4,848           | 5,107           |
| 1228.00    | 6,671           | 6,732           | 7,132           |
| 1229.00    | 6,213           | 6,255           | 6,533           |
| 1302.01    | 4,231           | 4,380           | 4,672           |
| 1302.02    | 12,747          | 13,795          | 15,030          |
| 1302.03    | 14,496          | 15,629          | 17,375          |
| 1304.01    | 8,334           | 8,917           | 9,867           |
| 1307.00    | 3,857           | 3,908           | 4,113           |
| 1308.00    | 3,148           | 3,248           | 3,411           |
| 1309.00    | 2,771           | 2,830           | 2,972           |
| 1310.00    | 4,452           | 4,523           | 4,744           |
| 1311.00    | 4,835           | 4,762           | 5,019           |

Research and compilation of the 1998 population by tract database was conducted by NCTCOG Research and Information Services (RIS) Senior Associate Rocky Gardiner. If you have any questions or require further information on this or any other RIS product, please call (817) 695-9150.

# Population Growth 1995-1998

• = 100 persons



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Governments  
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# NCTCOG Mid-Decade Update

## 1995 Land Use

by City



North Central Texas Council of Governments • Research and Information Services

The North Central Texas Council of Governments (NCTCOG) Land Use Inventory is part of the NCTCOG's mid-decade update program, providing small area demographic and land use information for 1995 in the North Central Texas region. The Land Use Inventory covers the Metropolitan Planning Area (MPA), as designated for regional transportation planning, which encompasses more than three million acres of land including all of Collin, Dallas, Denton, Tarrant and Rockwall counties as well as portions of Ellis, Johnson, Kaufman and Parker. Approximately 90% of all residential and commercial activities in North Central Texas are located within this planning area as shown on page 4.

This publication reports the 1995 land uses for 141 cities in the MPA with total land areas of 300 acres or more. The listing for each city reports the total acres of land in 11 land use categories as well as the total acreage and percent of land that is vacant. Descriptions of the land use categories follow the city listings.

Within the MPA, vacant land accounts for nearly 70% of the 3.17 million acres. Another 129,388 acres or 4% of the total MPA land area is devoted to lakes and other water resources. Of the remaining 26% or 826,241 acres in development, 58% is in residential uses, 20% is in employment uses and another 21% is devoted to infrastructure and dedicated land. Employment land includes all commercial, industrial and institutional land. Only one percent of the MPA's land area was under construction in 1995, nearly all of which was located in the suburban communities.

The top ten cities in total residential land within the MPA, listed on page five of this publication, are also the ten most populous cities in North Central Texas. Nine of these ten cities also rank within the top ten for

employment land. The City of Denton finishes out the employment top ten. Denton ranks unexpectedly high in total employment land because it serves as a central city for Denton County rather than as a suburb to Dallas and Fort Worth. As such, it has a higher ratio of commercial to residential activity than the surrounding suburban communities.

The NCTCOG Land Use Inventory was used to calculate typical land use requirements per one hundred residents for large and small suburban cities within the MPA, as presented in the Suburban Land Uses section of this publication. The smaller communities range in size from 20,000 to 40,000 residents and larger cities range from 40,000 to 100,000 persons.

The smaller cities are relatively dispersed settlements, reporting an average total land area of 43 acres and developed land area of 20 acres per 100 residents. This yields an average residential density 2.3 persons per total and 5 persons per developed acre of land. Developed land area is the total land area less vacant land and water.

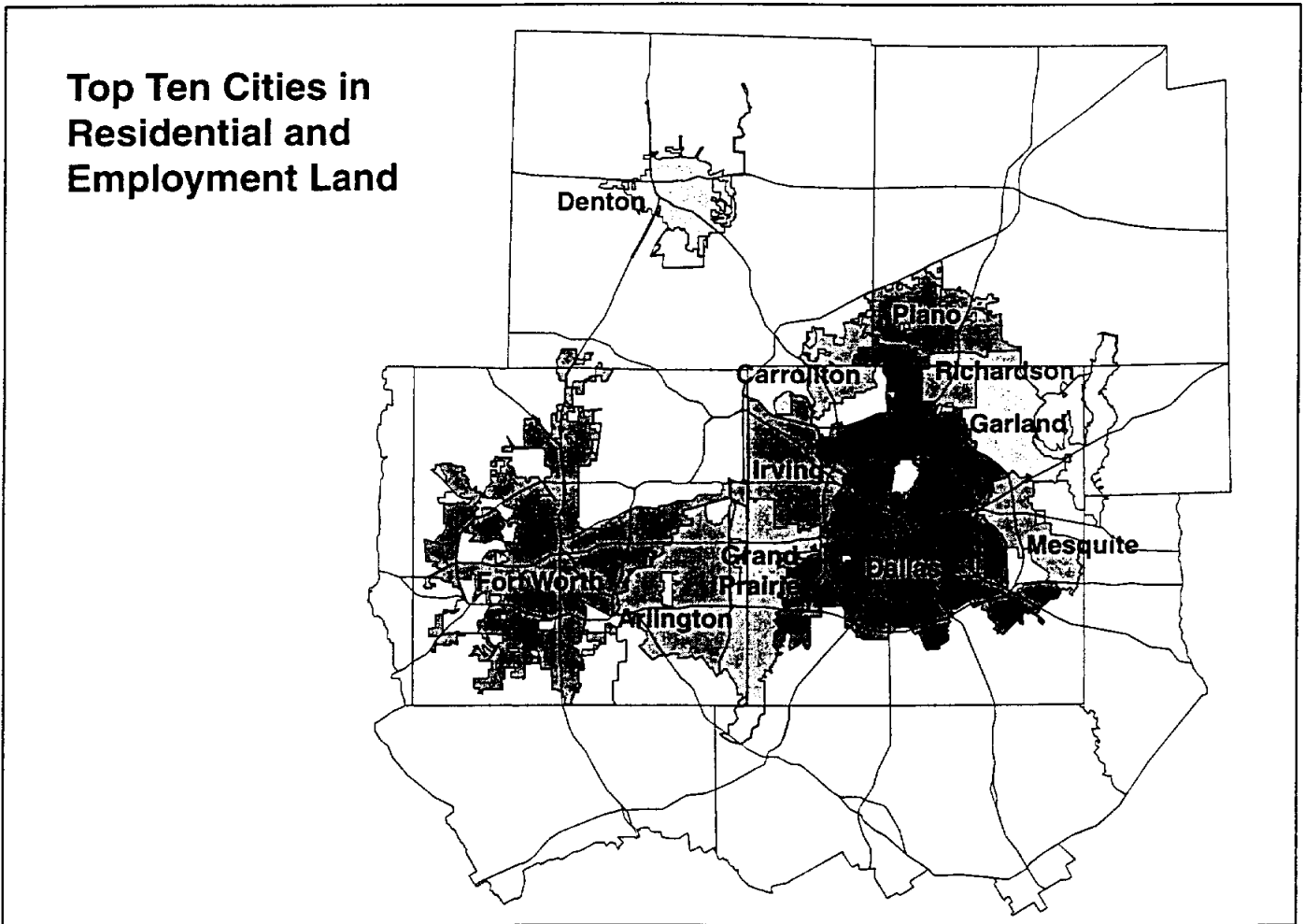
The larger communities, on the other hand, require less than 31 total acres and 16 developed acres per 100 residents. These figures yield average densities for the larger communities of 3.3 persons per total and 6.2 persons per developed acre. The most notable differences between the developed land uses required to support 100 residents in large and small communities are in the single family and parks/open space categories. Smaller cities in the region are less densely populated and have designated a larger amount of their land area to parks and open space. And in total area, small communities have a much higher share of land that is vacant than do the larger communities.

| City                        | Single Family | Multi-Family | Other Res. | Industrial | Comm.  | Inst. | Infra. | Dedicated | Water  | Under Const. | Vacant | Total Acres | Percent Vacant |
|-----------------------------|---------------|--------------|------------|------------|--------|-------|--------|-----------|--------|--------------|--------|-------------|----------------|
| Addison                     | 306           | 243          | 0          | 556        | 618    | 137   | 305    | 4         | 2      | 58           | 585    | 2,812       | 20.8%          |
| Aledo                       | 137           | 0            | 29         | 11         | 13     | 36    | 3      | 0         | 0      | 0            | 896    | 1,124       | 79.7%          |
| Allen                       | 2646          | 31           | 0          | 72         | 235    | 197   | 259    | 733       | 0      | 24           | 7,929  | 12,124      | 65.4%          |
| Alvarado                    | 443           | 14           | 26         | 49         | 113    | 36    | 205    | 28        | 10     | 0            | 1,888  | 2,813       | 67.1%          |
| Anna                        | 219           | 0            | 16         | 14         | 18     | 7     | 0      | 5         | 0      | 0            | 723    | 1,003       | 72.1%          |
| Argyle                      | 786           | 0            | 36         | 6          | 9      | 25    | 90     | 0         | 0      | 0            | 5,603  | 6,555       | 85.5%          |
| Arlington                   | 21,410        | 2,243        | 610        | 2,645      | 4,240  | 2,313 | 3,061  | 3,336     | 1,971  | 344          | 19,262 | 61,434      | 31.4%          |
| Aubrey                      | 192           | 0            | 12         | 5          | 28     | 38    | 6      | 0         | 0      | 0            | 312    | 593         | 52.6%          |
| Aurora                      | 75            | 0            | 44         | 4          | 5      | 4     | 11     | 8         | 0      | 0            | 1,915  | 2,065       | 92.7%          |
| Azle                        | 1,527         | 29           | 24         | 45         | 202    | 98    | 164    | 106       | 65     | 0            | 2,328  | 4,587       | 50.8%          |
| Balch Springs               | 1,925         | 83           | 15         | 191        | 251    | 74    | 362    | 69        | 0      | 41           | 2,161  | 5,172       | 41.8%          |
| Bartonville                 | 598           | 0            | 30         | 126        | 9      | 0     | 32     | 0         | 8      | 0            | 3,059  | 3,861       | 79.2%          |
| Bedford                     | 3,444         | 420          | 4          | 54         | 506    | 357   | 354    | 89        | 5      | 24           | 1,143  | 6,400       | 17.9%          |
| Benbrook                    | 2,265         | 125          | 3          | 99         | 184    | 96    | 364    | 1,209     | 394    | 80           | 2,696  | 7,515       | 35.9%          |
| Blue Mound                  | 197           | 0            | 0          | 49         | 6      | 13    | 0      | 5         | 0      | 0            | 72     | 342         | 21.1%          |
| Blue Ridge                  | 130           | 0            | 3          | 4          | 14     | 13    | 0      | 0         | 0      | 0            | 216    | 380         | 56.8%          |
| Boyd                        | 177           | 1            | 4          | 61         | 20     | 39    | 15     | 0         | 0      | 0            | 1,522  | 1,839       | 82.8%          |
| Briar Oaks                  | 226           | 0            | 0          | 0          | 0      | 0     | 0      | 0         | 0      | 0            | 424    | 650         | 65.2%          |
| Burleson                    | 2,013         | 32           | 86         | 195        | 314    | 193   | 377    | 204       | 13     | 0            | 7,320  | 10,746      | 68.1%          |
| Carrollton                  | 6,728         | 630          | 45         | 2,117      | 899    | 471   | 909    | 2,079     | 394    | 181          | 7,964  | 22,418      | 35.5%          |
| Cedar Hill                  | 3,246         | 49           | 6          | 206        | 162    | 311   | 960    | 1,897     | 21     | 54           | 14,697 | 21,608      | 68.0%          |
| Celina                      | 320           | 0            | 0          | 11         | 53     | 37    | 0      | 0         | 1      | 0            | 831    | 1,253       | 66.3%          |
| Cleburne                    | 3,096         | 10           | 49         | 353        | 962    | 184   | 678    | 501       | 1,654  | 0            | 6,656  | 14,142      | 47.1%          |
| Cockrell Hill               | 297           | 9            | 0          | 8          | 30     | 12    | 0      | 0         | 0      | 0            | 14     | 370         | 3.8%           |
| Colleyville                 | 3,917         | 13           | 2          | 73         | 186    | 185   | 4      | 85        | 28     | 433          | 3,478  | 8,403       | 41.4%          |
| Combine                     | 649           | 0            | 169        | 6          | 17     | 0     | 84     | 5         | 80     | 0            | 3,569  | 4,579       | 77.9%          |
| Coppell                     | 2,561         | 56           | 40         | 272        | 133    | 537   | 302    | 266       | 70     | 144          | 5,031  | 9,412       | 53.5%          |
| Copper Canyon               | 493           | 0            | 0          | 0          | 0      | 0     | 83     | 0         | 0      | 0            | 1,863  | 2,438       | 76.4%          |
| Corinth                     | 595           | 0            | 71         | 72         | 79     | 1     | 164    | 171       | 21     | 20           | 3,733  | 4,929       | 75.7%          |
| Crandall                    | 317           | 0            | 3          | 10         | 18     | 54    | 141    | 8         | 10     | 0            | 952    | 1,513       | 62.9%          |
| Crossroads                  | 122           | 0            | 0          | 67         | 5      | 8     | 75     | 0         | 5      | 0            | 3,755  | 4,035       | 93.1%          |
| Crowley                     | 650           | 6            | 44         | 113        | 51     | 129   | 50     | 79        | 0      | 31           | 2,911  | 4,063       | 71.6%          |
| Dallas                      | 76,570        | 10,741       | 1,060      | 15,975     | 13,822 | 8,227 | 13,247 | 18,194    | 27,449 | 587          | 60,045 | 245,917     | 24.4%          |
| Dalworthington Gardens      | 536           | 12           | 0          | 11         | 59     | 16    | 5      | 26        | 17     | 0            | 479    | 1,161       | 41.3%          |
| DeSoto                      | 4,363         | 133          | 88         | 190        | 364    | 293   | 225    | 282       | 0      | 51           | 7,615  | 13,603      | 56.0%          |
| Denton                      | 5,504         | 547          | 628        | 1,167      | 1,235  | 1,062 | 1,838  | 1,060     | 126    | 17           | 20,818 | 34,002      | 61.2%          |
| Double Oak                  | 631           | 0            | 0          | 0          | 0      | 0     | 0      | 0         | 4      | 50           | 695    | 1,380       | 50.4%          |
| Duncanville                 | 4,259         | 157          | 3          | 250        | 443    | 378   | 350    | 266       | 11     | 14           | 1,087  | 7,219       | 15.1%          |
| Edgecliff Village (1110.03) | 465           | 0            | 0          | 27         | 4      | 6     | 1      | 4         | 0      | 0            | 256    | 764         | 33.5%          |
| Ennis                       | 1,812         | 36           | 23         | 473        | 347    | 186   | 545    | 119       | 240    | 0            | 7,139  | 10,919      | 65.4%          |
| Eules                       | 2,647         | 486          | 17         | 186        | 462    | 343   | 3,208  | 461       | 40     | 35           | 2,377  | 10,261      | 23.2%          |
| Everman                     | 514           | 15           | 0          | 65         | 31     | 63    | 36     | 49        | 0      | 0            | 328    | 1,100       | 29.8%          |
| Fairview (Collin)           | 1,232         | 0            | 4          | 19         | 13     | 16    | 43     | 54        | 0      | 37           | 2,634  | 4,051       | 65.0%          |
| Farmers Branch              | 2,411         | 135          | 8          | 1,134      | 860    | 462   | 326    | 580       | 100    | 1            | 1,662  | 7,677       | 21.6%          |
| Farmersville                | 550           | 0            | 0          | 117        | 78     | 57    | 19     | 115       | 102    | 0            | 1,080  | 2,117       | 51.0%          |
| Fate                        | 111           | 0            | 1          | 49         | 0      | 0     | 169    | 0         | 0      | 0            | 2,372  | 2,701       | 87.8%          |
| Ferris                      | 291           | 6            | 0          | 57         | 36     | 62    | 127    | 10        | 0      | 0            | 825    | 1,412       | 58.4%          |
| Flower Mound                | 4,489         | 18           | 98         | 112        | 113    | 203   | 80     | 921       | 175    | 343          | 13,892 | 20,443      | 68.0%          |
| Forest Hill                 | 1,307         | 0            | 32         | 78         | 240    | 48    | 109    | 33        | 0      | 19           | 853    | 2,718       | 31.4%          |
| Forney                      | 544           | 7            | 25         | 103        | 78     | 86    | 179    | 46        | 0      | 143          | 3,571  | 4,782       | 74.7%          |
| Fort Worth                  | 43,024        | 2,838        | 1,361      | 10,267     | 6,625  | 6,066 | 11,936 | 13,584    | 4,269  | 786          | 83,038 | 183,796     | 45.2%          |
| Frisco                      | 1,667         | 21           | 53         | 150        | 90     | 75    | 441    | 355       | 12     | 270          | 18,801 | 21,935      | 85.7%          |
| Garland                     | 15,213        | 1,336        | 39         | 2,634      | 1,771  | 1,155 | 1,064  | 2,139     | 80     | 53           | 11,163 | 36,647      | 30.5%          |
| Glenn Heights               | 625           | 0            | 122        | 16         | 28     | 20    | 78     | 35        | 0      | 0            | 3,461  | 4,385       | 78.9%          |
| Godley                      | 168           | 0            | 2          | 1          | 21     | 20    | 0      | 0         | 0      | 0            | 239    | 451         | 53.0%          |
| Grand Prairie               | 8,423         | 575          | 316        | 2,919      | 1,361  | 698   | 2,059  | 4,862     | 5,209  | 253          | 23,390 | 50,065      | 46.7%          |
| Grapevine                   | 3,352         | 182          | 81         | 460        | 533    | 1,921 | 6,270  | 2,655     | 2,349  | 215          | 4,230  | 22,248      | 19.0%          |
| Haltom City                 | 3,229         | 152          | 126        | 690        | 490    | 322   | 277    | 339       | 26     | 50           | 2,235  | 7,935       | 28.2%          |
| Haslet                      | 1,046         | 0            | 0          | 2          | 5      | 72    | 85     | 0         | 0      | 0            | 1,995  | 3,205       | 62.2%          |
| Heath                       | 756           | 4            | 0          | 0          | 12     | 0     | 0      | 20        | 112    | 147          | 3,198  | 4,248       | 75.3%          |
| Hebron                      | 79            | 1            | 4          | 13         | 0      | 16    | 150    | 46        | 22     | 5            | 4,178  | 4,515       | 92.5%          |
| Hickory Creek               | 313           | 0            | 47         | 13         | 1      | 0     | 58     | 1,095     | 134    | 0            | 1,252  | 2,912       | 43.0%          |
| Highland Park               | 1,111         | 32           | 0          | 0          | 31     | 31    | 19     | 185       | 15     | 0            | 3      | 1,426       | 0.2%           |
| Highland Village            | 1,415         | 0            | 0          | 33         | 49     | 16    | 79     | 173       | 595    | 22           | 805    | 3,188       | 25.3%          |
| Hurst                       | 3,179         | 272          | 23         | 177        | 737    | 340   | 276    | 221       | 0      | 14           | 1,109  | 6,347       | 17.5%          |
| Hutchins                    | 300           | 0            | 73         | 250        | 67     | 15    | 259    | 76        | 76     | 64           | 4,339  | 5,519       | 78.6%          |
| Irving                      | 9,728         | 2,001        | 213        | 2,462      | 2,946  | 1,615 | 7,484  | 2,142     | 613    | 815          | 13,525 | 43,544      | 31.1%          |

| City              | Single Family | Multi-Family | Other Res. | Industrial | Comm. | Inst. | Infra. | Dedicated | Water | Under Const. | Vacant | Total Acres | Percent Vacant |
|-------------------|---------------|--------------|------------|------------|-------|-------|--------|-----------|-------|--------------|--------|-------------|----------------|
| Joshua            | 751           | 9            | 98         | 29         | 86    | 78    | 106    | 96        | 12    | 0            | 2,307  | 3,571       | 64.6%          |
| Justin            | 197           | 9            | 0          | 56         | 30    | 12    | 21     | 4         | 3     | 57           | 1,095  | 1,484       | 73.8%          |
| Keene             | 450           | 26           | 84         | 16         | 61    | 115   | 0      | 48        | 0     | 0            | 710    | 1,510       | 47.0%          |
| Keller            | 3,998         | 1            | 43         | 138        | 92    | 188   | 57     | 94        | 20    | 77           | 6,947  | 11,653      | 59.6%          |
| Kennedale         | 644           | 7            | 24         | 217        | 74    | 48    | 60     | 60        | 0     | 18           | 1,443  | 2,595       | 55.6%          |
| Krugerville       | 222           | 0            | 0          | 0          | 12    | 0     | 7      | 0         | 0     | 0            | 202    | 443         | 45.6%          |
| Krum              | 290           | 0            | 0          | 4          | 9     | 26    | 3      | 3         | 0     | 0            | 527    | 861         | 61.2%          |
| Lake Dallas       | 344           | 20           | 62         | 43         | 40    | 67    | 66     | 153       | 218   | 0            | 651    | 1,665       | 39.1%          |
| Lake Worth        | 732           | 1            | 8          | 7          | 156   | 95    | 74     | 61        | 1     | 0            | 460    | 1,593       | 28.9%          |
| Lakeside          | 197           | 0            | 2          | 9          | 19    | 7     | 15     | 5         | 0     | 0            | 736    | 990         | 74.3%          |
| Lakewood Village  | 52            | 0            | 0          | 0          | 0     | 0     | 0      | 0         | 8     | 0            | 486    | 545         | 89.2%          |
| Lancaster         | 3,243         | 95           | 47         | 420        | 324   | 268   | 488    | 315       | 0     | 0            | 13,476 | 18,675      | 72.2%          |
| Lavon             | 101           | 0            | 0          | 0          | 0     | 0     | 16     | 0         | 6     | 0            | 563    | 685         | 82.2%          |
| Lewisville        | 3,455         | 354          | 293        | 950        | 1,024 | 409   | 1,160  | 2,095     | 3,804 | 166          | 12,806 | 26,515      | 48.3%          |
| Little Elm        | 179           | 0            | 52         | 0          | 24    | 25    | 0      | 0         | 24    | 0            | 1,788  | 2,090       | 85.6%          |
| Lowrey Crossing   | 592           | 0            | 0          | 1          | 14    | 3     | 0      | 10        | 11    | 0            | 1,197  | 1,828       | 65.5%          |
| Lucas             | 1,866         | 0            | 0          | 3          | 0     | 9     | 3      | 20        | 21    | 0            | 3,047  | 4,970       | 61.3%          |
| Mansfield         | 3,050         | 23           | 165        | 682        | 271   | 220   | 525    | 405       | 107   | 56           | 19,329 | 24,832      | 77.8%          |
| Maypearl          | 120           | 0            | 0          | 8          | 16    | 0     | 0      | 0         | 0     | 0            | 158    | 302         | 52.3%          |
| McKinney          | 3,039         | 130          | 84         | 564        | 573   | 371   | 576    | 1,077     | 312   | 143          | 21,953 | 28,822      | 76.2%          |
| McLendon-Chisholm | 664           | 0            | 0          | 0          | 0     | 0     | 0      | 0         | 46    | 0            | 7,224  | 7,935       | 91.0%          |
| Melissa           | 224           | 0            | 0          | 20         | 19    | 16    | 21     | 0         | 0     | 0            | 732    | 1,032       | 70.9%          |
| Mesquite          | 8,582         | 578          | 37         | 826        | 1,452 | 1,032 | 1,425  | 1,104     | 37    | 92           | 12,279 | 27,443      | 44.7%          |
| Midlothian        | 619           | 17           | 56         | 1,505      | 114   | 88    | 283    | 47        | 185   | 187          | 12,511 | 15,611      | 80.1%          |
| Murphy            | 550           | 0            | 1          | 8          | 10    | 1     | 18     | 0         | 0     | 49           | 1,798  | 2,435       | 73.8%          |
| N. Richland Hills | 5,167         | 264          | 64         | 192        | 800   | 434   | 261    | 408       | 15    | 123          | 3,946  | 11,675      | 33.8%          |
| Nevada            | 121           | 0            | 0          | 0          | 9     | 16    | 0      | 5         | 0     | 0            | 397    | 547         | 72.6%          |
| New Hope          | 335           | 0            | 0          | 4          | 0     | 0     | 0      | 0         | 1     | 0            | 590    | 930         | 63.4%          |
| North Lake        | 13            | 0            | 34         | 354        | 0     | 0     | 200    | 1         | 0     | 0            | 7,288  | 7,889       | 92.4%          |
| Oak Leaf          | 400           | 0            | 0          | 0          | 0     | 0     | 0      | 0         | 0     | 0            | 440    | 840         | 52.4%          |
| Oak Point         | 403           | 0            | 0          | 0          | 0     | 0     | 0      | 0         | 199   | 0            | 3,113  | 3,716       | 83.8%          |
| Ovilla            | 1,185         | 0            | 0          | 0          | 3     | 14    | 0      | 7         | 0     | 40           | 2,210  | 3,459       | 63.9%          |
| Palmer            | 523           | 0            | 0          | 20         | 52    | 59    | 86     | 0         | 0     | 0            | 1,001  | 1,740       | 57.5%          |
| Pantego           | 274           | 31           | 0          | 21         | 198   | 3     | 1      | 0         | 0     | 4            | 95     | 627         | 15.2%          |
| Parker            | 1,031         | 0            | 3          | 0          | 0     | 2     | 0      | 25        | 0     | 0            | 2,827  | 3,888       | 72.7%          |
| Pecan Hill        | 98            | 0            | 22         | 0          | 0     | 0     | 0      | 0         | 0     | 0            | 1,144  | 1,264       | 90.5%          |
| Pelican Bay       | 7             | 1            | 291        | 0          | 8     | 0     | 0      | 2         | 1     | 20           | 91     | 420         | 21.7%          |
| Pilot Point       | 570           | 5            | 9          | 43         | 132   | 44    | 0      | 25        | 0     | 0            | 1,051  | 1,879       | 55.9%          |
| Plano             | 15,182        | 898          | 76         | 939        | 2,850 | 1,049 | 1,259  | 2,582     | 14    | 593          | 17,072 | 42,513      | 40.2%          |
| Ponder            | 100           | 0            | 0          | 8          | 6     | 14    | 0      | 0         | 0     | 0            | 1,667  | 1,795       | 92.9%          |
| Princeton         | 315           | 9            | 66         | 15         | 55    | 72    | 50     | 41        | 17    | 0            | 1,884  | 2,523       | 74.7%          |
| Prosper           | 321           | 0            | 3          | 29         | 16    | 36    | 17     | 0         | 0     | 7            | 500    | 929         | 53.8%          |
| Red Oak           | 499           | 20           | 33         | 1          | 74    | 68    | 33     | 0         | 0     | 32           | 934    | 1,693       | 55.2%          |
| Richardson        | 7,541         | 355          | 22         | 1,146      | 1,473 | 1,168 | 611    | 1,389     | 0     | 747          | 3,594  | 18,045      | 19.9%          |
| Richland Hills    | 1,143         | 24           | 3          | 143        | 153   | 78    | 127    | 30        | 0     | 0            | 308    | 2,007       | 15.3%          |
| River Oaks        | 940           | 5            | 0          | 0          | 72    | 72    | 2      | 165       | 0     | 0            | 13     | 1,268       | 1.0%           |
| Roanoke           | 282           | 3            | 20         | 177        | 41    | 14    | 75     | 0         | 0     | 0            | 1,452  | 2,064       | 70.3%          |
| Rockwall          | 1,347         | 100          | 12         | 214        | 219   | 187   | 249    | 369       | 206   | 385          | 6,173  | 9,458       | 65.3%          |
| Rosser            | 109           | 0            | 0          | 20         | 12    | 12    | 0      | 0         | 11    | 0            | 1,396  | 1,560       | 89.5%          |
| Rowlett           | 3,882         | 24           | 26         | 148        | 189   | 93    | 17     | 187       | 111   | 89           | 7,184  | 11,949      | 60.1%          |
| Royse City        | 316           | 11           | 53         | 23         | 84    | 29    | 286    | 18        | 0     | 0            | 5,422  | 6,244       | 86.8%          |
| Sachse            | 1,302         | 3            | 4          | 21         | 53    | 33    | 43     | 155       | 91    | 4            | 4,149  | 5,856       | 70.9%          |
| Saginaw           | 727           | 43           | 3          | 666        | 78    | 67    | 325    | 178       | 0     | 0            | 2,691  | 4,778       | 56.3%          |
| Saint Paul        | 284           | 0            | 0          | 5          | 0     | 0     | 2      | 0         | 3     | 0            | 591    | 884         | 66.9%          |
| Sanger            | 390           | 10           | 51         | 35         | 81    | 36    | 147    | 3         | 0     | 0            | 883    | 1,635       | 54.0%          |
| Sansom Park       | 567           | 0            | 2          | 27         | 70    | 15    | 0      | 56        | 0     | 0            | 47     | 784         | 6.0%           |
| Seagoville        | 1,138         | 29           | 284        | 297        | 181   | 54    | 306    | 227       | 84    | 8            | 7,727  | 10,333      | 74.8%          |
| Shady Shore       | 299           | 0            | 7          | 0          | 0     | 0     | 17     | 17        | 12    | 0            | 1,425  | 1,776       | 80.2%          |
| Southlake         | 3,644         | 0            | 67         | 312        | 157   | 171   | 220    | 421       | 183   | 528          | 8,262  | 13,964      | 59.2%          |
| Sunnyvale         | 967           | 28           | 0          | 247        | 54    | 14    | 401    | 142       | 40    | 0            | 8,797  | 10,689      | 82.3%          |
| The Colony        | 1,917         | 0            | 7          | 1          | 115   | 233   | 235    | 962       | 219   | 40           | 3,864  | 7,592       | 50.9%          |
| Trophy Club       | 586           | 11           | 3          | 0          | 6     | 25    | 30     | 352       | 10    | 0            | 1,347  | 2,370       | 56.8%          |
| University Park   | 1,859         | 114          | 31         | 4          | 71    | 224   | 21     | 62        | 0     | 0            | 1      | 2,387       | 0.0%           |
| Venus             | 117           | 6            | 18         | 38         | 13    | 37    | 36     | 11        | 0     | 0            | 956    | 1,232       | 77.6%          |
| Watauga           | 1,756         | 0            | 0          | 19         | 104   | 79    | 16     | 13        | 0     | 0            | 613    | 2,600       | 23.6%          |
| Waxahachie        | 2,498         | 51           | 88         | 453        | 605   | 199   | 1,430  | 224       | 774   | 0            | 14,313 | 20,632      | 69.4%          |
| Westlake          | 19            | 1            | 0          | 0          | 74    | 1     | 169    | 5         | 72    | 3            | 3,623  | 3,967       | 91.3%          |

| City              | Single Family | Multi-Family | Other Res. | Industrial | Comm. | Inst. | Infra. | Dedicated | Water | Under Const. | Vacant | Total Acres | Percent Vacant |
|-------------------|---------------|--------------|------------|------------|-------|-------|--------|-----------|-------|--------------|--------|-------------|----------------|
| Westminster       | 132           | 0            | 21         | 3          | 1     | 0     | 0      | 0         | 0     | 0            | 1,115  | 1,271       | 87.7%          |
| Weston            | 147           | 0            | 0          | 0          | 0     | 0     | 16     | 0         | 0     | 0            | 2,601  | 2,763       | 94.1%          |
| Westover Hills    | 391           | 4            | 0          | 0          | 0     | 0     | 0      | 54        | 0     | 0            | 6      | 455         | 1.3%           |
| Westworth Village | 309           | 0            | 0          | 0          | 3     | 406   | 19     | 285       | 0     | 0            | 237    | 1,259       | 18.8%          |
| White Settlement  | 1,397         | 67           | 31         | 98         | 238   | 399   | 108    | 63        | 0     | 0            | 815    | 3,215       | 25.3%          |
| Wilmer            | 332           | 7            | 55         | 13         | 19    | 35    | 155    | 4         | 0     | 0            | 3,124  | 3,744       | 83.4%          |
| Wylie             | 949           | 11           | 168        | 206        | 118   | 148   | 261    | 453       | 9,722 | 252          | 7,609  | 19,896      | 38.2%          |

| MPA TOTAL  |               |              |            |            |        |        |        |           |         |              |           |             |
|------------|---------------|--------------|------------|------------|--------|--------|--------|-----------|---------|--------------|-----------|-------------|
| Year       | Single Family | Multi-Family | Other Res. | Industrial | Comm.  | Inst.  | Infra. | Dedicated | Water   | Under Const. | Vacant    | Total Acres |
| 1995       | 423,568       | 27,162       | 24,270     | 67,390     | 57,580 | 39,144 | 85,731 | 91,205    | 129,388 | 10,190       | 2,218,935 | 3,174,563   |
| percentage | 13.3%         | 0.9%         | 0.8%       | 2.1%       | 0      | 1.8%   | 2.7%   | 2.9%      | 4.1%    | 0.3%         | 69.9%     |             |



The research and compilation of the 1995 land use database was conducted by NCTCOG Research and Information Services (RIS) Associate Rocky Gardiner, assisted by RIS Intern Ekong Peters. If you have any questions or require further information on this or any other RIS products, please call (817) 695-9150.

## Top Ten Cities in Residential/Employment Land by City Size

| No. | City          | Total Acres | Res. Acres | Percent Res. | No. | City          | Total Acres | Emp. Acres | Percent Emp. |
|-----|---------------|-------------|------------|--------------|-----|---------------|-------------|------------|--------------|
| 1   | Dallas        | 245,918     | 88,371     | 35.9%        | 1   | Dallas        | 245,918     | 38,025     | 15.5%        |
| 2   | Fort Worth    | 183,796     | 47,224     | 25.7%        | 2   | Fort Worth    | 183,796     | 22,958     | 12.5%        |
| 3   | Arlington     | 61,434      | 9,198      | 15.0%        | 3   | Arlington     | 61,434      | 9,198      | 15.0%        |
| 4   | Garland       | 36,647      | 16,588     | 45.3%        | 4   | Irving        | 43,544      | 7,024      | 16.1%        |
| 5   | Plano         | 42,513      | 16,156     | 38.0%        | 5   | Garland       | 36,647      | 5,559      | 15.2%        |
| 6   | Irving        | 43,544      | 11,942     | 27.4%        | 6   | Grand Prairie | 50,065      | 4,978      | 9.9%         |
| 7   | Grand Prairie | 50,065      | 9,314      | 18.6%        | 7   | Plano         | 42,513      | 4,838      | 11.4%        |
| 8   | Mesquite      | 27,443      | 9,196      | 33.5%        | 8   | Richardson    | 18,045      | 3,786      | 21.0%        |
| 9   | Richardson    | 18,045      | 7,918      | 43.9%        | 9   | Carrollton    | 22,418      | 3,487      | 15.6%        |
| 10  | Carrollton    | 22,418      | 7,403      | 33.0%        | 10  | Denton        | 34,003      | 3,464      | 10.2%        |

## Definitions

|                           |   |
|---------------------------|---|
| <b>Single Family</b>      | One family detached unit and duplexes.  |
| <b>Multi-Family</b>       | Structures with three or more separate units such as apartments, townhouses and condominiums.   |
| <b>Other Residential</b>  | Includes both mobile homes inside mobile home parks and free standing units outside parks. Also includes group quarters or nursing homes, orphanages, college dormitories, jail, military base personnel quarters.  |
| <b>Industrial</b>         | Manufacturing plants, warehouses, office showrooms, etc.  |
| <b>Commercial</b>         | Includes all office structures and retail buildings, such as department stores, repair shops, supermarkets and restaurants, as well as hotels and motels.   |
| <b>Institutional</b>      | Churches, governmental facilities, museums, schools, hospitals, medical clinics, libraries, military bases, are among those uses included.  |
| <b>Infrastructure</b>     | All roads, airports (including terminals and runways), railroads, radio and television communication stations, truck terminals, sewage treatment and power plants, power line easements, pump stations, water treatment plants, and water systems etc.                    |
| <b>Dedicated Land</b>     | Includes all public and private parks, golf courses, cemeteries, tennis courts, swimming pools, amusement parks, sanitary landfills, land applications, and similar waste management facilities. Also includes major flood control structures, levies and flood channels. |
| <b>Under Construction</b> | Land that has undergone site preparation and construction has begun.  |
| <b>Water</b>              | All water bodies.   |
| <b>Vacant</b>             | Undeveloped land.   |
| <b>Total acres</b>        | All land and water acreage within the city.   |

## Suburban Land Uses

### Cities of 40,000 to 100,000 Persons

| Land Use Category         | Avg. # of Acres | Acres per 100 persons |
|---------------------------|-----------------|-----------------------|
| Single-Family Residential | 5,307           | 8.18                  |
| Multi-Family Residential  | 428             | 0.66                  |
| Mobile Homes              | 137             | 0.21                  |
| Commercial                | 989             | 1.52                  |
| Industrial                | 937             | 1.44                  |
| Institutional             | 650             | 1.00                  |
| Parks & Open Space        | 870             | 1.34                  |
| All other Catagories      | <u>10,523</u>   | <u>16.22</u>          |
| <b>Total Land Area</b>    | <b>19,841</b>   | <b>30.58</b>          |

### Cities of 20,000 to 40,000 Persons

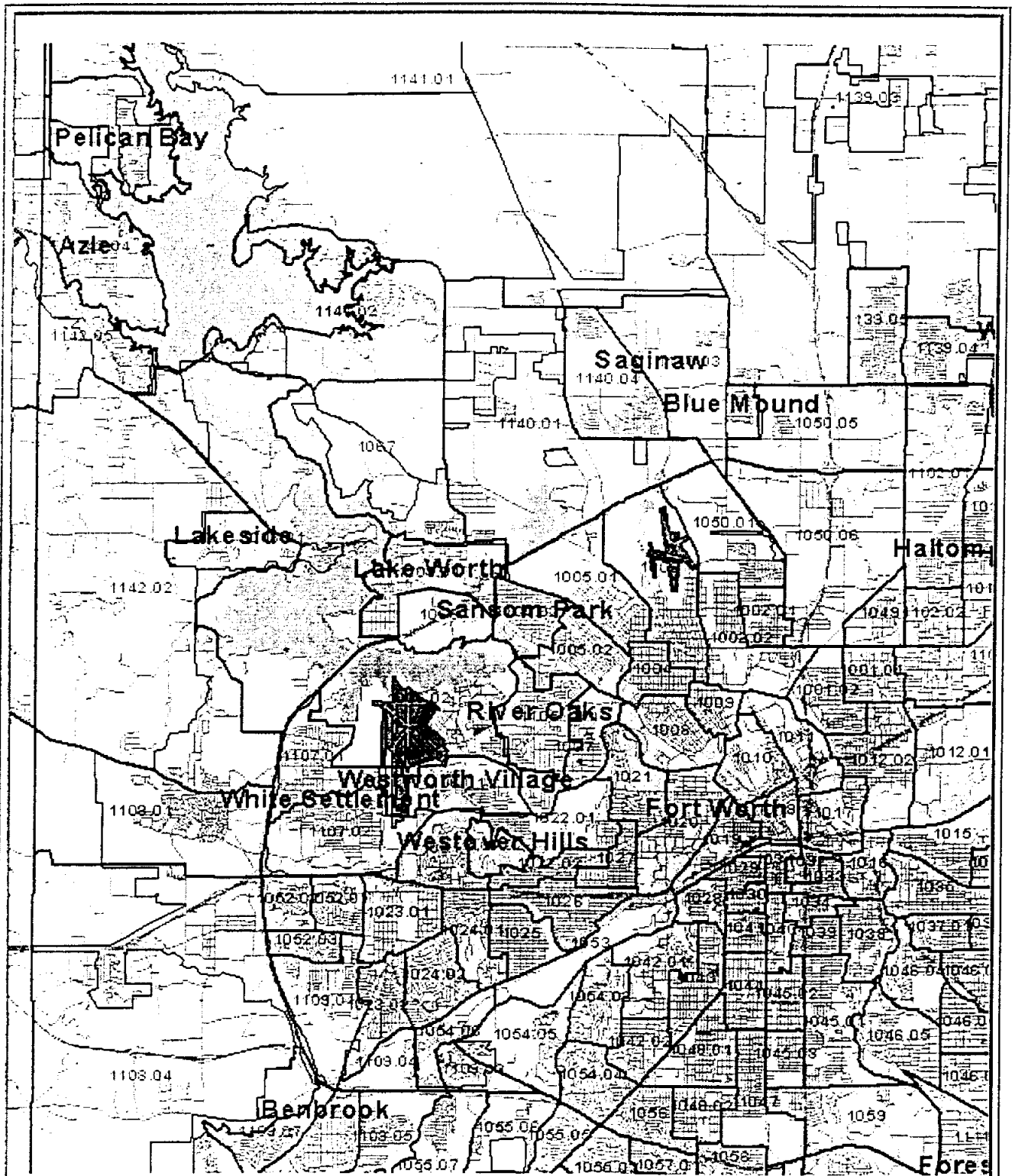
| Land Use Category         | Avg. # of Acres | Acres per 100 persons |
|---------------------------|-----------------|-----------------------|
| Single-Family Residential | 3,023           | 10.75                 |
| Multi-Family Residential  | 114             | 0.41                  |
| Mobile Homes              | 31              | 0.11                  |
| Commercial                | 371             | 1.32                  |
| Industrial                | 282             | 1.00                  |
| Institutional             | 361             | 1.28                  |
| Parks & Open Space        | 662             | 2.35                  |
| All other Catagories      | <u>7,396</u>    | <u>26.29</u>          |
| <b>Total Land Area</b>    | <b>12,240</b>   | <b>43.51</b>          |



North Central Texas Council of Governments  
 Centerpoint Two, 616 Six Flags Drive  
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 Arlington, TX 76005-5888

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***CITY OF FORT WORTH***









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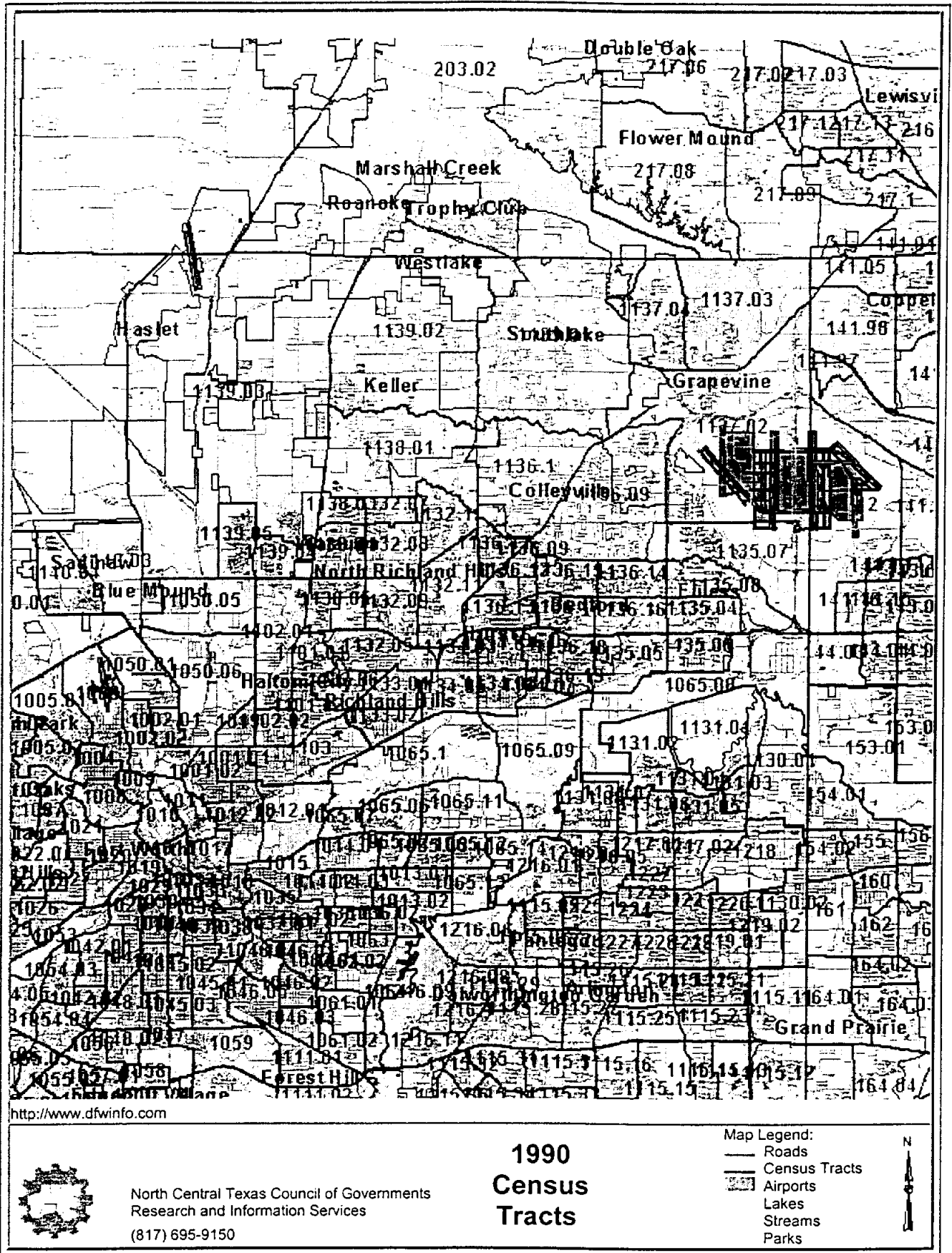
North Central Texas Council of Governments  
 Research and Information Services  
 (817) 695-9150

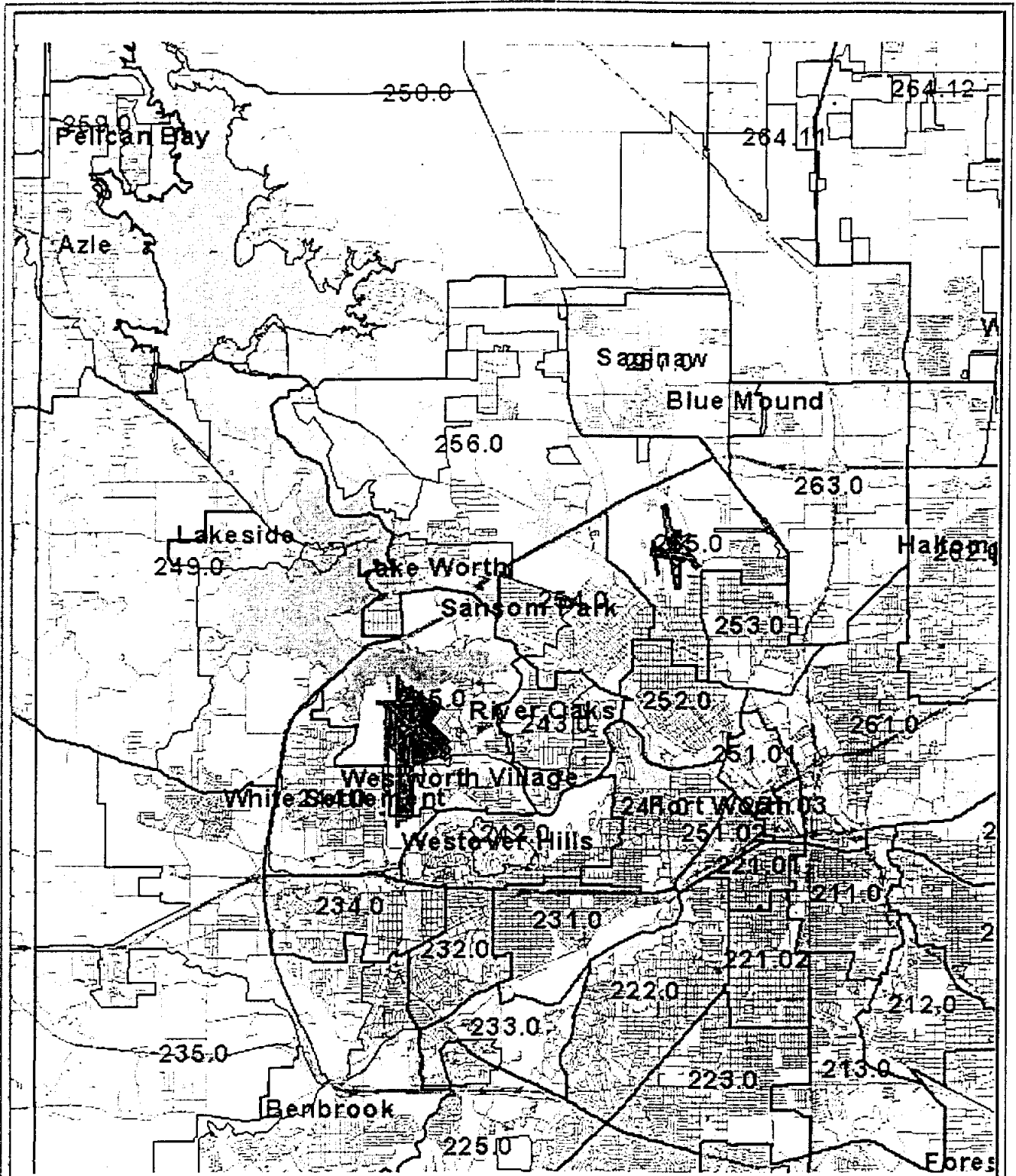
### 1990 Census Tracts

- Map Legend:
-  Roads
  -  Census Tracts
  -  Airports
  -  Lakes
  -  Streams
  -  Parks









<http://www.dfwinfo.com>



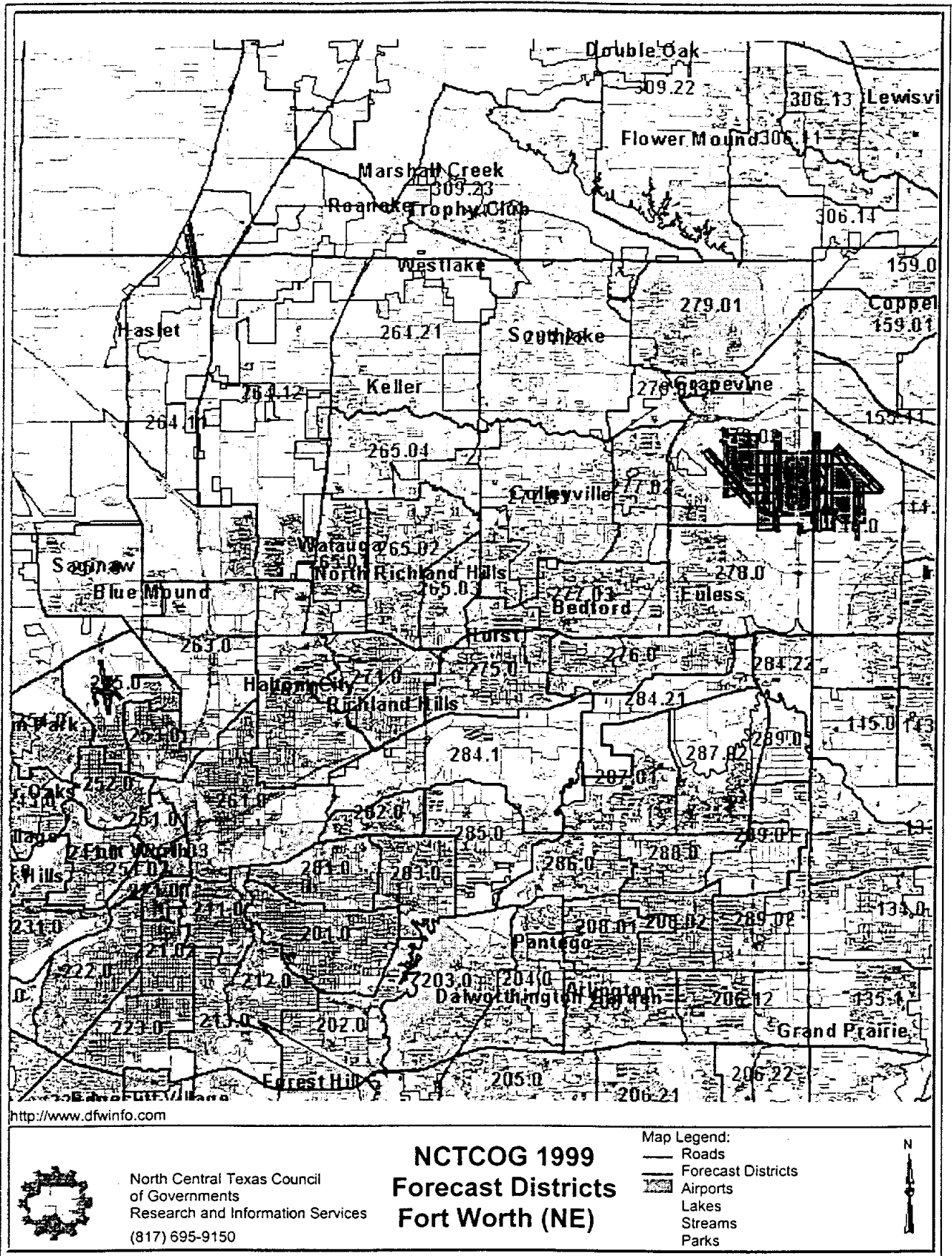
North Central Texas Council  
of Governments  
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### NCTCOG 1999 Forecast Districts Fort Worth (NW)

Map Legend:

- Roads
- ▭ Forecast Districts
- ▭ Airports
- ▭ Lakes
- ▭ Streams
- ▭ Parks





**Fort Worth**

| (1)           | (2)        | (3)               | (4)            | (5)            | (6)              | (7)               | (8)                   | (9)                    | (10)                  |
|---------------|------------|-------------------|----------------|----------------|------------------|-------------------|-----------------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in Watershed | % Area In Wshd | Total 1995 Pop | Avg. Pop Density | 1995 Pop. In Wshd | 1995 Total Households | 1995 Population /House | 1995 Total Employment |
| 1050.05       | 2524       | 1191              | 47.19%         | 1884           | 0.75             | 889               | 763                   | 2.47                   | 2619                  |
| 1065.1        | 4618       | 279               | 6.04%          | 1975           | 0.43             | 119               | 693                   | 2.85                   | 5194                  |
| 1139.03       | 27591      | 11829             | 42.15%         | 8283           | 0.30             | 3491              | 2710                  | 3.06                   | 4672                  |
| 1139.04       | 1036       | 901               | 86.97%         | 5509           | 5.32             | 4791              | 1951                  | 2.82                   | 248                   |
| 1139.05       | 1276       | 1276              | 100.00%        | 8494           | 6.66             | 8494              | 2557                  | 3.32                   | 476                   |
| 1141.01       | 47204      | 8882              | 18.82%         | 1754           | 0.04             | 330               | 648                   | 2.71                   | 1510                  |
|               |            | 24158             |                | 27899          | 13.49            | 18115             | 9322                  | 17.23                  | 14719                 |

**POPULATION**

| (11)               | (12)       | (13)              | (14)           | (15)  | (16)  | (17)  | (18)              | (19)            | (20)         | (21)            | (22)         | (23)            | (24)         |
|--------------------|------------|-------------------|----------------|-------|-------|-------|-------------------|-----------------|--------------|-----------------|--------------|-----------------|--------------|
| Forecast Districts | Total Area | Area in Watershed | % Area In Wshd | Thh95 | Thh05 | Thh25 | Population /House | 1995 Population | 1995 Density | 2005 Population | 2005 Density | 2025 Population | 2025 Density |
| 258                | 50461      | 8882              | 17.60%         | 2484  | 2662  | 5046  | 2.71              | 6731.64         | 0.13         | 7214.02         | 0.14         | 13674.66        | 0.27         |
| 264.11             | 12661      | 7022              | 55.46%         | 2901  | 4509  | 13517 | 3.09              | 8964.09         | 0.71         | 13932.81        | 1.10         | 41767.53        | 3.30         |
| 264.12             | 17248      | 6785              | 39.34%         | 4317  | 6885  | 21562 | 2.82              | 12173.94        | 0.71         | 19415.7         | 1.13         | 60804.84        | 3.53         |
| 263                | 6542       | 1191              | 18.21%         | 1006  | 1533  | 6500  | 3.95              | 3973.7          | 0.61         | 6055.35         | 0.93         | 25675           | 3.92         |
| 284.1              | 8739       | 278               | 3.18%          | 1979  | 2790  | 4700  | 2.85              | 5640.15         | 0.65         | 7951.5          | 0.91         | 13395           | 1.53         |
|                    | 95651      | 24158             |                | 12687 | 18379 | 51325 | 3.08              | 37483.52        | 2.80         | 54569.38        | 4.20         | 155317.03       | 12.55        |

**EMPLOYMENT**

| (25)               | (26)       | (27)              | (28)           | (29)  | (30)         | (31)  | (32)         | (33)  | (34)             |
|--------------------|------------|-------------------|----------------|-------|--------------|-------|--------------|-------|------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area In Wshd | Tot95 | 1995 Density | Tot05 | 2005 Density | Tot25 | 2,025.00 Density |
| 258                | 50461      | 8882              | 17.60%         | 2224  | 0.04         | 2616  | 0.05         | 6640  | 0.13             |
| 264.11             | 12661      | 7022              | 55.46%         | 2679  | 0.21         | 8447  | 0.67         | 16635 | 1.31             |
| 264.12             | 17248      | 6785              | 39.34%         | 2717  | 0.16         | 11078 | 0.64         | 19948 | 1.16             |
| 263                | 6542       | 1191              | 18.21%         | 10302 | 1.57         | 13121 | 2.01         | 21305 | 3.26             |
| 284.1              | 8739       | 278               | 3.18%          | 12361 | 1.41         | 13944 | 1.60         | 20165 | 2.31             |
|                    |            | 24158             |                | 30283 | 3.40         | 49206 | 4.96         | 84693 | 8.17             |

| (35)              | (36)          | (37)           | (38)       | (39)                   | (40)      |
|-------------------|---------------|----------------|------------|------------------------|-----------|
| Forecast District | Census Tracts | Total Tr. Area | Area in FD | 1995 Population /House | 1995      |
| 258               | 1141.01       | 47204          | 47204      | 2.71                   | 127922.84 |
|                   | 1138.04       | 3195           | 3195       | 2.64                   | 8434.80   |
|                   |               | 50359          | 50399      |                        | 136357.64 |
| 264.11            | 1139.03       | 27591          | 11384      | 3.06                   | 34835.04  |
|                   | 1139.05       | 1276           | 1276       | 3.32                   | 4236.32   |
|                   |               |                | 12660      |                        | 39071.36  |
| 264.12            | 1139.04       | 1036           | 138        | 2.82                   | 385.16    |
| 263               | 1050.05       | 2524           | 2524       | 2.47                   | 6234.28   |
|                   | 1050.06       | 3973           | 3973       | 4.89                   | 19427.97  |
|                   |               | 6497           | 6497       |                        | 25662.25  |
| 284.1             | 1065.1        | 4618           | 4618       | 2.85                   | 13161.30  |
|                   |               | 4618           | 4618       |                        | 13161.3   |

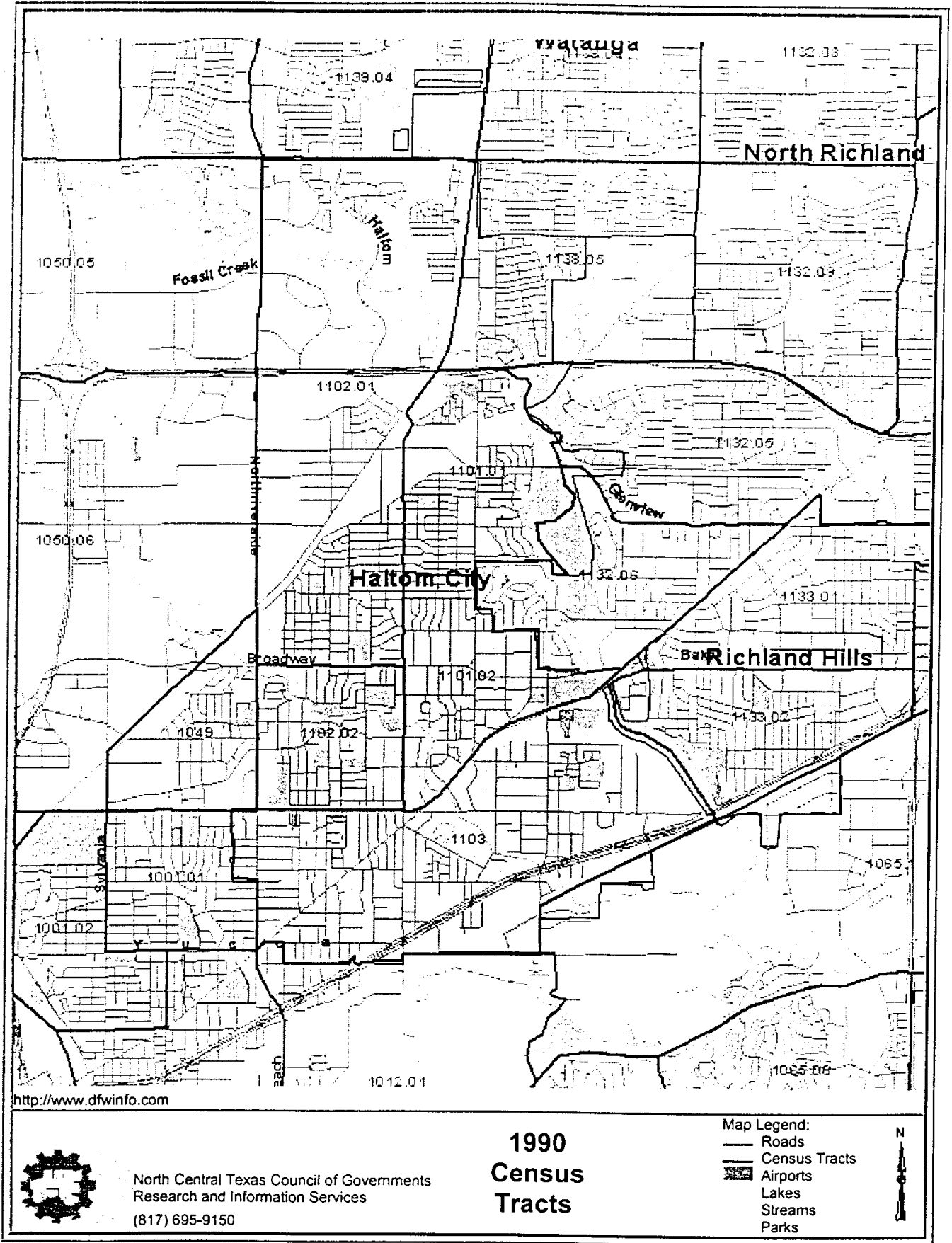
| (41)               | (42)            | (43)            | (44)            | (45)            | (46)            | (47)            |
|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Forecast Districts | 1995 Population | 2005 Population | 2025 Population | 1995 Employment | 2005 Employment | 2025 Employment |
| 258                | 1185            | 1270            | 2407            | 391             | 460             | 1169            |
| 264.11             | 4972            | 7727            | 23165           | 1486            | 4685            | 9226            |
| 264.12             | 4789            | 7638            | 23919           | 1069            | 4358            | 7847            |
| 263                | 723             | 1102            | 4674            | 1876            | 2389            | 3879            |
| 284.1              | 179             | 253             | 426             | 393             | 444             | 641             |
| TOTAL              | 11848           | 17990           | 54592           | 5215            | 12333           | 22752           |

**FUTURE POP. & EMP. LAND USE AREAS**

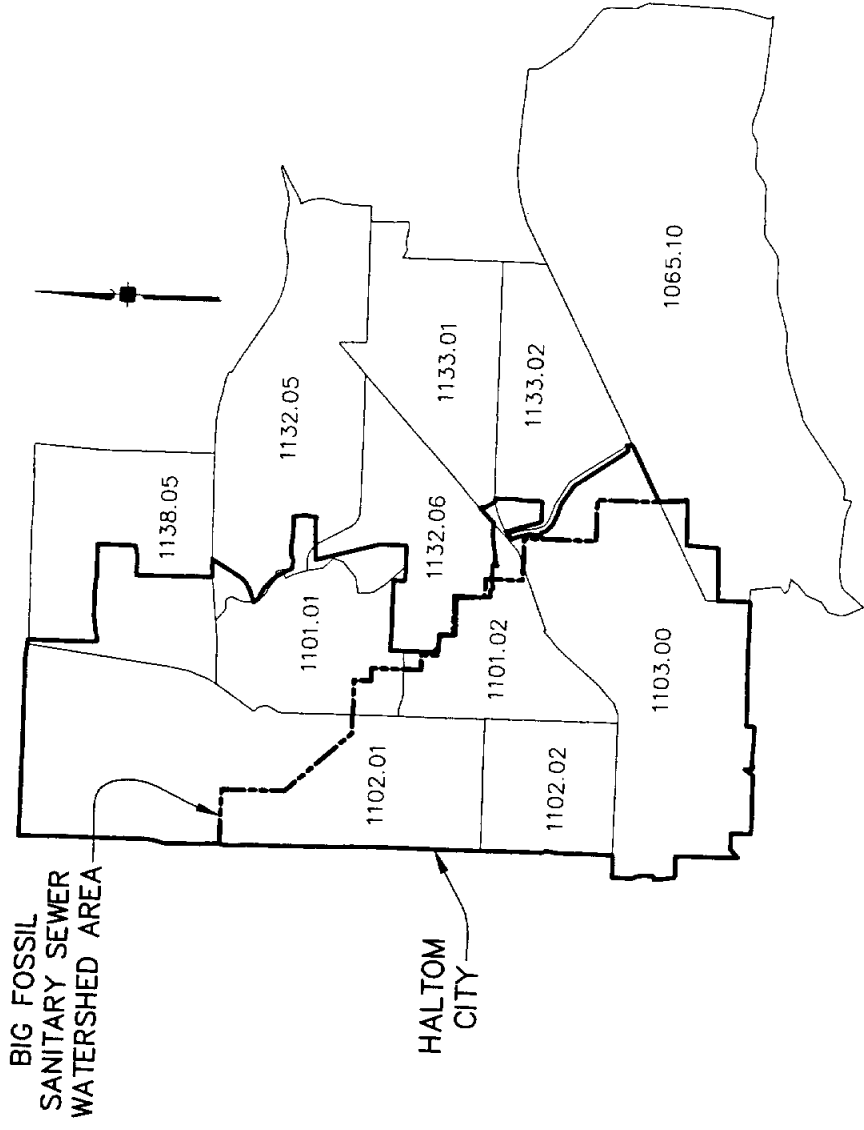
|                        |              |                      |              |
|------------------------|--------------|----------------------|--------------|
| 1995 Population        | 11848        | 1995 Employment      | 5215         |
| 1995 Residential Area  | 6207         | 1995 Employment Area | 3017         |
| 1995 Density           | 1.91         | 1995 Density         | 1.73         |
| 2005 Residential Area  | 9425         | 2005 Employment Area | 7137         |
| 2025 Residential Area  | 28599        | 2025 Employment Area | 13169        |
|                        | <b>1995</b>  | <b>2005</b>          | <b>2025</b>  |
| Residential Area       | 6207         | 9425                 | 28599        |
| Employment Area        | 3017         | 7137                 | 13169        |
| <b>SEWERED AREA</b>    | <b>9224</b>  | <b>16561</b>         | <b>41768</b> |
| Total Unsewered        | 3915         | 5272                 | 9972         |
| Vacant & Under Constr. | 11018        | 2325                 | 0            |
| <b>REMINADER</b>       | <b>14933</b> | <b>7597</b>          | <b>9972</b>  |
|                        | 24157        | 24158                | 51740        |
| <b>TOTAL AREA</b>      | <b>24158</b> | <b>24158</b>         | <b>24158</b> |

|       |   |
|-------|---|
| NOTES | Census Tracts from NCTCOG Population Database   |
|       | Total Census Tract Area (Acres)   |
| (1)   | Total Area in City (Acres)  |
| (2)   | Percent of Census Tract Area within City  |
| (3)   | Total 1995 Population in Census Tract from NCTCOG data  |
| (4)   | Average Population Density in People/Acre = (5) / (2)   |
| (5)   | 1995 Population within City = (5) x (4)   |
| (6)   | 1995 Total Households from NCTCOG Database  |
| (7)   | 1995 Population per House = (5) / (8)   |
| (8)   | 1995 Total Employment from NCTCOG Database  |
| (9)   | Population Forecast Districts from NCTCOG Database  |
| (10)  | Total Computed Area within Forecast District from AutoCAD map (Acres)                         |
| (11)  | Area of Forecast District within City (Acres)   |
| (12)  | Percent of Forecast District Total Area within City   |
| (13)  | 1995 Total Households in Forecast District  |
| (14)  | 2005 Total Households in Forecast District (Projected by NCTCOG)                              |
| (15)  | 2025 Total Households in Forecast District (Projected by NCTCOG)                              |
| (16)  | Computed Weighted Average Population per House Density from Col. (40)                         |
| (17)  | Computed 1995 Forecast District Population = (18) x (15)                                      |
| (18)  | Average 1995 Population Density of Forecast District in People / Acre = (19) / (12)           |
| (19)  | Computed 2005 Forecast District Population = (18) x (16)                                      |
| (20)  | Average 2005 Population Density of Forecast District in People / Acre = (21) / (12)           |
| (21)  | Computed 2025 Forecast District Population = (18) x (17)                                      |
| (22)  | Average 2025 Population Density of Forecast District in People / Acre = (23) / (12)           |
| (23)  | Population Forecast Districts from NCTCOG Database  |
| (24)  | Total Computed Area within Forecast District from AutoCAD map (Acres)                         |
| (25)  | Area of Forecast District within City (Acres)   |
| (26)  | Percent of Forecast District Total Area within City   |
| (27)  | 1995 Total Employment in Forecast District  |
| (28)  | Average 1995 Employment Density of Forecast District in Employees / Acre = (29) / (26)        |
| (29)  | 2005 Total Employment in Forecast District  |
| (30)  | Average 2005 Employment Density of Forecast District in Employees / Acre = (31) / (26)        |
| (31)  | 2025 Total Employment in Forecast District  |
| (32)  | Average 2025 Employment Density of Forecast District in Employees / Acre = (33) / (26)        |
| (33)  | Population Forecast Districts from NCTCOG Database  |
| (34)  | Census Tracts from NCTCOG Population Database   |
| (35)  | Total Census Tract Area (Acres)   |
| (36)  | Portion of Census Tract Area in Forecast District (Acres)                                     |
| (37)  | Population per House Density from Col. (9)  |
| (38)  | (38) x (39), Sum Col (40) / (37) = Weighted Average Population per House in Forecast District |
| (39)  | Population Forecast Districts from NCTCOG Database  |
| (40)  | Computed 1995 Forecast District Population in City Limits = (19) x (14)                       |
| (41)  | Computed 2005 Forecast District Population in City Limits = (19) x (14)                       |
| (42)  | Computed 2025 Forecast District Population in City Limits = (19) x (14)                       |
| (43)  | 1995 Total Employment in Forecast District for City Limits = (29) x (28)                      |
| (44)  | 2005 Total Employment in Forecast District for City Limits = (29) x (28)                      |
| (45)  | 2025 Total Employment in Forecast District for City Limits = (29) x (28)                      |

***HALTOM CITY***



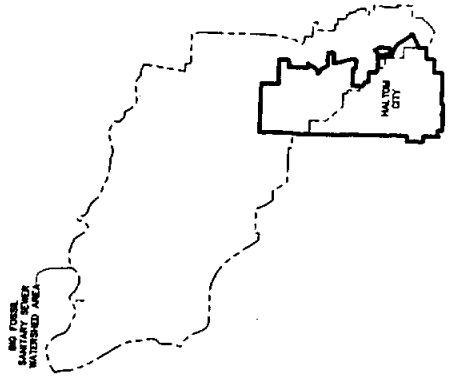
BIG FOSSIL  
SANITARY SEWER  
WATERSHED AREA



BIG FOSSIL  
SANITARY SEWER  
WATERSHED AREA

HALTOM  
CITY

BIG FOSSIL INDEX



**Halton City Census Tract Data**

| Tract   | Total Area | Area in Watershed | Population Data |      |      |      | RESIDENTIAL ACRES | POPULATION DENSITY |
|---------|------------|-------------------|-----------------|------|------|------|-------------------|--------------------|
|         |            |                   | Percentage      | 1950 | 1965 | 1998 |                   |                    |
| 1101.01 | 863        | 791.7             | 91.7%           | 5122 | 5261 | 5417 | 317               | 15.6               |
| 1101.02 | 756        | 57                | 7.5%            | 4275 | 4375 | 4405 | 70                | 5.6                |
| 1102.01 | 2666       | 1668.8            | 62.6%           | 7865 | 8277 | 9600 | 823               | 15.03              |
| 1103    | 2235       | 214               | 9.6%            | 3097 | 4276 | 4309 | 1793              | 2.38               |
| 1132.05 | 1711       | 878.43            | 51.3%           | 7307 | 7561 | 7923 | 599               | 10.52              |
| 1132.06 | 913        | 608.3             | 66.6%           | 4174 | 4495 | 4566 | 407               | 11.04              |
| 1133.01 | 1023       | 517.1             | 50.5%           | 4383 | 4465 | 4529 | 542               | 8.24               |
| 1133.02 | 666        | 686.22            | 102.9%          | 4002 | 4073 | 4342 | 571               | 7.13               |
| 1138.05 | 1455       | 1411.44           | 97.0%           | 8991 | 9138 | 9317 | 342               | 23.80              |
| 1065.1  | 4618       | 407.5             | 8.8%            | 1320 | 1975 | 2766 | 438               | 4.51               |

**BIG FOSSIL SEWER STUDY**

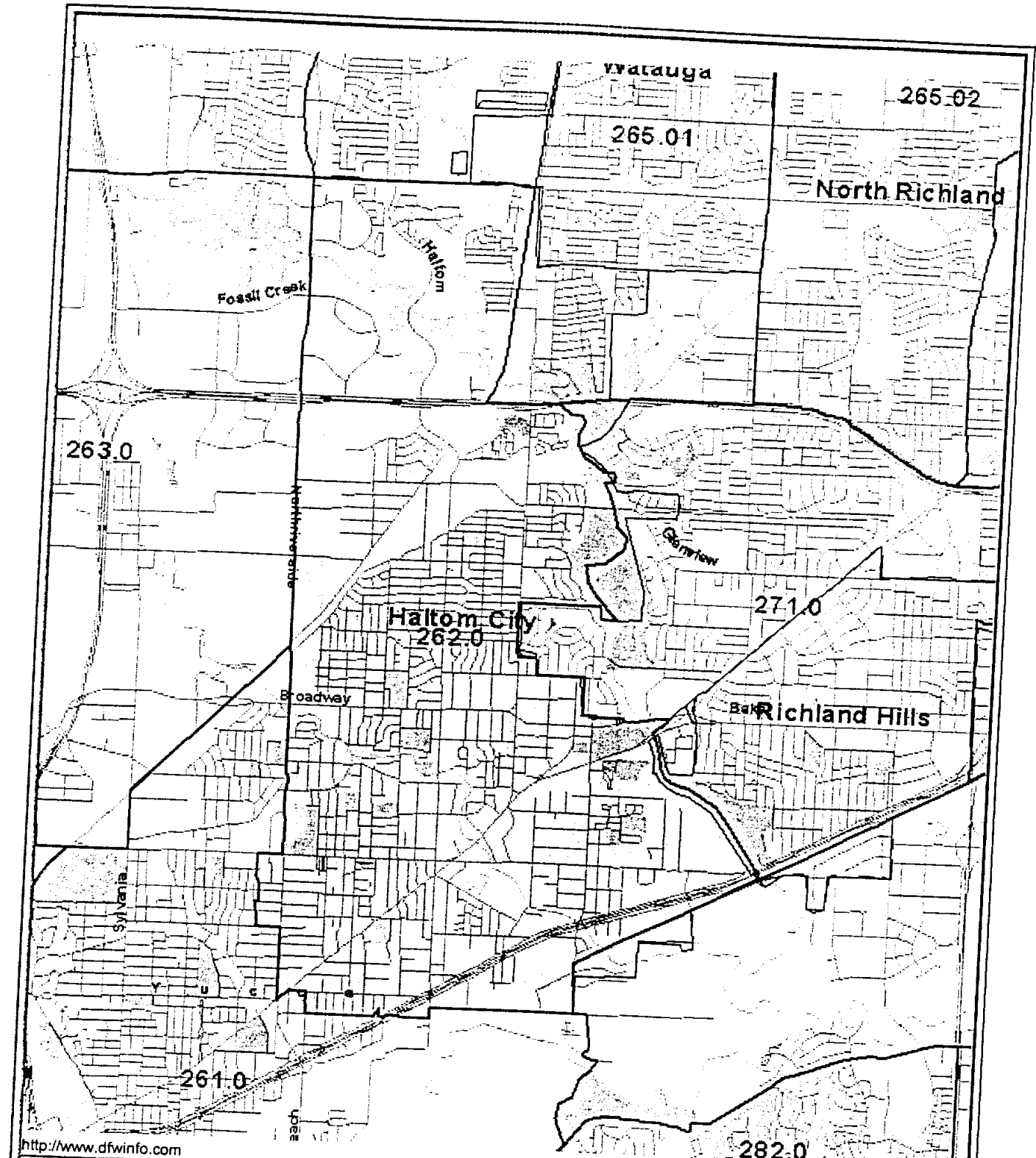
**HALTOM CITY CENSUS TRACTS**

CITY OF  
**NORTH RICHLAND HILLS**

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
CONSULTING ENGINEER / PERMISSIVE ENGINEER

DESIGNED BY: C.S.    DATE:    MONTH: 1999  
DRAWN BY: C.S.    DATE:    MONTH: 1999  
CHECKED BY:    DATE:    MONTH: 1999  
PROJECT NO.: 93-148





<http://www.dfwinfo.com>



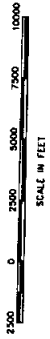
North Central Texas Council  
of Governments  
Research and Information Services  
(817) 695-9150

### NCTCOG 1999 Forecast Districts Haltom City

- Map Legend:
- Roads
  - ▬ Forecast Districts
  - ✈ Airports
  - Lakes
  - ~ Streams
  - Parks



BIG FOSSIL  
SANITARY SEWER  
WATERSHED AREA



BIG FOSSIL  
SANITARY SEWER  
WATERSHED AREA

HALTOM  
CITY

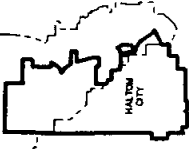
265.01

271.0

262.0

284.1

BIG FOSSIL INDEX



**BIG FOSSIL SEWER STUDY**  
**HALTOM CITY FORECAST DISTRICTS**  
 City of  
**NORTH RICHLAND HILLS**

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
 CONSULTING ENGINEERS / FEE: \$100,000.00

|                  |                |                   |
|------------------|----------------|-------------------|
| DESIGNED BY: GCS | REV. BY: DJL   | DATE: 10/20/08    |
| DRAWN BY: GCS    | DATE: 10/20/08 | SCALE: 1" = 1000' |
| CHECKED BY:      | DATE:          | SCALE:            |

PROJECT NO.: 08-001  
 SHEET NO.: 1 OF 11

**HALTOM CITY**

| (1)           | (2)        | (3)          | (4)            | (5)            | (6)               | (7)               | (8)                   | (9)                    | (10)                  |
|---------------|------------|--------------|----------------|----------------|-------------------|-------------------|-----------------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in City | % Area In City | Total 1995 Pop | Avg. Pop. Density | 1995 Pop. In City | 1995 Total Households | 1995 Population /House | 1995 Total Employment |
| 1065.1        | 4618       | 81           | 1.75%          | 1975           | 0.43              | 35                | 693                   | 2.85                   | 5194                  |
| 1101.01       | 868        | 868          | 100.00%        | 5261           | 6.06              | 5261              | 2297                  | 2.29                   | 720                   |
| 1101.02       | 758        | 758          | 100.00%        | 4174           | 5.51              | 4174              | 1732                  | 2.41                   | 1083                  |
| 1102.01       | 2666       | 2666         | 100.00%        | 8277           | 3.10              | 8277              | 3109                  | 2.66                   | 2677                  |
| 1102.02       | 655        | 655          | 100.00%        | 3293           | 5.03              | 3293              | 1228                  | 2.68                   | 782                   |
| 1103          | 2235       | 2196         | 98.26%         | 8532           | 3.82              | 8383              | 3222                  | 2.65                   | 5725                  |
| 1132.05       | 1711       | 90           | 5.28%          | 7561           | 4.42              | 399               | 2941                  | 2.57                   | 3591                  |
| 1132.06       | 913        | 93           | 10.19%         | 4495           | 4.92              | 458               | 1754                  | 2.56                   | 1206                  |
| 1133.01       | 1023       | 11           | 1.09%          | 4456           | 4.36              | 48                | 1803                  | 2.47                   | 1279                  |
| 1133.02       | 866        | 42           | 4.85%          | 4073           | 4.70              | 198               | 1497                  | 2.72                   | 2545                  |
| 1138.05       | 1455       | 475          | 32.65%         | 8138           | 5.59              | 2657              | 2775                  | 2.93                   | 2338                  |
|               |            | 7935         |                | 60235          | 47.94             | 33183             | 23051                 | 28.80                  | 27140                 |

**POPULATION**

| (11)               | (12)       | (13)         | (14)           | (15)  | (16)  | (17)  | (18)              | (19)            | (20)         | (21)            | (22)         | (23)            | (24)         |
|--------------------|------------|--------------|----------------|-------|-------|-------|-------------------|-----------------|--------------|-----------------|--------------|-----------------|--------------|
| Forecast Districts | Total Area | Area in City | % Area In City | Thh95 | Thh05 | Thh25 | Population /House | 1995 Population | 1995 Density | 2005 Population | 2005 Density | 2025 Population | 2025 Density |
| 262                | 7139.37    | 7128         | 99.84%         | 11588 | 13259 | 14059 | 2.58              | 29897.04        | 4.19         | 34208.22        | 4.79         | 36272.22        | 5.08         |
| 265.01             | 3397.7     | 479          | 14.10%         | 8012  | 8862  | 11662 | 2.37              | 18988.44        | 5.59         | 21002.94        | 6.18         | 27638.94        | 8.13         |
| 271                | 4540.6     | 247          | 5.44%          | 7995  | 8840  | 10330 | 2.15              | 17189.25        | 3.79         | 19006           | 4.19         | 22209.5         | 4.89         |
| 284.1              | 8738.65    | 81           | 0.93%          | 1979  | 2790  | 4700  | 2.15              | 4254.85         | 0.49         | 5998.5          | 0.69         | 10105           | 1.16         |
|                    | 23816.32   | 7935         | 33.32%         | 29574 | 33751 | 40751 | 2.31              | 70329.58        | 14.05        | 80215.66        | 15.85        | 96225.66        | 19.26        |

**EMPLOYMENT**

| (25)               | (26)       | (27)         | (28)           | (29)       | (30)         | (31)       | (32)         | (33)       | (34)         |
|--------------------|------------|--------------|----------------|------------|--------------|------------|--------------|------------|--------------|
| Forecast Districts | Total Area | Area in City | % Area In City | 1995 Tot95 | 1995 Density | 2005 Tot05 | 2005 Density | 2025 Tot25 | 2025 Density |
| 262                | 7139.37    | 7128         | 99.84%         | 10987      | 1.54         | 13469      | 1.89         | 15948      | 2.23         |
| 265.01             | 3397.7     | 479          | 14.10%         | 3290       | 0.97         | 4197       | 1.24         | 6074       | 1.79         |
| 271                | 4540.6     | 247          | 5.44%          | 8621       | 1.90         | 9769       | 2.15         | 12762      | 2.81         |
| 284.1              | 8738.65    | 81           | 0.93%          | 12361      | 1.41         | 13944.00   | 1.60         | 20165      | 2.31         |
|                    |            | 7935         |                | 35259      | 5.82         | 41379      | 6.87         | 54949      | 9.14         |

| (35)              | (36)          | (37)           | (38)       | (39)                   | (40)         |
|-------------------|---------------|----------------|------------|------------------------|--------------|
| Forecast District | Census Tracts | Total Tr. Area | Area in FD | 1995 Population /House | 1995 Density |
| 262               | 1101.01       | 868            | 868        | 2.29                   | 1988.05      |
|                   | 1101.02       | 758            | 758        | 2.41                   | 1826.73      |
|                   | 1102.01       | 2666           | 2666       | 2.66                   | 7097.61      |
|                   | 1102.02       | 655            | 655        | 2.68                   | 1756.45      |
|                   | 1103          | 2235           | 2235       | 2.65                   | 5918.38      |
|                   |               | 7182           | 7182       |                        | 16587.22     |
| 265.01            | 1138.05       | 1455           | 1455       | 2.93                   | 4266.95      |
| 271               | 1132.05       | 1711           | 1711       | 2.57                   | 4398.80      |
|                   | 1132.06       | 913            | 913        | 2.56                   | 2339.76      |
|                   | 1133.01       | 1023           | 1023       | 2.47                   | 2528.28      |
|                   | 1133.02       | 866            | 866        | 2.72                   | 2356.19      |
|                   |               | 4513           | 4513       |                        | 11523.03     |
| 284.1             | 1065.1        | 4618           | 4618       | 2.85                   | 13180.97     |

| (41)               | (42)                 | (43)  | (44)  | (45)       | (46)  | (47)  |
|--------------------|----------------------|-------|-------|------------|-------|-------|
| Forecast Districts | CITY ONLY Population |       |       | Employment |       |       |
|                    | 1995                 | 2005  | 2025  | 1995       | 2005  | 2025  |
| 262                | 29849                | 34154 | 36214 | 10970      | 13448 | 15923 |
| 265.01             | 2677                 | 2961  | 3896  | 464        | 592   | 856   |
| 271                | 935                  | 1034  | 1208  | 469        | 531   | 694   |
| 284.1              | 39                   | 56    | 94    | 115        | 129   | 187   |
| TOTAL              | 33501                | 36204 | 41413 | 12017      | 14700 | 17660 |

Haltom City Ultimate Population 47408

| Haltom City # | 1995  | 1998  | 1999  | 2000  | 2005  | 2010  | 2020  |
|---------------|-------|-------|-------|-------|-------|-------|-------|
|               | 33500 | 35350 | 36200 | 37450 | 38982 | 40514 | 42986 |

**FUTURE POP. & EMP. LAND USE AREAS**

|                       |       |                      |       |
|-----------------------|-------|----------------------|-------|
| 1995 Population       | 33501 | 1995 Employment      | 12017 |
| 1995 Residential Area | 3507  | 1995 Employment Area | 1502  |
| 1995 Density          | 9.55  | 1995 Density         | 8.00  |

|                       |      |                       |      |
|-----------------------|------|-----------------------|------|
| 2005 Residential Area | 3999 | 2005 Residential Area | 1837 |
| 2025 Residential Area | 4335 | 2025 Residential Area | 2207 |

|                     | 1995        | 2005        | 2025        |
|---------------------|-------------|-------------|-------------|
| Residential Area    | 3507        | 3999        | 4335        |
| Employment Area     | 1502        | 1837        | 2207        |
| <b>SEWERED AREA</b> | <b>5009</b> | <b>5837</b> | <b>6543</b> |
| Infrastructure      | 641         | 747         | 837         |
| Vacant              | 2285        | 1354        | 539         |
| <b>REMINADER</b>    | <b>2926</b> | <b>2101</b> | <b>1376</b> |
|                     | 7935        | 7938        | 7919        |
| <b>TOTAL AREA</b>   | <b>7935</b> | <b>7935</b> | <b>7935</b> |

## NOTES:

- (1) Census Tracts from NCTCOG Population Database
- (2) Total Census Tract Area (Acres)
- (3) Total Area in City (Acres)
- (4) Percent of Census Tract Area within City
- (5) Total 1995 Population in Census Tract from NCTCOG data
- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City (Acres)
- (14) Percent of Forecast District Total Area within City
- (15) 1995 Total Households in Forecast District
- (16) 2005 Total Households in Forecast District (Projected by NCTCOG)
- (17) 2025 Total Households in Forecast District (Projected by NCTCOG)
- (18) Computed Weighted Average Population per House Density from Col. (40)
- (19) Computed 1995 Forecast District Population = (18) x (15)
- (20) Average 1995 Population Density of Forecast District in People / Acre = (19) / (12)
- (21) Computed 2005 Forecast District Population = (18) x (16)
- (22) Average 2005 Population Density of Forecast District in People / Acre = (21) / (12)
- (23) Computed 2025 Forecast District Population = (18) x (17)
- (24) Average 2025 Population Density of Forecast District in People / Acre = (23) / (12)
- (25) Population Forecast Districts from NCTCOG Database
- (26) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (27) Area of Forecast District within City (Acres)
- (28) Percent of Forecast District Total Area within City
- (29) 1995 Total Employment in Forecast District
- (30) Average 1995 Employment Density of Forecast District in Employees / Acre = (29) / (26)
- (31) 2005 Total Employment in Forecast District
- (32) Average 2005 Employment Density of Forecast District in Employees / Acre = (31) / (26)
- (33) 2025 Total Employment in Forecast District
- (34) Average 2025 Employment Density of Forecast District in Employees / Acre = (33) / (26)
- (35) Population Forecast Districts from NCTCOG Database
- (36) Census Tracts from NCTCOG Population Database
- (37) Total Census Tract Area (Acres)
- (38) Portion of Census Tract Area in Forecast District (Acres)
- (39) Population per House Density from Col. (9)
- (40) (38) x (39) Sum Col (40) / (37) = Weighted Average Population per House in Forecast District
- (41) Population Forecast Districts from NCTCOG Database
- (42) Computed 1995 Forecast District Population in City Limits = (19) x (14)
- (43) Computed 2005 Forecast District Population in City Limits = (19) x (14)
- (44) Computed 2025 Forecast District Population in City Limits = (19) x (14)
- (45) 1995 Total Employment in Forecast District for City Limits = (29) x (28)
- (46) 2005 Total Employment in Forecast District for City Limits = (29) x (28)
- (47) 2025 Total Employment in Forecast District for City Limits = (29) x (28)

**HALTOM CITY (BIG FOSSIL)**

| (1)           | (2)        | (3)               | (4)              | (5)             | (6)               | (7)                | (8)                   | (9)                    | (10)                  |
|---------------|------------|-------------------|------------------|-----------------|-------------------|--------------------|-----------------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Pop. | Avg. Pop. Density | 1995 Pop. In Wshed | 1995 Total Households | 1995 Population /House | 1995 Total Employment |
| 1101.01       | 868        | 790               | 91.01%           | 5261            | 6.06              | 4788               | 2297                  | 2.29                   | 720                   |
| 1101.02       | 758        | 58                | 7.65%            | 4174            | 5.51              | 319                | 1732                  | 2.41                   | 1083                  |
| 1102.01       | 2666       | 1675              | 62.83%           | 8277            | 3.10              | 5200               | 3109                  | 2.66                   | 2677                  |
| 1103          | 2235       | 183               | 8.19%            | 8532            | 3.82              | 699                | 3222                  | 2.65                   | 5725                  |
| 1132.05       | 1711       | 90                | 5.28%            | 7561            | 4.42              | 399                | 2941                  | 2.57                   | 3591                  |
| 1132.06       | 913        | 93                | 10.19%           | 4495            | 4.92              | 458                | 1754                  | 2.56                   | 1206                  |
| 1133.01       | 1023       | 11                | 1.09%            | 4456            | 4.36              | 48                 | 1803                  | 2.47                   | 1279                  |
| 1133.02       | 866        | 42                | 4.85%            | 4073            | 4.70              | 198                | 1497                  | 2.72                   | 2545                  |
| 1138.05       | 1455       | 475               | 32.65%           | 8138            | 5.59              | 2657               | 2775                  | 2.93                   | 2338                  |
|               |            | <b>3418</b>       |                  | <b>54967</b>    | <b>42.48</b>      | <b>14766</b>       | <b>21130</b>          | <b>23.27</b>           | <b>21164</b>          |

**POPULATION**

| (11)               | (12)       | (13)              | (14)             | (15)                           | (16)                           | (17)                           | (18)              | (19)                     | (20)                     | (21)                     |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|-------------------|--------------------------|--------------------------|--------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Households In Wshed | Total 2005 Households In Wshed | Total 2025 Households In Wshed | Population /House | 1995 Population in Wshed | 2005 Population In Wshed | 2025 Population In Wshed |
| 262                | 7139.37    | 2701              | 37.83%           | 4384                           | 5016                           | 5319                           | 2.59              | 11355                    | 12992                    | 13776                    |
| 265.01             | 3397.7     | 479               | 14.10%           | 1130                           | 1249                           | 1644                           | 2.93              | 3309                     | 3661                     | 4817                     |
| 271                | 4540.6     | 238               | 5.24%            | 419                            | 463                            | 541                            | 2.58              | 1081                     | 1195                     | 1397                     |
|                    |            | <b>3418</b>       |                  | <b>5933</b>                    | <b>6729</b>                    | <b>7504</b>                    | <b>2.70</b>       | <b>15745.3</b>           | <b>17848.018</b>         | <b>19990</b>             |

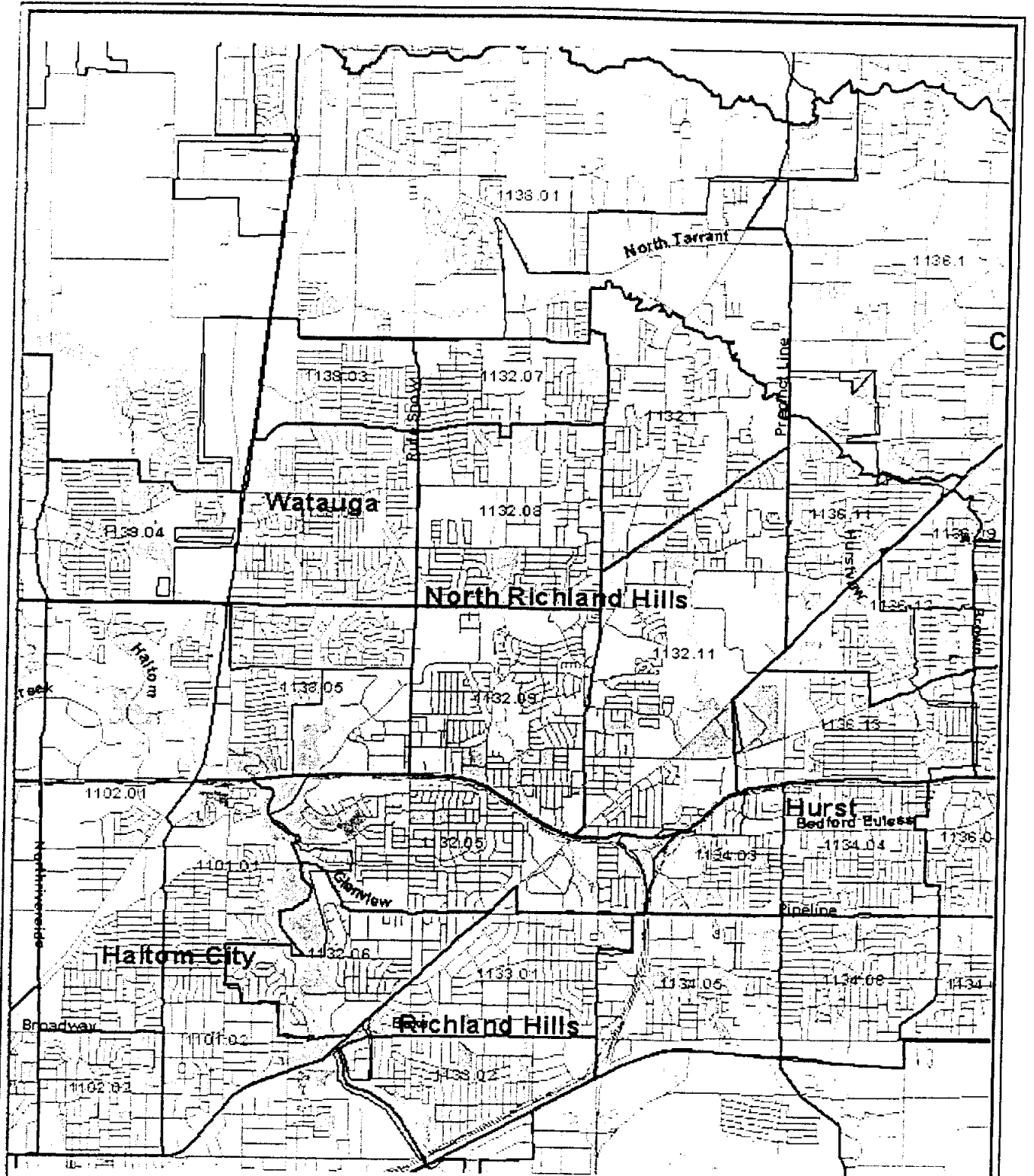
**EMPLOYMENT**

| (22)               | (23)       | (24)              | (25)             | (26)                           | (27)                           | (28)                           |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Employment In Wshed | Total 2005 Employment In Wshed | Total 2025 Employment In Wshed |
| 262                | 7139.37    | 2701              | 37.83%           | 4157                           | 5096                           | 6034                           |
| 265.01             | 3397.7     | 479               | 14.10%           | 464                            | 592                            | 856                            |
| 271                | 4540.6     | 238               | 5.24%            | 452                            | 512                            | 669                            |
|                    |            | <b>3418</b>       |                  | <b>5072</b>                    | <b>6199</b>                    | <b>7559</b>                    |

**NOTES:**

- (1) Census Tracts from NCTCOG Population Database that are contained by the Haltom City limits and contribute to the Big Fossil Watershed
- (2) Total Census Tract Area (Acres)
- (3) Total Area in Haltom City limits that contribute to the Big Fossil Watershed (Acres)
- (4) Percent of Census Tract Area within City Limits that contribute to the Big Fossil Watershed
- (5) Total 1995 Population in Census Tract from NCTCOG data
- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City that contributes to the Big Fossil Watershed = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (14) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (15) 1995 Total Households in Forecast District that contributes to Big Fossil Watershed
- (16) 2005 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (17) 2025 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (18) Computed Weighted Average Population per House Density (previously computed for entire Forecast Districts)
- (19) Computed 1995 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (15)
- (20) Computed 2005 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (16)
- (21) Computed 2025 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (17)
- (22) Population Forecast Districts from NCTCOG Database
- (23) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (24) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (25) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (26) 1995 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (27) 2005 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (28) 2025 Employment in Forecast District in city which contributes to Big Fossil Watershed

***NORTH RICHLAND HILLS***



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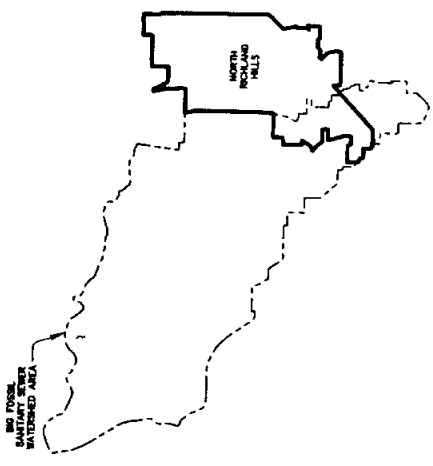
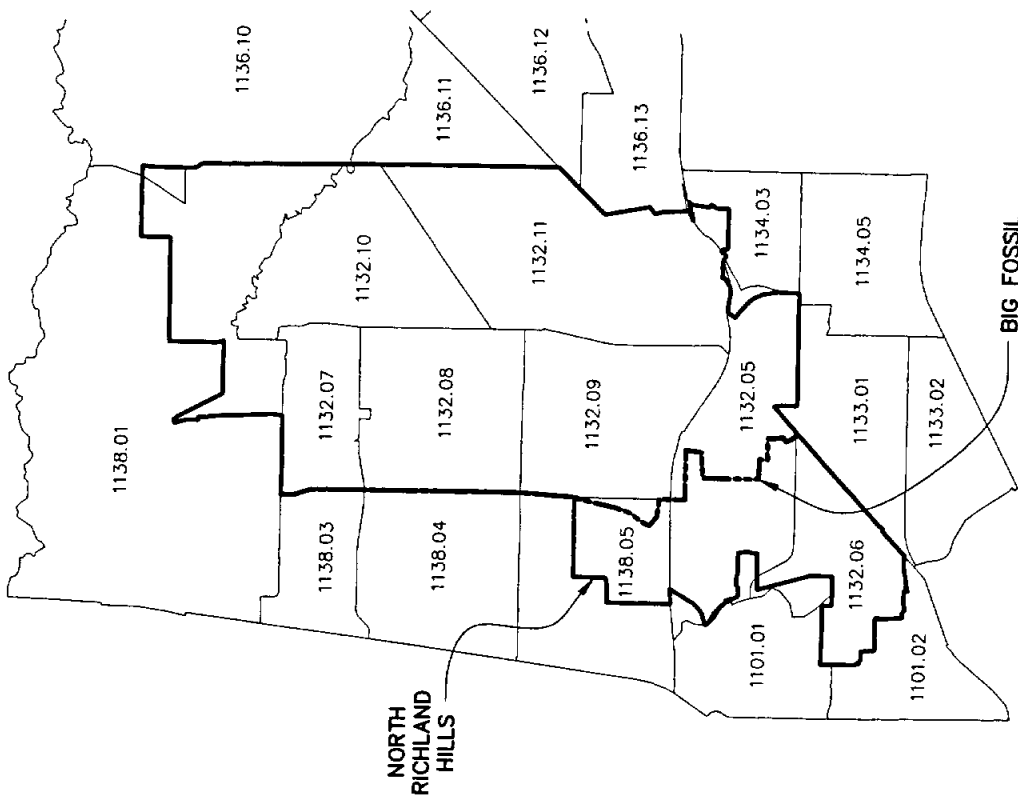


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 (817) 695-9150

## 1990 Census Tracts

- Map Legend:
- Roads
  - Census Tracts
  - Airports
  - Lakes
  - Streams
  - Parks

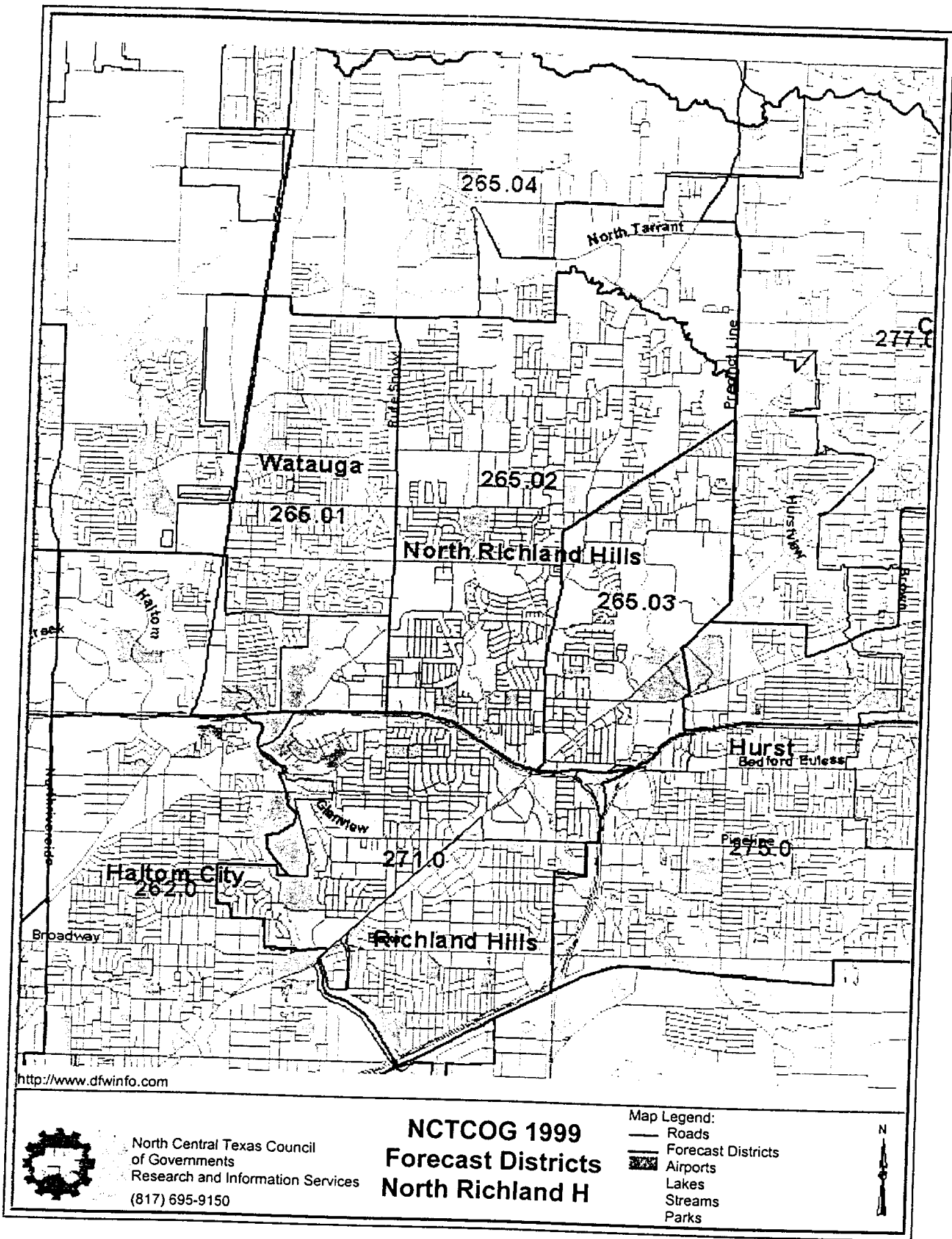




BIG FOSSIL INDEX

|   |                     |
|---|---------------------|
| <b>BIG FOSSIL SEWER STUDY</b>   |                     |
| <b>NORTH RICHLAND HILLS CENSUS TRACTS</b>   |                     |
| <b>NORTH RICHLAND HILLS</b>   |                     |
| City of   |                     |
| <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br><small>CONSULTING ENGINEERS / P.C. PROFESSIONALS</small> |                     |
| DESIGNED BY: G.S.   | DATE: NOVEMBER 1988 |
| DRAWN BY: G.S.  | JOB NO. 03-124      |
| CHECKED BY:   | NO. APPROVATIONS: 0 |





<http://www.dfvinfo.com>

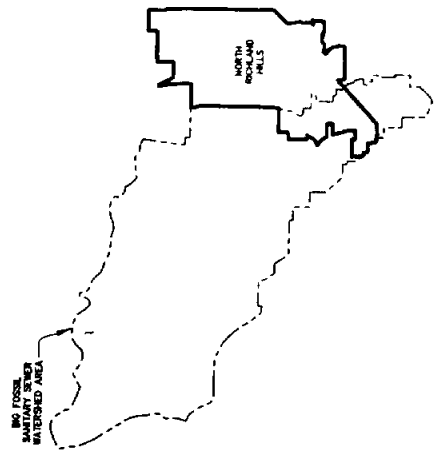
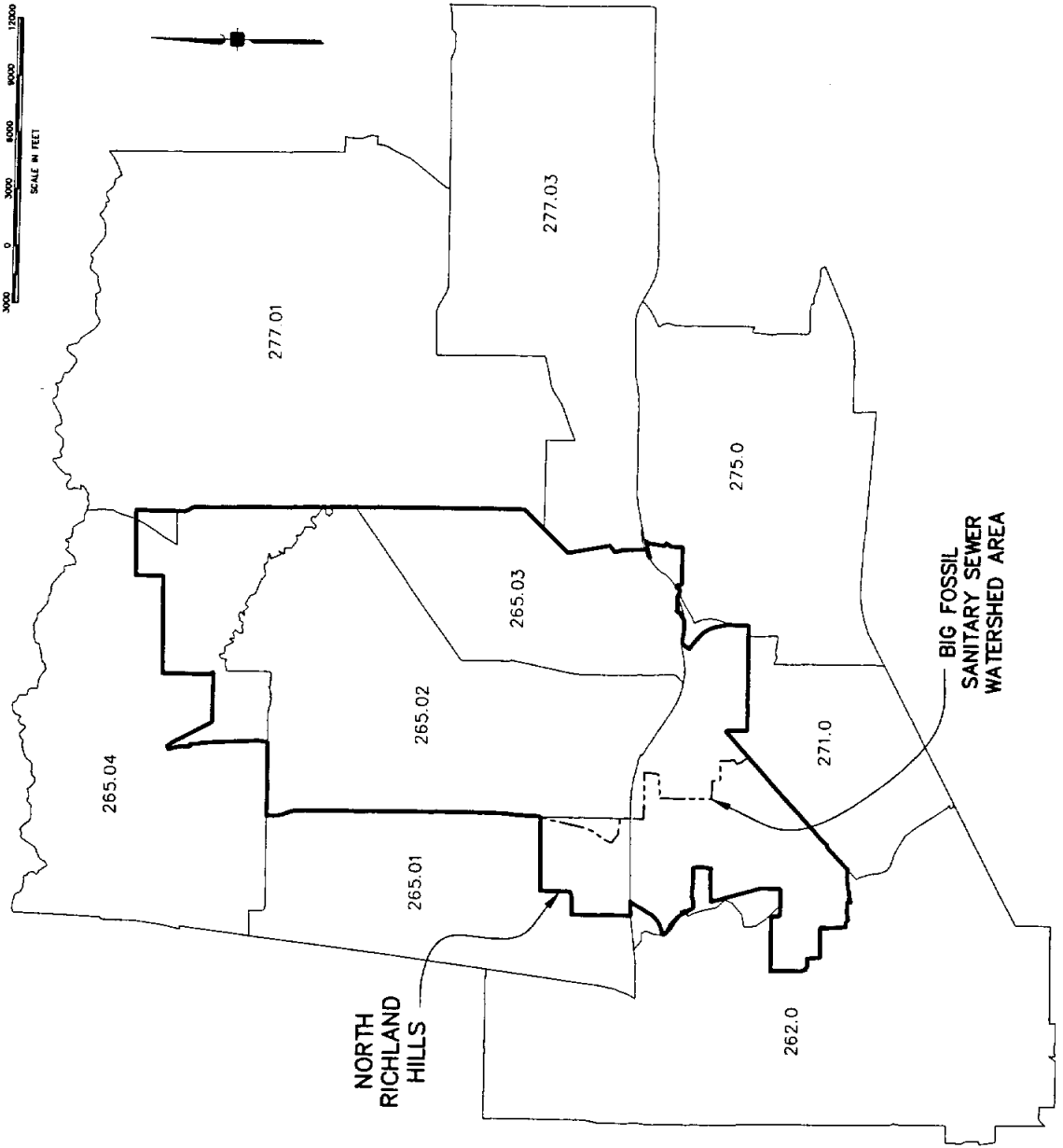


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### NCTCOG 1999 Forecast Districts North Richland H

- Map Legend:
- Roads
  - ▭ Forecast Districts
  - ✈ Airports
  - Lakes
  - ~ Streams
  - ⊞ Parks





BIG FOSSIL INDEX

|  |                       |
|--|-----------------------|
| <b>BIG FOSSIL SEWER STUDY</b>  |                       |
| NORTH RICHLAND HILLS<br>FORECAST DISTRICTS                                     |                       |
| CITY OF<br><b>NORTH RICHLAND HILLS</b>   |                       |
| <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br>CONSULTING ENGINEERS / SANITARY SEWER |                       |
| DESIGNED BY: CJS   | DATE: NOVEMBER 1992   |
| DRAWN BY: CJS  | JOB NO: 01-158        |
| CHECKED BY:  | PER. APPROVATION MARK |
|  | SHEET NO. 2 OF 2      |

North Richland Hills

| (1)           | (2)        | (3)          | (4)            | (5)            | (6)              | (7)              | (8)                   | (9)                    | (10)                  |
|---------------|------------|--------------|----------------|----------------|------------------|------------------|-----------------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in City | % Area in City | Total 1995 Pop | Avg. Pop Density | 1995 Pop In City | Total 1995 Households | 1995 Population /House | Total 1995 Employment |
| 1132 05       | 1711       |              |                |                |                  |                  |                       |                        |                       |
| 1132 06       | 913        | 1572         | 91.88%         | 7561           | 4.42             | 6647             | 2941                  | 2.57                   | 3591                  |
| 1132 07       | 699        | 822          | 90.03%         | 4495           | 4.92             | 4047             | 1754                  | 2.56                   | 1206                  |
| 1132 08       | 1440       | 859          | 100.00%        | 4282           | 6.13             | 4282             | 1394                  | 3.07                   | 95                    |
| 1132 09       | 1462       | 1440         | 100.00%        | 9030           | 6.27             | 9030             | 2939                  | 3.07                   | 544                   |
| 1132 1        | 1394       | 1462         | 100.00%        | 9364           | 5.40             | 9364             | 1652                  | 2.52                   | 2958                  |
| 1132 11       | 2308       | 1394         | 100.00%        | 5047           | 3.82             | 5047             | 3588                  | 2.61                   | 2866                  |
| 1134 03       | 603        | 2308         | 100.00%        | 8859           | 3.84             | 8859             | 3510                  | 2.52                   | 338                   |
| 1136 1        | 4583       | 603          | 10.43%         | 3038           | 5.04             | 317              | 1176                  | 2.58                   | 3681                  |
| 1136 01       | 5800       | 55           | 1.20%          | 5708           | 1.25             | 69               | 1935                  | 2.95                   | 773                   |
| 1138 01       | 1455       | 1365         | 23.53%         | 8394           | 1.45             | 1975             | 2780                  | 3.02                   | 253                   |
| 1138 05       | 1455       | 495          | 34.02%         | 8138           | 5.59             | 2769             | 2775                  | 2.93                   | 2338                  |
|               |            | 11675        |                | 73916          |                  | 48 93            | 52705                 | 26444                  | 30 95                 |
|               |            |              |                |                |                  |                  |                       |                        | 18643                 |

POPULATION

| (11)               | (12)       | (13)         | (14)           | (15)           | (16)         | (17)           | (18)         | (19)           | (20)         | (21)           | (22)         | (23)           | (24)         |
|--------------------|------------|--------------|----------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
| Forecast Districts | Total Area | Area in City | % Area in City | 1995 Total Pop | 1995 Density | 2005 Total Pop | 2005 Density | 1995 Total Pop | 1995 Density | 2005 Total Pop | 2005 Density | 2025 Total Pop | 2025 Density |
| 265 01             | 3446       | 495          | 14.36%         | 8012           | 8.62         | 11562          | 11.56        | 24757 08       | 7.18         | 27383 58       | 7.95         | 36035 58       | 10.46        |
| 265 02             | 4995       | 4995         | 100.00%        | 9573           | 10.27        | 14603          | 14.60        | 28048 89       | 5.62         | 31723 11       | 6.35         | 42786 79       | 8.57         |
| 265 03             | 2308       | 2308         | 100.00%        | 3510           | 4.04         | 6726           | 2.92         | 8845 2         | 3.83         | 10090 08       | 4.37         | 16949 52       | 7.34         |
| 265 04             | 5813       | 1365         | 23.48%         | 2780           | 5.59         | 13146          | 3.02         | 8395 6         | 1.44         | 16887 84       | 2.91         | 26548 1        | 6.84         |
| 271                | 4540 6     | 2394         | 52.72%         | 7995           | 8.84         | 10330          | 2.57         | 20547 15       | 4.53         | 22718 8        | 5.00         | 26548 1        | 6.84         |
| 275                | 4405 4     | 63           | 1.43%          | 10757          | 11.11        | 11811          | 2.56         | 27430 35       | 6.23         | 28330 5        | 6.43         | 30116 05       | 6.84         |
| 277 01             | 9187       | 55           | 0.60%          | 6700           | 6.63         | 14146          | 2.96         | 19832          | 2.16         | 25547 78       | 2.78         | 41872 16       | 4.56         |
|                    | 34695      | 11675        |                | 49327          | 57.868       | 82424          | 28.1         | 137858 27      | 30.99        | 162681 67      | 35.79        | 234011 12      | 50.44        |

EMPLOYMENT

| (25)               | (26)       | (27)         | (28)           | (29)           | (30)         | (31)           | (32)         | (33)           | (34)         |
|--------------------|------------|--------------|----------------|----------------|--------------|----------------|--------------|----------------|--------------|
| Forecast Districts | Total Area | Area in City | % Area in City | 1995 Total Emp | 1995 Density | 2005 Total Emp | 2005 Density | 2025 Total Emp | 2025 Density |
| 265 01             | 3446       | 495          | 14.36%         | 3290           | 0.95         | 4197           | 1.22         | 6704           | 1.95         |
| 265 02             | 4995       | 4995         | 100.00%        | 3843           | 0.77         | 5556           | 1.11         | 5518           | 1.10         |
| 265 03             | 2308       | 2308         | 100.00%        | 2958           | 1.28         | 4955           | 2.15         | 4925           | 2.13         |
| 265 04             | 5813       | 1365         | 23.48%         | 253            | 0.04         | 2472           | 0.43         | 5971           | 1.03         |
| 271                | 4540 6     | 2394         | 52.72%         | 8621           | 1.90         | 9769           | 2.15         | 12762          | 2.81         |
| 275                | 4405 4     | 63           | 1.43%          | 13242          | 3.01         | 15646          | 3.55         | 22022          | 5.00         |
| 277 01             | 9187       | 55           | 0.60%          | 5386           | 0.59         | 6025           | 0.72         | 9939           | 1.08         |
|                    | 11675      |              |                | 37593          | 8.54         | 49220          | 11.33        | 67841          | 15.10        |

CITY ONLY

| (35)              | (36)          | (37)          | (38)       | (39)            | (40)         | (41)            | (42)         | (43)            | (44)         | (45)            | (46)         | (47)            |
|-------------------|---------------|---------------|------------|-----------------|--------------|-----------------|--------------|-----------------|--------------|-----------------|--------------|-----------------|
| Forecast District | Census Tracts | Total Tr Area | Area in FD | 1995 Population | 1995 Density | 1995 Population | 1995 Density | 2005 Population | 2005 Density | 2025 Population | 2025 Density | 2025 Employment |
| 265 01            | 1138 03       | 638           | 638        | 3 18            | 2028 84      | 265 01          | 3556         | 3934            | 5176         | 473             | 603          | 363             |
|                   | 1138 04       | 1365          | 1365       | 3.23            | 4408 95      | 265 02          | 28049        | 31723           | 42787        | 3843            | 5556         | 5518            |
|                   | 1138 05       | 1455          | 1455       | 2.93            | 4263 15      | 265 03          | 8845         | 10090           | 16950        | 2958            | 4955         | 4925            |
|                   |               | 1468          | 1468       |                 | 10757 94     | 265 04          | 1971         | 3966            | 9323         | 59              | 580          | 1402            |
|                   |               |               |            |                 | 10757 94     | 271             | 10833        | 11978           | 13897        | 4545            | 5151         | 6729            |
| 265 02            | 1132 07       | 899           | 899        | 3 07            | 2145 93      | 275             | 392          | 405             | 431          | 189             | 224          | 315             |
|                   | 1132 08       | 1440          | 1440       | 3 07            | 4420 80      | 277 01          | 119          | 153             | 251          | 32              | 40           | 60              |
|                   | 1132 09       | 1462          | 1462       | 2 61            | 3815 82      |                 |              |                 |              |                 |              |                 |
|                   | 1132 1        | 1394          | 1394       | 3 06            | 4265 64      |                 |              |                 |              |                 |              |                 |
|                   |               | 4995          | 4995       |                 | 14842 19     |                 |              |                 |              |                 |              |                 |
|                   |               |               |            |                 | 14842 19     |                 |              |                 |              |                 |              |                 |
| 265 03            | 1132 11       | 2308          | 2308       | 2 52            | 6815 18      |                 |              |                 |              |                 |              |                 |
|                   |               |               |            |                 | 6815 18      |                 |              |                 |              |                 |              |                 |
| 265 04            | 1138 01       | 5800          | 1365       | 3 02            | 4122 30      |                 |              |                 |              |                 |              |                 |
|                   |               |               |            |                 | 4122 30      |                 |              |                 |              |                 |              |                 |
| 271               | 1132 05       | 1711          | 1711       | 2 57            | 4397 27      |                 |              |                 |              |                 |              |                 |
|                   | 1132 06       | 913           | 913        | 2 56            | 2337 28      |                 |              |                 |              |                 |              |                 |
|                   | 1133 01       | 1023          | 1023       | 2 47            | 2526 81      |                 |              |                 |              |                 |              |                 |
|                   | 1133 02       | 866           | 866        | 2 72            | 2355 52      |                 |              |                 |              |                 |              |                 |
|                   |               | 4513          | 4513       |                 | 14616 38     |                 |              |                 |              |                 |              |                 |
|                   |               |               |            |                 | 14616 38     |                 |              |                 |              |                 |              |                 |
| 275               | 1134 03       | 603           | 603        | 2 58            | 1555 74      |                 |              |                 |              |                 |              |                 |
|                   | 1134 04       | 843           | 843        | 2 61            | 2200 23      |                 |              |                 |              |                 |              |                 |
|                   | 1134 05       | 1059          | 1059       | 2 42            | 2562 78      |                 |              |                 |              |                 |              |                 |
|                   | 1134 07       | 482           | 482        | 2 60            | 1253 20      |                 |              |                 |              |                 |              |                 |
|                   | 1134 08       | 903           | 903        | 2 85            | 2392 95      |                 |              |                 |              |                 |              |                 |
|                   | 1138 07       | 509           | 509        | 2 43            | 1236 87      |                 |              |                 |              |                 |              |                 |
|                   |               | 4395          | 4395       |                 | 1251 77      |                 |              |                 |              |                 |              |                 |
|                   |               |               |            |                 | 1251 77      |                 |              |                 |              |                 |              |                 |
| 277 01            | 1136 09       | 6389          | 2832       | 2 94            | 8326 08      |                 |              |                 |              |                 |              |                 |
|                   | 1136 1        | 4583          | 4583       | 2 95            | 13519 85     |                 |              |                 |              |                 |              |                 |
|                   | 1136 11       | 783           | 783        | 3 12            | 2442 96      |                 |              |                 |              |                 |              |                 |
|                   | 1136 12       | 978           | 978        | 2 93            | 2865 54      |                 |              |                 |              |                 |              |                 |
|                   |               | 12132         | 9178       |                 | 27134 11     |                 |              |                 |              |                 |              |                 |
|                   |               |               |            |                 | 27134 11     |                 |              |                 |              |                 |              |                 |

North Richland Hills Ultimate Population  
Fort Worth Impact Fee Study

| Pop   | Year |
|-------|------|
| 12757 |      |
| 13335 | 2015 |

FUTURE POP. & EMP. LAND USE AREAS

|                        |       |                         |       |
|------------------------|-------|-------------------------|-------|
| 1995 Population        | 53768 | 1995 Employment         | 12100 |
| 1995 Residential Area  | 5495  | 1995 Employment Area    | 1426  |
| 1995 Density           | 9.78  | 1995 Density            | 8.49  |
| 2005 Residential Area  | 6362  | 2005 Residential Area   | 2016  |
| 2025 Residential Area  | 9087  | 2025 Residential Area   | 2347  |
| 1995 Residential Area  | 5495  | 2005 Residential Area   | 2016  |
| Employment Area        | 1426  | 2025 Residential Area   | 2347  |
| SEWERED AREA           | 6921  | 2005 Employment         | 330   |
| Total Unsewered        | 684   | 2005 Employment Area    | 3056  |
| Vacant & Under Constr. | 4070  | 2005 Employment Density | 201   |
| REMINADER              | 4754  | 2005 Employment Density | -2469 |
|                        | 11675 | 2005 Employment Density | -2288 |
|                        | 11675 | 2005 Employment Density |       |
|                        | 11675 | 2005 Employment Density |       |
|                        | 11675 | 2005 Employment Density |       |
| TOTAL AREA             | 11675 | 2005 Employment Density |       |

|       |   |
|-------|---|
| NOTES | Census Tracts from NCTCOG Population Database   |
|       | Total Census Tract Area (Acres)   |
| (1)   | Total Area in City (Acres)  |
| (2)   | Percent of Census Tract Area within City  |
| (3)   | Total 1995 Population in Census Tract from NCTCOG data  |
| (4)   | Average Population Density in People/Acre = (5) / (2)   |
| (5)   | 1995 Population within City = (5) x (4)   |
| (6)   | 1995 Total Households from NCTCOG Database  |
| (7)   | 1995 Population per House = (5) / (8)   |
| (8)   | 1995 Total Employment from NCTCOG Database  |
| (9)   | Population Forecast Districts from NCTCOG Database  |
| (10)  | Total Computed Area within Forecast District from AutoCAD map (Acres)                         |
| (11)  | Area of Forecast District within City (Acres)   |
| (12)  | Percent of Forecast District Total Area within City   |
| (13)  | 1995 Total Households in Forecast District  |
| (14)  | 2005 Total Households in Forecast District (Projected by NCTCOG)                              |
| (15)  | 2025 Total Households in Forecast District (Projected by NCTCOG)                              |
| (16)  | Computed Weighted Average Population per House Density from Col (40)                          |
| (17)  | Computed 1995 Forecast District Population = (18) x (15)                                      |
| (18)  | Average 1995 Population Density of Forecast District in People / Acre = (19) / (12)           |
| (19)  | Computed 2005 Forecast District Population = (18) x (16)                                      |
| (20)  | Average 2005 Population Density of Forecast District in People / Acre = (21) / (12)           |
| (21)  | Computed 2025 Forecast District Population = (18) x (17)                                      |
| (22)  | Average 2025 Population Density of Forecast District in People / Acre = (23) / (12)           |
| (23)  | Population Forecast Districts from NCTCOG Database  |
| (24)  | Total Computed Area within Forecast District from AutoCAD map (Acres)                         |
| (25)  | Area of Forecast District within City (Acres)   |
| (26)  | Percent of Forecast District Total Area within City   |
| (27)  | 1995 Total Employment in Forecast District  |
| (28)  | Average 1995 Employment Density of Forecast District in Employees / Acre = (29) / (26)        |
| (29)  | 2005 Total Employment in Forecast District  |
| (30)  | Average 2005 Employment Density of Forecast District in Employees / Acre = (31) / (26)        |
| (31)  | 2025 Total Employment in Forecast District  |
| (32)  | Average 2025 Employment Density of Forecast District in Employees / Acre = (33) / (26)        |
| (33)  | Population Forecast Districts from NCTCOG Database  |
| (34)  | Census Tracts from NCTCOG Population Database   |
| (35)  | Total Census Tract Area (Acres)   |
| (36)  | Percent of Census Tract Area in Forecast District (Acres)                                     |
| (37)  | Population per House Density from Col (9)   |
| (38)  | (38) x (39). Sum Col (40) / (37) = Weighted Average Population per House in Forecast District |
| (39)  | Population Forecast Districts from NCTCOG Database  |
| (40)  | Computed 1995 Forecast District Population in City Limits = (19) x (14)                       |
| (41)  | Computed 2005 Forecast District Population in City Limits = (19) x (14)                       |
| (42)  | Computed 2025 Forecast District Population in City Limits = (19) x (14)                       |
| (43)  | 1995 Total Employment in Forecast District for City Limits = (29) x (28)                      |
| (44)  | 2005 Total Employment in Forecast District for City Limits = (29) x (28)                      |

**NORTH RICHLAND HILLS (BIG FOSSIL)**

| (1)           | (2)        | (3)               | (4)              | (5)             | (6)               | (7)                | (8)                   | (9)                    | (10)                  |
|---------------|------------|-------------------|------------------|-----------------|-------------------|--------------------|-----------------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Pop. | Avg. Pop. Density | 1995 Pop. In Wshed | 1995 Total Households | 1995 Population /House | 1995 Total Employment |
| 1132.05       | 1711       | 784               | 45.82%           | 7561            | 4.42              | 3465               | 2941                  | 2.57                   | 3591                  |
| 1132.06       | 913        | 822               | 90.03%           | 4495            | 4.92              | 4047               | 1754                  | 2.56                   | 1208                  |
| 1138.05       | 1455       | 446               | 30.65%           | 8138            | 5.59              | 2495               | 2775                  | 2.93                   | 2338                  |
|               |            | <b>2052</b>       |                  | <b>20194</b>    | <b>14.94</b>      | <b>10006</b>       | <b>7470</b>           | <b>8.07</b>            | <b>7135</b>           |

**POPULATION**

| (11)               | (12)       | (13)              | (14)             | (15)                           | (16)                           | (17)                           | (18)              | (19)                     | (20)                     | (21)                     |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|-------------------|--------------------------|--------------------------|--------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Households In Wshed | Total 2005 Households In Wshed | Total 2025 Households In Wshed | Population /House | 1995 Population in Wshed | 2005 Population In Wshed | 2025 Population In Wshed |
| 265.01             | 3446       | 446               | 12.94%           | 8012                           | 8862                           | 11662                          | 3.09              | 3204                     | 3544                     | 4664                     |
| 271                | 4540.6     | 1606              | 35.37%           | 7995                           | 8840                           | 10330                          | 2.57              | 7267                     | 8036                     | 9390                     |
|                    |            | <b>2052</b>       |                  | <b>16007</b>                   | <b>17702</b>                   | <b>21992</b>                   | <b>2.83</b>       | <b>10472</b>             | <b>11580</b>             | <b>14054</b>             |

**EMPLOYMENT**

| (22)               | (23)       | (24)              | (25)             | (26)                           | (27)                           | (28)                           |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Employment In Wshed | Total 2005 Employment In Wshed | Total 2025 Employment In Wshed |
| 265.01             | 3446       | 446               | 12.94%           | 426                            | 543                            | 868                            |
| 271                | 4540.6     | 1606              | 35.37%           | 3049                           | 3455                           | 4514                           |
|                    |            | <b>2052</b>       |                  | <b>3475</b>                    | <b>3998</b>                    | <b>5382</b>                    |

**NOTES:**

- (1) Census Tracts from NCTCOG Population Database that are contained by the Haltom City limits and contribute to the Big Fossil Watershed
- (2) Total Census Tract Area (Acres)
- (3) Total Area in Haltom City limits that contribute to the Big Fossil Watershed (Acres)
- (4) Percent of Census Tract Area within City Limits that contribute to the Big Fossil Watershed
- (5) Total 1995 Population in Census Tract from NCTCOG data
- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City that contributes to the Big Fossil Watershed = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (14) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (15) 1995 Total Households in Forecast District that contributes to Big Fossil Watershed
- (16) 2005 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (17) 2025 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (18) Computed Weighted Average Population per House Density (previously computed for entire Forecast Districts)
- (19) Computed 1995 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (15)
- (20) Computed 2005 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (16)
- (21) Computed 2025 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (17)
- (22) Population Forecast Districts from NCTCOG Database
- (23) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (24) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (25) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (26) 1995 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (27) 2005 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (28) 2025 Employment in Forecast District in city which contributes to Big Fossil Watershed

***RICHLAND HILLS***



http://www.dfwinfo.com



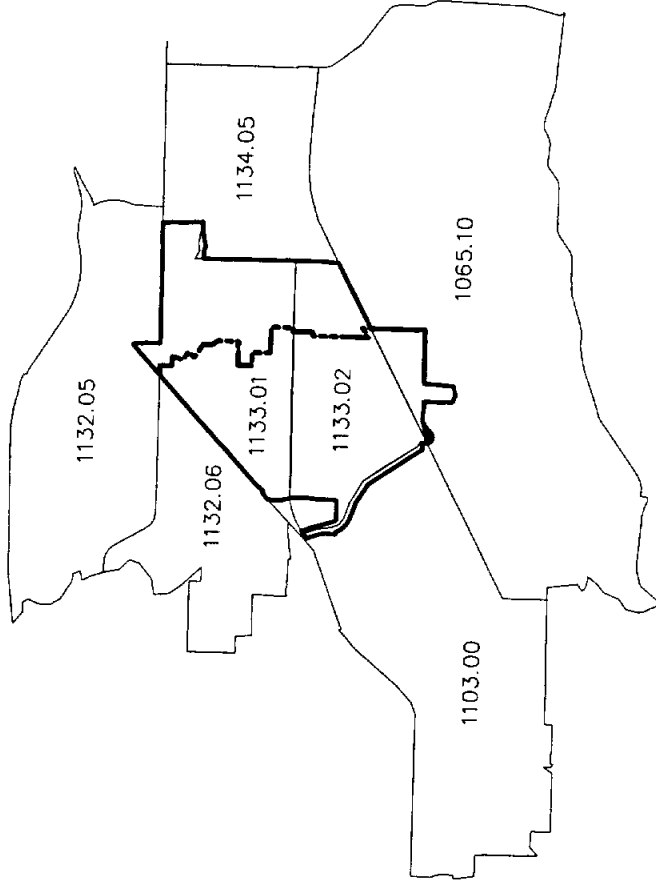
North Central Texas Council of Governments  
 Research and Information Services  
 (817) 695-9150

# 1990 Census Tracts

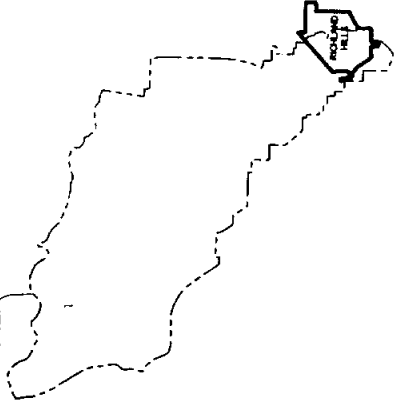
- Map Legend:
- Roads
  - Census Tracts
  - Airports
  - Lakes
  - Streams
  - Parks



RICHLAND  
HILLS



BIG FOSSIL  
SANITARY SEWER  
WATERSHED AREA



BIG FOSSIL INDEX

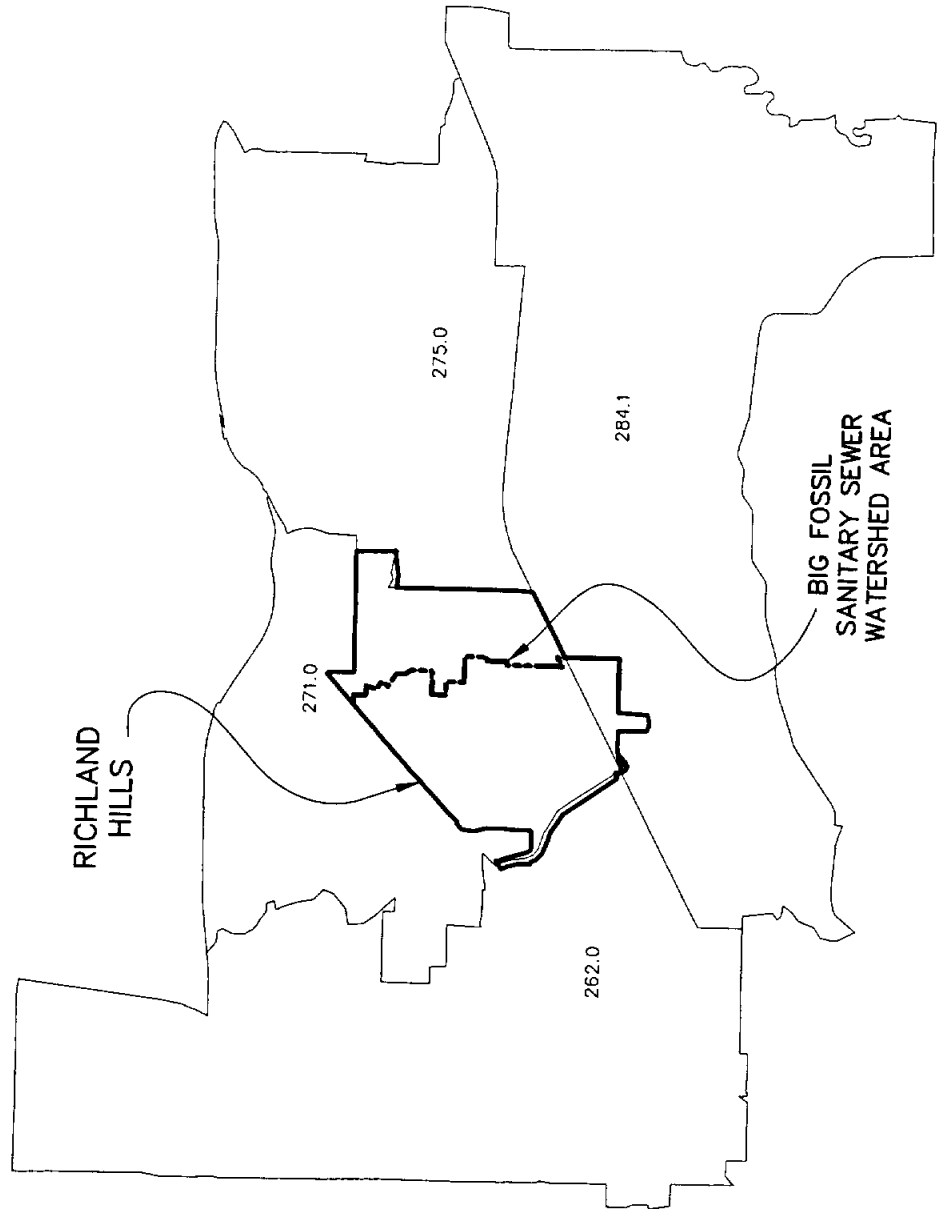
|   |                     |
|---|---------------------|
| <b>BIG FOSSIL SEWER STUDY</b>   |                     |
| <b>RICHLAND HILLS CENSUS TRACTS</b>   |                     |
| CITY OF <b>NORTH RICHLAND HILLS</b>   |                     |
| PREPARED BY <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br>CONSULTING ENGINEERS / P.C. NORTH-RICHLAND |                     |
| DESIGNED BY: G.J.   | DATE: NOVEMBER 1992 |
| DRAWN BY: G.J.  | JOB NO. 02-02       |
| CHECKED BY:   | SCALE: AS SHOWN     |



BIG FOSSIL  
SANITARY SEWER  
WATERSHED AREA

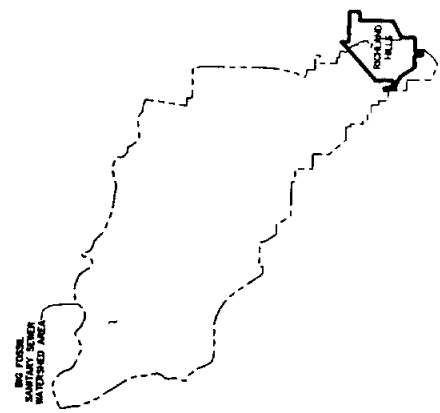


RICHLAND  
HILLS



BIG FOSSIL  
SANITARY SEWER  
WATERSHED AREA

BIG FOSSIL INDEX



|   |                             |
|---|-----------------------------|
| <b>BIG FOSSIL SEWER STUDY</b>   |                             |
| <b>RICHLAND HILLS FORECAST DISTRICTS</b>  |                             |
| CITY OF   | <b>NORTH RICHLAND HILLS</b> |
| <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br><small>CONSULTING ENGINEERS / 1001 West 10th Street, Suite 100, Fort Worth, TX 76102</small> |                             |
| DESIGNED BY: C.E.S.   | CHECKED BY: C.E.S.          |
| DRAWN BY: C.E.S.  | DATE: NOVEMBER 1999         |
| CHECKED BY:   | JOB NO. 01-158              |
|   | DATE PLOTTED: 01/15/00      |
|   | SHEET NO. 1 OF 12           |

**Richland Hills**

| (1)           | (2)        | (3)          | (4)            | (5)             | (6)               | (7)               | (8)             | (9)                    | (10)                  |
|---------------|------------|--------------|----------------|-----------------|-------------------|-------------------|-----------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in City | % Area In City | Total 1995 Pop. | Avg. Pop. Density | 1995 Pop. In City | 1995 Households | 1995 Population /House | 1995 Total Employment |
| 1065.1        | 4618       | 127          | 2.75%          | 1975            | 0.43              | 54                | 693             | 2.85                   | 5194                  |
| 1103          | 2235       | 33           | 1.48%          | 8532            | 3.82              | 126               | 3222            | 2.65                   | 5725                  |
| 1133.01       | 1023       | 1016         | 99.32%         | 4456            | 4.36              | 4426              | 1803            | 2.47                   | 1279                  |
| 1133.02       | 866        | 825          | 95.27%         | 4073            | 4.70              | 3880              | 1497            | 2.72                   | 2545                  |
| 1134.05       | 1059       | 6            | 0.59%          | 4800            | 4.53              | 28                | 1986            | 2.42                   | 2337                  |
|               |            | 2007         |                | 23836           | 17.84             | 8514              | 9201            | 13.11                  | 17080                 |

**POPULATION**

| (11)               | (12)       | (13)         | (14)           | (15)  | (16)  | (17)  | (18)              | (19)            | (20)         | (21)            | (22)         | (23)            | (24)         |
|--------------------|------------|--------------|----------------|-------|-------|-------|-------------------|-----------------|--------------|-----------------|--------------|-----------------|--------------|
| Forecast Districts | Total Area | Area in City | % Area In City | Thh95 | Thh05 | Thh25 | Population /House | 1995 Population | 1995 Density | 2005 Population | 2005 Density | 2025 Population | 2025 Density |
| 262                | 7139.37    | 33           | 0.46%          | 11588 | 13259 | 14059 | 2.65              | 30708.2         | 4.30         | 35136.35        | 4.92         | 37256.35        | 5.22         |
| 271                | 4540.6     | 1838         | 40.48%         | 7995  | 8840  | 10330 | 2.57              | 20547.15        | 4.53         | 22718.8         | 5.00         | 26548.1         | 5.85         |
| 275                | 4405.4     | 6            | 0.14%          | 10757 | 11110 | 11811 | 2.42              | 26031.94        | 5.91         | 26886.2         | 6.10         | 28582.62        | 6.49         |
| 284.1              | 8738.65    | 130          | 1.49%          | 1979  | 2790  | 4700  | 2.85              | 5640.15         | 0.65         | 7951.5          | 0.91         | 13395           | 1.53         |
|                    | 24824.02   | 2007         |                | 32319 | 35999 | 40900 | 2.62              | 82927.44        | 15.38        | 92692.85        | 16.94        | 105782.07       | 19.09        |

**EMPLOYMENT**

| (25)               | (26)       | (27)         | (28)           | (29)       | (30)         | (31)       | (32)         | (33)       | (34)         |
|--------------------|------------|--------------|----------------|------------|--------------|------------|--------------|------------|--------------|
| Forecast Districts | Total Area | Area in City | % Area In City | 1995 Tot95 | 1995 Density | 2005 Tot05 | 2005 Density | 2025 Tot25 | 2025 Density |
| 262                | 7139.37    | 33           | 0.46%          | 10987      | 1.54         | 13469      | 1.89         | 15948      | 2.23         |
| 271                | 4540.6     | 1838         | 40.48%         | 8621       | 1.90         | 9769       | 2.15         | 12762      | 2.81         |
| 275                | 4405.4     | 6            | 0.14%          | 13242      | 3.01         | 15646      | 3.55         | 22022      | 5.00         |
| 284.1              | 8738.65    | 130          | 1.49%          | 12361      | 1.41         | 13944      | 1.60         | 20165      | 2.31         |
|                    |            | 2007         |                | 45211      | 7.86         | 52828      | 9.19         | 70897      | 12.35        |

| (35)              | (36)          | (37)           | (38)       | (39)                   | (40)     |
|-------------------|---------------|----------------|------------|------------------------|----------|
| Forecast District | Census Tracts | Total Tr. Area | Area in FD | 1995 Population /House |          |
| 262               | 1103          | 2235           | 2235       | 2.65                   | 5918.38  |
|                   |               |                |            |                        | 2.65     |
| 271               | 1132.05       | 1711           | 1711       | 2.57                   | 4397.27  |
|                   | 1132.06       | 913            | 913        | 2.56                   | 2337.28  |
|                   | 1133.01       | 2235           | 1023       | 2.65                   | 2708.95  |
|                   | 1133.02       | 1023           | 866        | 2.47                   | 2140.26  |
|                   |               | 5882           | 4513       |                        | 11583.76 |
|                   |               |                |            |                        | 2.57     |
| 275               | 1134.05       | 1059           | 1059       | 2.42                   | 2562.78  |
|                   |               |                |            |                        | 2.42     |
| 284.1             | 1065.1        | 4618           | 4618       | 2.85                   | 13161.30 |
|                   |               |                |            |                        | 2.85     |

| (41)   | (42) | (43) | (44) CITY ONLY     |                 |                 | (45) | (46) | (47) |
|--------|------|------|--------------------|-----------------|-----------------|------|------|------|
|        |      |      | Forecast Districts | 1995 Population | 2005 Population |      |      |      |
| 262    | 142  | 162  | 172                | 51              | 62              | 74   |      |      |
| 265.01 | 8317 | 9196 | 10746              | 3490            | 3954            | 5166 |      |      |
| 271    | 35   | 37   | 39                 | 18              | 21              | 30   |      |      |
| 284.1  | 84   | 118  | 199                | 184             | 207             | 300  |      |      |
| TOTAL  | 8579 | 9514 | 11157              | 3742            | 4245            | 5570 |      |      |

Richland Hills Ultimate Population  
Fort Worth Impact Fee Study

Pop 9627  
Year 2019

**FUTURE POP. & EMP. LAND USE AREAS**

|                       |      |                      |       |
|-----------------------|------|----------------------|-------|
| 1995 Population       | 8579 | 1995 Employment      | 3742  |
| 1995 Residential Area | 1170 | 1995 Employment Area | 374   |
| 1995 Density          | 7.33 | 1995 Density         | 10.01 |

|                       |      |                       |     |
|-----------------------|------|-----------------------|-----|
| 2005 Residential Area | 1298 | 2005 Residential Area | 424 |
| 2025 Residential Area | 1522 | 2025 Residential Area | 557 |

|                     | 1995        | 2005        | 2025        |
|---------------------|-------------|-------------|-------------|
| Residential Area    | 1170        | 1298        | 1522        |
| Employment Area     | 374         | 424         | 557         |
| <b>SEWERED AREA</b> | <b>1544</b> | <b>1722</b> | <b>2078</b> |
| Infrastructure      | 155         | 173         | 0           |
| Vacant              | 308         | 112         | 0           |
| <b>REMINADER</b>    | <b>463</b>  | <b>285</b>  | <b>0</b>    |
|                     | 2007        | 2007        | 2078        |
| <b>TOTAL AREA</b>   | <b>2007</b> | <b>2007</b> | <b>2007</b> |

## NOTES:

- (1) Census Tracts from NCTCOG Population Database
- (2) Total Census Tract Area (Acres)
- (3) Total Area in City (Acres)
- (4) Percent of Census Tract Area within City
- (5) Total 1995 Population in Census Tract from NCTCOG data
- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City (Acres)
- (14) Percent of Forecast District Total Area within City
- (15) 1995 Total Households in Forecast District
- (16) 2005 Total Households in Forecast District (Projected by NCTCOG)
- (17) 2025 Total Households in Forecast District (Projected by NCTCOG)
- (18) Computed Weighted Average Population per House Density from Col. (40)
- (19) Computed 1995 Forecast District Population = (18) x (15)
- (20) Average 1995 Population Density of Forecast District in People / Acre = (19) / (12)
- (21) Computed 2005 Forecast District Population = (18) x (16)
- (22) Average 2005 Population Density of Forecast District in People / Acre = (21) / (12)
- (23) Computed 2025 Forecast District Population = (18) x (17)
- (24) Average 2025 Population Density of Forecast District in People / Acre = (23) / (12)
- (25) Population Forecast Districts from NCTCOG Database
- (26) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (27) Area of Forecast District within City (Acres)
- (28) Percent of Forecast District Total Area within City
- (29) 1995 Total Employment in Forecast District
- (30) Average 1995 Employment Density of Forecast District in Employees / Acre = (29) / (26)
- (31) 2005 Total Employment in Forecast District
- (32) Average 2005 Employment Density of Forecast District in Employees / Acre = (31) / (26)
- (33) 2025 Total Employment in Forecast District
- (34) Average 2025 Employment Density of Forecast District in Employees / Acre = (33) / (26)
- (35) Population Forecast Districts from NCTCOG Database
- (36) Census Tracts from NCTCOG Population Database
- (37) Total Census Tract Area (Acres)
- (38) Portion of Census Tract Area in Forecast District (Acres)
- (39) Population per House Density from Col. (9)
- (40) (38) x (39), Sum Col (40) / (37) = Weighted Average Population per House in Forecast District
- (41) Population Forecast Districts from NCTCOG Database
- (42) Computed 1995 Forecast District Population in City Limits = (19) x (14)
- (43) Computed 2005 Forecast District Population in City Limits = (19) x (14)
- (44) Computed 2025 Forecast District Population in City Limits = (19) x (14)
- (45) 1995 Total Employment in Forecast District for City Limits = (29) x (28)
- (46) 2005 Total Employment in Forecast District for City Limits = (29) x (28)
- (47) 2025 Total Employment in Forecast District for City Limits = (29) x (28)

**RICHLAND HILLS (BIG FOSSIL)**

| (1)           | (2)        | (3)               | (4)              | (5)             | (6)               | (7)                | (8)                   | (9)                    | (10)                  |
|---------------|------------|-------------------|------------------|-----------------|-------------------|--------------------|-----------------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Pop. | Avg. Pop. Density | 1995 Pop. In Wshed | 1995 Total Households | 1995 Population /House | 1995 Total Employment |
| 1065.1        | 4618       | 127               | 2.75%            | 1975            | 0.43              | 54                 | 693                   | 2.85                   | 5194                  |
| 1103          | 2235       | 33                | 1.48%            | 8532            | 3.82              | 126                | 3222                  | 2.65                   | 5725                  |
| 1133.01       | 1023       | 489               | 47.83%           | 4456            | 4.36              | 2131               | 1803                  | 2.47                   | 1279                  |
| 1133.02       | 866        | 651               | 75.17%           | 4073            | 4.70              | 3062               | 1497                  | 2.72                   | 2545                  |
| 1134.05       | 1059       | 6                 | 0.59%            | 4800            | 4.53              | 28                 | 1986                  | 2.42                   | 2337                  |
|               |            | <b>1307</b>       |                  | <b>23836</b>    | <b>17.84</b>      | <b>5401</b>        | <b>9201</b>           | <b>13.11</b>           | <b>17080</b>          |

**POPULATION**

| (11)               | (12)       | (13)              | (14)             | (15)                           | (16)                           | (17)                           | (18)              | (19)                     | (20)                     | (21)                     |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|-------------------|--------------------------|--------------------------|--------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Households In Wshed | Total 2005 Households In Wshed | Total 2025 Households In Wshed | Population /House | 1995 Population in Wshed | 2005 Population In Wshed | 2025 Population In Wshed |
| 262                | 7139.37    | 33                | 0.46%            | 54                             | 61                             | 65                             | 2.59              | 139                      | 159                      | 168                      |
| 271                | 4540.6     | 1141              | 25.13%           | 2912                           | 3332                           | 3533                           | 2.58              | 7513                     | 8596                     | 9115                     |
| 275                | 4405.4     | 6                 | 0.14%            | 11                             | 12                             | 14                             | 2.42              | 26                       | 29                       | 34                       |
| 284.1              | 8738.7     | 127               | 1.45%            | 156                            | 161                            | 172                            | 2.85              | 446                      | 460                      | 489                      |
|                    |            | <b>1307</b>       |                  | <b>3133</b>                    | <b>3567</b>                    | <b>3784</b>                    | <b>2.61</b>       | <b>8123.4</b>            | <b>9244.1637</b>         | <b>9806</b>              |

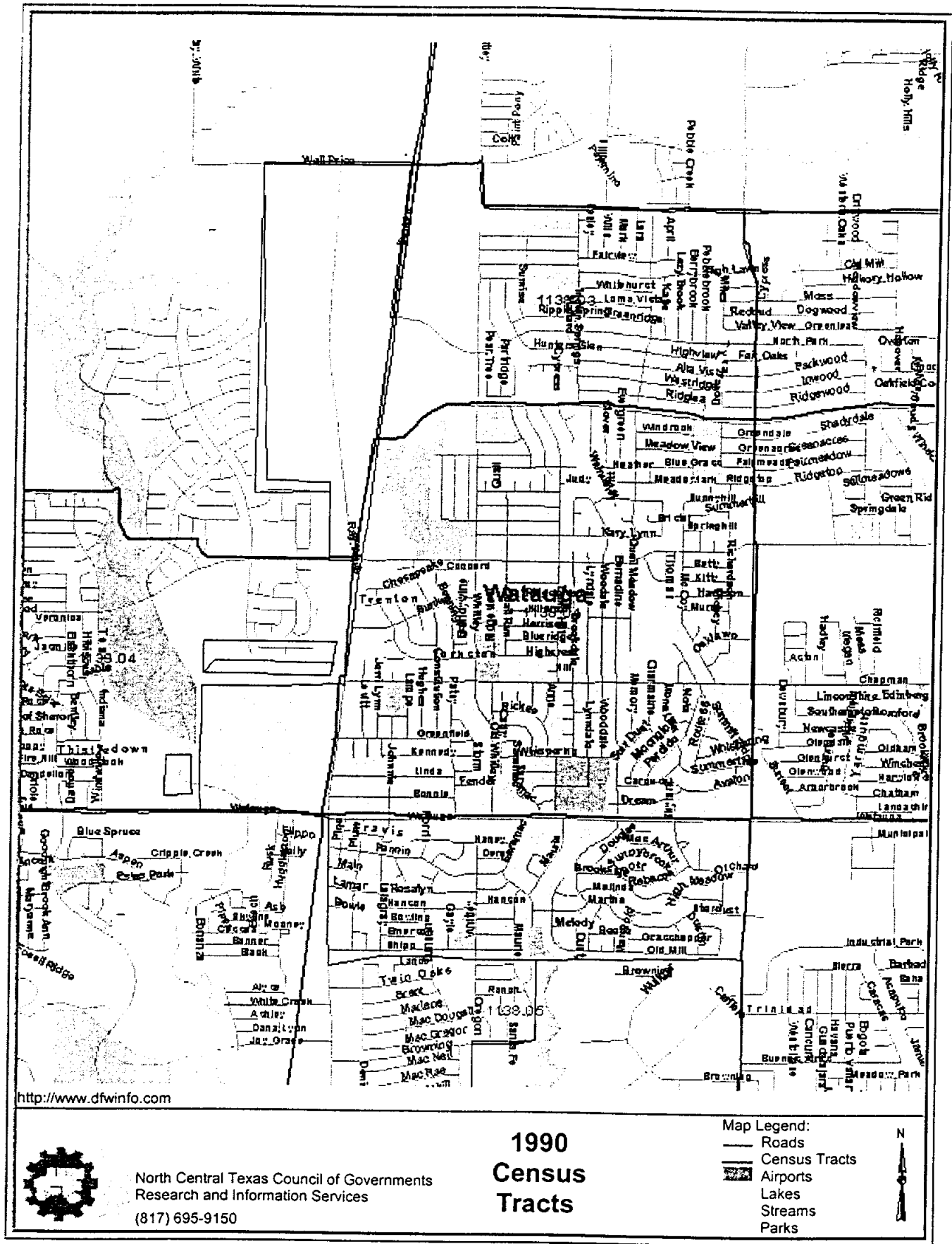
**EMPLOYMENT**

| (22)               | (23)       | (24)              | (25)             | (26)                           | (27)                           | (28)                           |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Employment In Wshed | Total 2005 Employment In Wshed | Total 2025 Employment In Wshed |
| 262                | 7139.37    | 33                | 0.46%            | 51                             | 62                             | 74                             |
| 271                | 4540.6     | 1141              | 25.13%           | 2761                           | 3385                           | 4008                           |
| 275                | 4405.4     | 6                 | 0.14%            | 12                             | 13                             | 17                             |
| 284.1              | 8738.7     | 127               | 1.45%            | 192                            | 227                            | 320                            |
|                    |            | <b>1307</b>       |                  | <b>3016</b>                    | <b>3688</b>                    | <b>4419</b>                    |

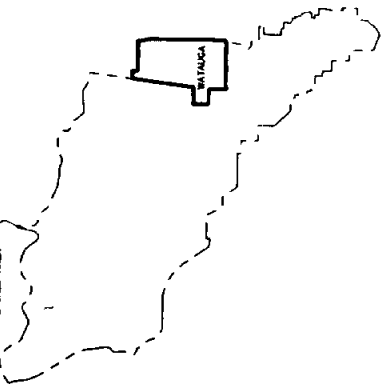
**NOTES:**

- (1) Census Tracts from NCTCOG Population Database that are contained by the Haltom City limits and contribute to the Big Fossil Watershed
- (2) Total Census Tract Area (Acres)
- (3) Total Area in Haltom City limits that contribute to the Big Fossil Watershed (Acres)
- (4) Percent of Census Tract Area within City Limits that contribute to the Big Fossil Watershed
- (5) Total 1995 Population in Census Tract from NCTCOG data
- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City that contributes to the Big Fossil Watershed = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (14) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (15) 1995 Total Households in Forecast District that contributes to Big Fossil Watershed
- (16) 2005 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (17) 2025 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (18) Computed Weighted Average Population per House Density (previously computed for entire Forecast Districts)
- (19) Computed 1995 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (15)
- (20) Computed 2005 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (16)
- (21) Computed 2025 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (17)
- (22) Population Forecast Districts from NCTCOG Database
- (23) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (24) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (25) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (26) 1995 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (27) 2005 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (28) 2025 Employment in Forecast District in city which contributes to Big Fossil Watershed

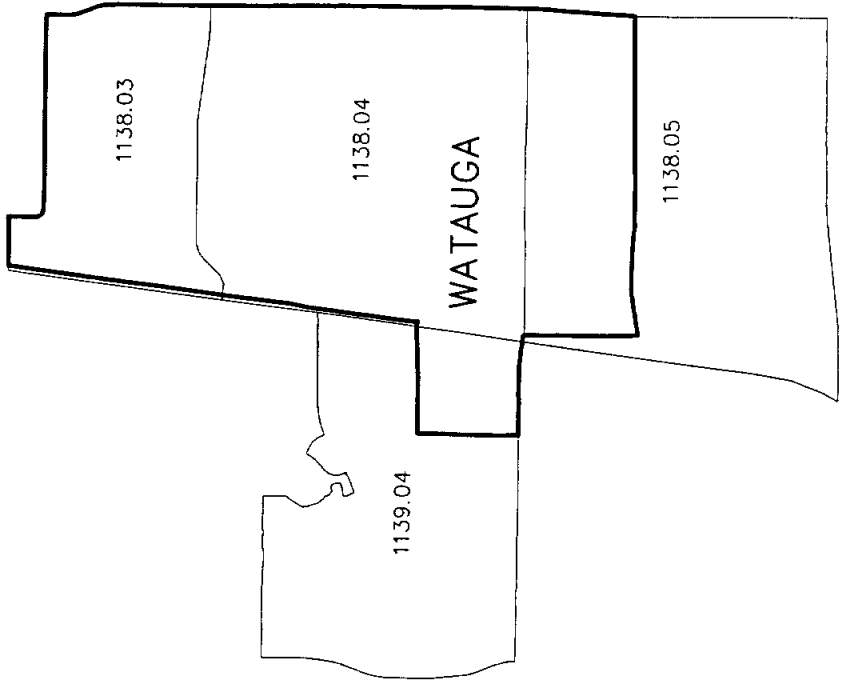
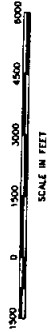
**WATAUGA**



SEE FUGAL  
SAMPLING  
WATERSHED AREA



BIG FOSSIL INDEX



**BIG FOSSIL SEWER STUDY**

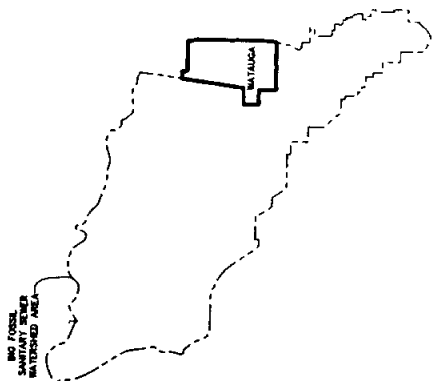
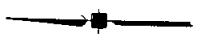
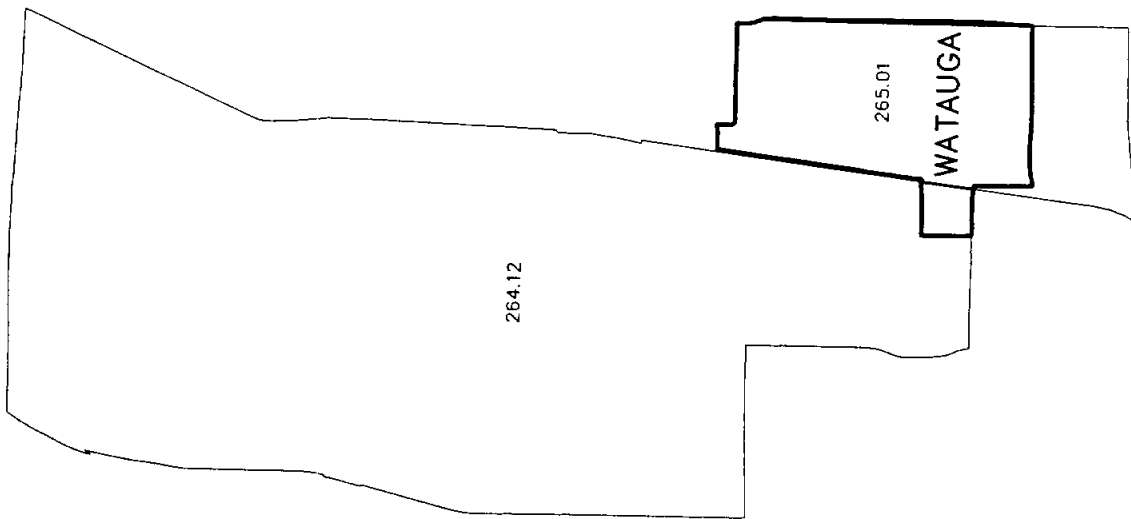
**WATAUGA CENSUS TRACTS**

**CITY OF NORTH RICHLAND HILLS**




**KNOWLTON-ENGLISH-FLOWERS, INC.**  
CONSULTING ENGINEERS / 1001 West-10th

DESIGNED BY: OLS  
DRAWN BY: OLS  
CHECKED BY: [blank]  
DATE: NOVEMBER 1992  
JOB NO.: 03-138  
SHEET NO. 8 OF 11



BIG FOSSIL INDEX

|  |                             |
|--|-----------------------------|
| <b>BIG FOSSIL SEWER STUDY</b>  |                             |
| <b>WATAUGA FORECAST DISTRICTS</b>  |                             |
| City of  | <b>NORTH RICHLAND HILLS</b> |
|  <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br><small>CONSULTING ENGINEERS / FORT WORTH, TEXAS</small> |                             |
| DESIGNED BY: G.S.  | SCALE: AS SHOWN             |
| CHECKED BY: G.S.   | DATE: 03-1-88               |
| CHECKED BY:  | DATE:                       |



**Watauga**

| (1)           | (2)                | (3)            | (4)                     | (5)               | (6)               | (7)         | (8)                   | (9)                    | (10)                  |
|---------------|--------------------|----------------|-------------------------|-------------------|-------------------|-------------|-----------------------|------------------------|-----------------------|
| Census Tracts | Total Area in City | % Area in City | Total 1995 Pop. In City | Avg. Pop. Density | 1995 Pop. In City | Households  | Total 1995 Population | 1995 Population /House | 1995 Total Employment |
| 1138.03       | 626                | 98.12%         | 4921                    | 7.71              | 4826              | 1548        | 318                   | 120                    |                       |
| 1138.04       | 1363               | 98.12%         | 11922                   | 8.73              | 11817             | 3689        | 323                   | 832                    |                       |
| 1138.05       | 1455               | 33.20%         | 8138                    | 5.59              | 2701              | 2775        | 293                   | 2338                   |                       |
| 1139.04       | 1036               | 13.32%         | 5509                    | 5.32              | 734               | 1951        | 282                   | 248                    |                       |
| <b>2600</b>   | <b>30490</b>       |                | <b>20081</b>            | <b>27.36</b>      | <b>20081</b>      | <b>9663</b> | <b>12.17</b>          | <b>3638</b>            |                       |

**POPULATION**

| (11)               | (12)               | (13)           | (14)              | (15)         | (16)              | (17)         | (18)                  | (19)         | (20)                  | (21)         | (22)                  | (23)                  | (24)         |
|--------------------|--------------------|----------------|-------------------|--------------|-------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|-----------------------|--------------|
| Forecast Districts | Total Area in City | % Area in City | 1995 Pop. In City | 1995 Density | 2005 Pop. In City | 2005 Density | 1995 Total Population | 1995 Density | 2005 Total Population | 2005 Density | 2005 Total Employment | 2005 Total Population | 2005 Density |
| 264.12             | 17248              | 0.80%          | 138               | 0.08%        | 11078             | 0.64         | 12173.94              | 0.71         | 19415.7               | 1.13         | 60804.84              | 3.53                  |              |
| 265.01             | 3432               | 71.74%         | 2462              | 0.71         | 4197              | 1.22         | 25478.16              | 7.42         | 28181.16              | 8.21         | 37085.16              | 10.81                 |              |
| <b>20680</b>       | <b>2600</b>        |                | <b>12329</b>      | <b>15747</b> | <b>33224</b>      | <b>3.00</b>  | <b>37652.1</b>        | <b>8.13</b>  | <b>47596.86</b>       | <b>9.34</b>  | <b>97860.00</b>       | <b>14.33</b>          |              |

**EMPLOYMENT**

| (25)               | (26)               | (27)           | (28)              | (29)         | (30)              | (31)         | (32)                  | (33)         | (34)                  |
|--------------------|--------------------|----------------|-------------------|--------------|-------------------|--------------|-----------------------|--------------|-----------------------|
| Forecast Districts | Total Area in City | % Area in City | 1995 Pop. In City | 1995 Density | 2005 Pop. In City | 2005 Density | 1995 Total Population | 1995 Density | 2005 Total Population |
| 264.12             | 1139.04            | 138            | 2.82              | 389.16       |                   |              | 2025.00               |              |                       |
| 265.01             | 1138.03            | 638            | 3.48              | 1560.66      |                   |              |                       |              |                       |
|                    | 1138.04            | 1365           | 3.23              | 4370.19      |                   |              |                       |              |                       |
|                    | 1138.05            | 1455           | 4.83              | 1415.19      |                   |              |                       |              |                       |

| (41)               | (42)            | (43)            | (44)         | (45)         | (46)            | (47)                  |
|--------------------|-----------------|-----------------|--------------|--------------|-----------------|-----------------------|
| Forecast Districts | 1995 Population | 2005 Population | 1995 Density | 2005 Density | 2005 Employment | 2005 Total Population |
| 264.12             | 97              | 195             | 0.56         | 1.36         | 89              | 160                   |
| 265.01             | 18277           | 20216           | 12.22        | 14.22        | 3011            | 4357                  |
| <b>TOTAL</b>       | <b>18375</b>    | <b>20372</b>    | <b>2.562</b> | <b>3.039</b> | <b>3039</b>     | <b>4517</b>           |

**Watauga Ultimate Population**

|                       | 1995  | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |  |
|-----------------------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| 1995 Population       | 18375 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| 1995 Residential Area | 1756  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| 1995 Employment       | 2382  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| 1995 Residential Area | 212   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| 1995 Density          | 11.79 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| 2005 Residential Area | 263   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| 2025 Residential Area | 333   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |

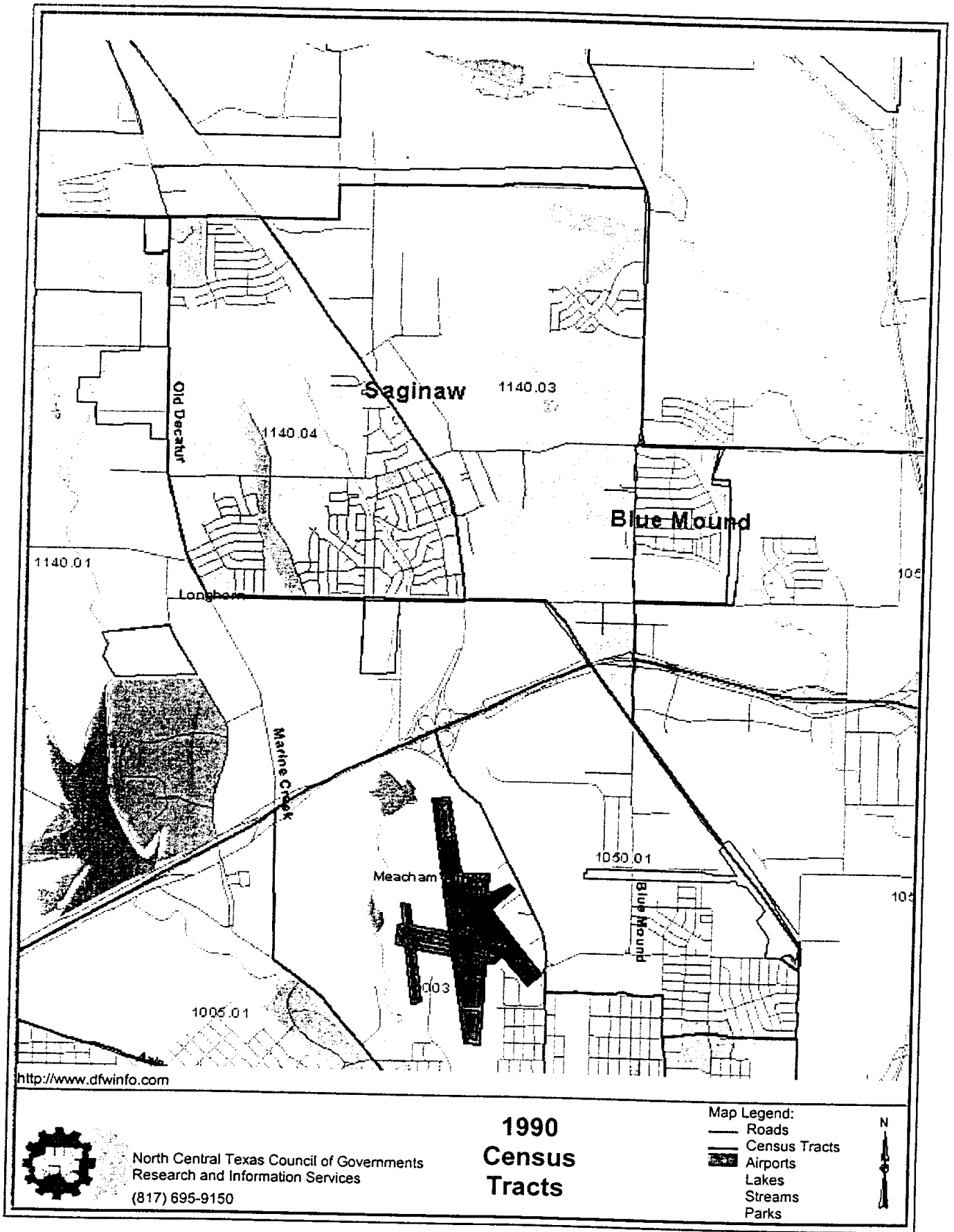
**FUTURE POP. & EMP. LAND USE AREAS**

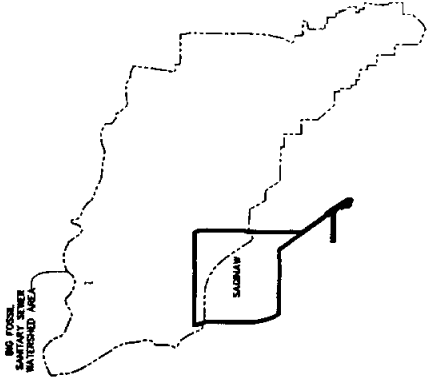
|                        | 1995        | 2005        | 2006        | 2007        | 2008        | 2009        | 2010        | 2011        | 2012        | 2013        | 2014        | 2015        | 2016        | 2017        | 2018        | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        |
|------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Residential Area       | 1740        | 1947        | 1979        | 2011        | 2043        | 2107        | 2139        | 2172        | 2204        | 2236        | 2268        | 2300        | 2332        | 2364        | 2396        | 2428        | 2460        | 2493        | 2525        | 2557        | 2589        | 2621        |
| Employment Area        | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         | 203         |
| <b>SEWERED AREA</b>    | <b>1938</b> | <b>2150</b> | <b>2182</b> | <b>2214</b> | <b>2246</b> | <b>2286</b> | <b>2324</b> | <b>2362</b> | <b>2400</b> | <b>2438</b> | <b>2476</b> | <b>2514</b> | <b>2552</b> | <b>2590</b> | <b>2628</b> | <b>2666</b> | <b>2704</b> | <b>2742</b> | <b>2780</b> | <b>2818</b> | <b>2856</b> | <b>2894</b> |
| Total Unsewered        | 29          | 33          | 33          | 34          | 34          | 35          | 35          | 36          | 37          | 37          | 38          | 38          | 39          | 39          | 40          | 41          | 42          | 42          | 43          | 43          | 44          | 44          |
| Vacant & Under Constr. | 613         | 358         | 333         | 308         | 283         | 258         | 233         | 208         | 183         | 158         | 133         | 108         | 83          | 58          | 33          | 8           | -17         | -42         | -67         | -92         | -117        | 0           |
| <b>REMINADER</b>       | <b>642</b>  | <b>391</b>  | <b>366</b>  | <b>342</b>  | <b>317</b>  | <b>293</b>  | <b>268</b>  | <b>244</b>  | <b>220</b>  | <b>195</b>  | <b>171</b>  | <b>146</b>  | <b>122</b>  | <b>97</b>   | <b>73</b>   | <b>48</b>   | <b>24</b>   | <b>0</b>    | <b>-25</b>  | <b>-49</b>  | <b>-74</b>  | <b>44</b>   |
| <b>TOTAL AREA</b>      | <b>2600</b> | <b>2600</b> | <b>2614</b> | <b>2628</b> | <b>2641</b> | <b>2655</b> | <b>2669</b> | <b>2682</b> | <b>2696</b> | <b>2710</b> | <b>2723</b> | <b>2737</b> | <b>2751</b> | <b>2764</b> | <b>2778</b> | <b>2792</b> | <b>2805</b> | <b>2819</b> | <b>2832</b> | <b>2846</b> | <b>2860</b> | <b>2874</b> |
| <b>TOTAL AREA</b>      | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> | <b>2600</b> |

NOTES

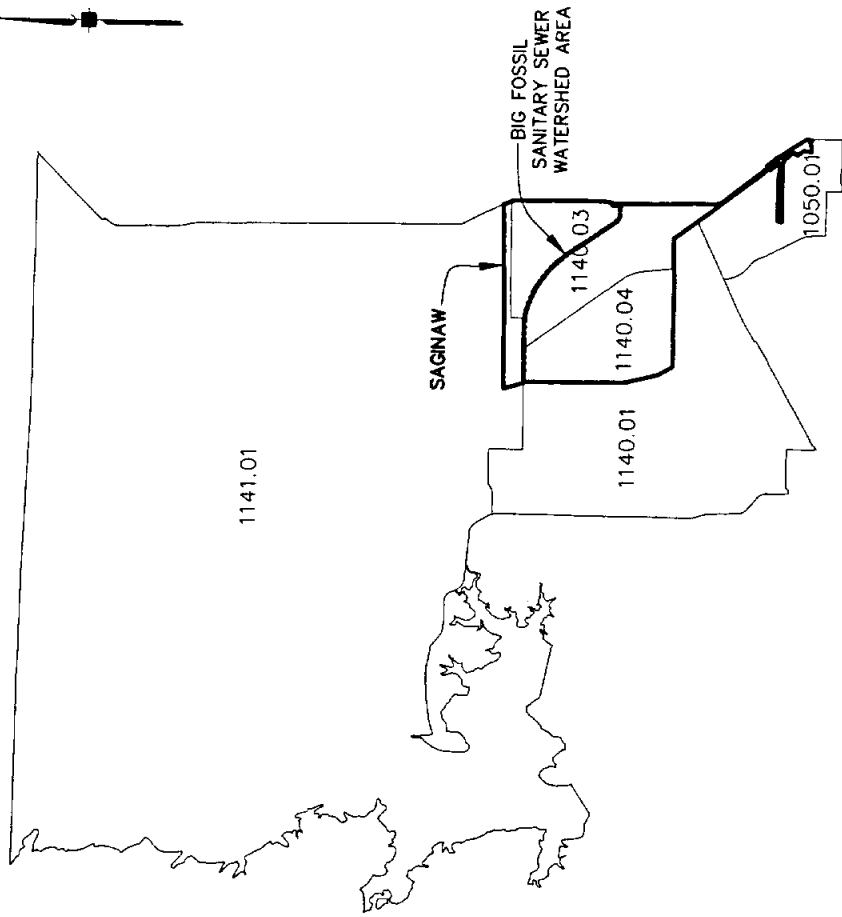
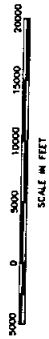
- (1) Census Tracts from NCTCOG Population Database
- (2) Total Census Tract Area (Acres)
- (3) Total Area in City (Acres)
- (4) Percent of Census Tract Area within City
- (5) Total 1995 Population in Census Tract from NCTCOG data
- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City (Acres)
- (14) Percent of Forecast District Total Area within City
- (15) 1995 Total Households in Forecast District
- (16) 2005 Total Households in Forecast District (Projected by NCTCOG)
- (17) 2025 Total Households in Forecast District (Projected by NCTCOG)
- (18) Computed Weighted Average Population per House Density from Col. (40)
- (19) Computed 1995 Forecast District Population = (18) x (15)
- (20) Average 1995 Population Density of Forecast District in People / Acre = (19) / (12)
- (21) Computed 2005 Forecast District Population = (18) x (16)
- (22) Average 2005 Population Density of Forecast District in People / Acre = (21) / (12)
- (23) Computed 2025 Forecast District Population = (18) x (17)
- (24) Average 2025 Population Density of Forecast District in People / Acre = (23) / (12)
- (25) Population Forecast Districts from NCTCOG Database
- (26) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (27) Area of Forecast District within City (Acres)
- (28) Percent of Forecast District Total Area within City
- (29) 1995 Total Employment in Forecast District
- (30) Average 1995 Employment Density of Forecast District in Employees / Acre = (29) / (26)
- (31) 2005 Total Employment in Forecast District
- (32) Average 2005 Employment Density of Forecast District in Employees / Acre = (31) / (26)
- (33) 2025 Total Employment in Forecast District
- (34) Average 2025 Employment Density of Forecast District in Employees / Acre = (33) / (26)
- (35) Population Forecast Districts from NCTCOG Database
- (36) Census Tracts from NCTCOG Population Database
- (37) Total Census Tract Area (Acres)
- (38) Portion of Census Tract Area in Forecast District (Acres)
- (39) Population per House Density from Col. (9)
- (40) (38) x (39), Sum Col.(40) / (37) = Weighted Average Population per House in Forecast District
- (41) Population Forecast Districts from NCTCOG Database
- (42) Computed 1995 Forecast District Population in City Limits = (19) x (14)
- (43) Computed 2005 Forecast District Population in City Limits = (19) x (14)
- (44) 1995 Total Employment in Forecast District for City Limits = (29) x (28)
- (45) 2005 Total Employment in Forecast District for City Limits = (29) x (28)
- (46) 2025 Total Employment in Forecast District for City Limits = (29) x (28)
- (47) 2025 Total Employment in Forecast District for City Limits = (29) x (28)

**SAGINAW**



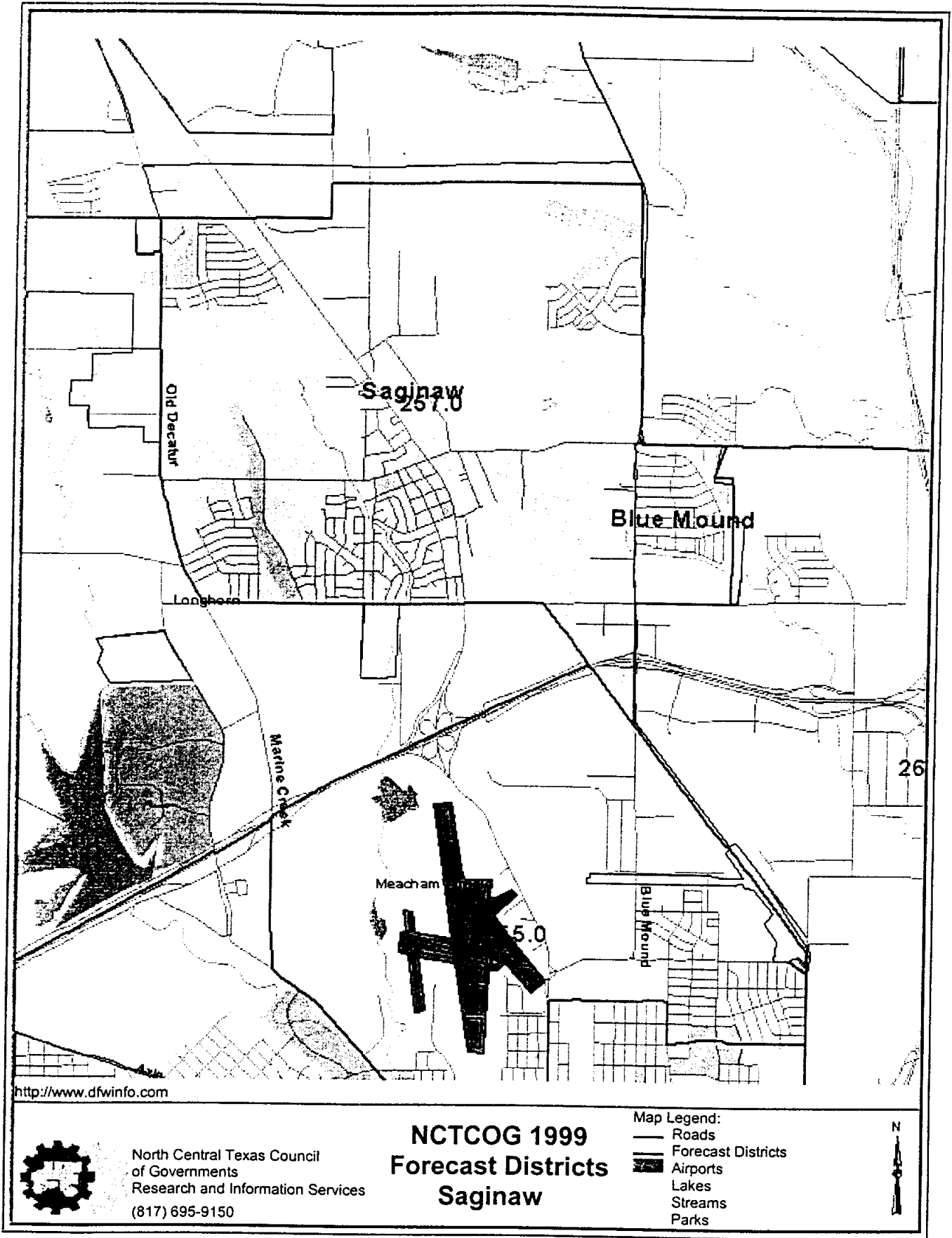


BIG FOSSIL INDEX



BIG FOSSIL SEWER STUDY  
SAGINAW CENSUS TRACTS  
City of NORTH RICHLAND HILLS

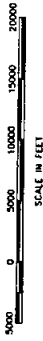
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| <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br>CONSULTING ENGINEERS / PLOT WORKS/SHADE |                        |
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| CHECKED BY:  | DATE: 11-11-99         |
| SHEET NO. 1 OF 11  |                        |



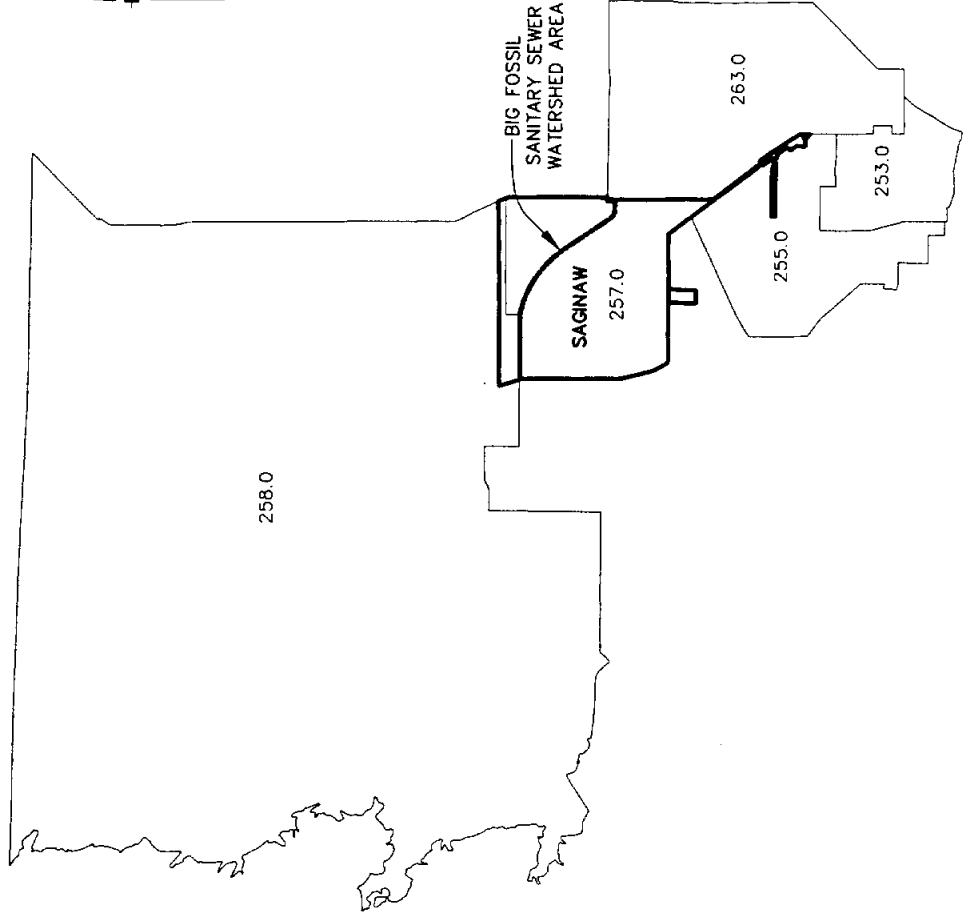
North Central Texas Council  
of Governments  
Research and Information Services  
(817) 695-9150

**NCTCOG 1999  
Forecast Districts  
Saginaw**

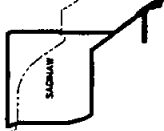
BIG FOSSIL  
SANITARY SEWER  
WATERSHED AREA



SCALE IN FEET



BIG FOSSIL INDEX



BIG FOSSIL SEWER STUDY

SAGINAW FORECAST DISTRICTS

City of NORTH RICHLAND HILLS

KNOWLTON - ENGLISH - FLOWERS, INC.  
CONSULTING ENGINEERS / 3001 West-20th

|             |     |           |               |
|-------------|-----|-----------|---------------|
| DESIGNED BY | CLS | DATE      | NOVEMBER 1989 |
| DRAWN BY    | CLS | SCALE     |               |
| CHECKED BY  |     | JOB NO.   | 23-114        |
|             |     | SHEET NO. | 1 OF 14       |

**Saginaw**

| (1)           | (2)        | (3)          | (4)            | (5)             | (6)               | (7)               | (8)             | (9)                    | (10)                  |
|---------------|------------|--------------|----------------|-----------------|-------------------|-------------------|-----------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in City | % Area In City | Total 1995 Pop. | Avg. Pop. Density | 1995 Pop. in City | 1995 Households | 1995 Population /House | 1995 Total Employment |
| 1050.01       | 1654       | 69           | 4.17%          | 5178            | 3.13              | 216               | 1482            | 3.49                   | 6213                  |
| 1050.06       | 3973       | 31           | 0.77%          | 1189            | 0.30              | 9                 | 243             | 4.89                   | 7683                  |
| 1140.03       | 2863       | 2505         | 87.50%         | 2852            | 1.00              | 2495              | 894             | 3.19                   | 2056                  |
| 1140.04       | 1831       | 1831         | 100.00%        | 8888            | 4.85              | 8888              | 2981            | 2.98                   | 1051                  |
| 1141.01       | 47204      | 342          | 0.72%          | 1754            | 0.04              | 13                | 648             | 2.71                   | 1510                  |
|               |            | <b>4778</b>  |                | <b>19861</b>    | <b>9.32</b>       | <b>11621</b>      | <b>6248</b>     | <b>17.27</b>           | <b>18513</b>          |

**POPULATION**

| (11)               | (12)         | (13)         | (14)           | (15)         | (16)         | (17)         | (18)              | (19)            | (20)         | (21)            | (22)         | (23)            | (24)         |
|--------------------|--------------|--------------|----------------|--------------|--------------|--------------|-------------------|-----------------|--------------|-----------------|--------------|-----------------|--------------|
| Forecast Districts | Total Area   | Area in City | % Area In City | Thh95        | Thh05        | Thh25        | Population /House | 1995 Population | 1995 Density | 2005 Population | 2005 Density | 2025 Population | 2025 Density |
| 255                | 3829         | 69           | 1.80%          | 2779         | 2872         | 3061         | 3.38              | 9393.02         | 2.45         | 9707.36         | 2.54         | 10346.18        | 2.70         |
| 257                | 4694         | 4336         | 92.37%         | 3875         | 6903         | 8719         | 3.11              | 12051.25        | 2.57         | 21468.33        | 4.57         | 27116.09        | 5.78         |
| 258                | 50461        | 342          | 0.68%          | 2484         | 2662         | 5046         | 2.71              | 6731.64         | 0.13         | 7214.02         | 0.14         | 13674.66        | 0.27         |
| 263                | 6523         | 31           | 0.48%          | 1006         | 1533         | 6500         | 3.85              | 3973.7          | 0.61         | 6055.35         | 0.93         | 25675           | 3.94         |
|                    | <b>65507</b> | <b>4778</b>  |                | <b>10144</b> | <b>13970</b> | <b>23326</b> | <b>3.29</b>       | <b>32149.61</b> | <b>5.76</b>  | <b>44445.06</b> | <b>8.18</b>  | <b>76811.93</b> | <b>12.69</b> |

**EMPLOYMENT**

| (25)               | (26)       | (27)         | (28)           | (29)         | (30)         | (31)         | (32)         | (33)         | (34)         |
|--------------------|------------|--------------|----------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Forecast Districts | Total Area | Area in City | % Area In City | 1995 Tot95   | 1995 Density | 2005 Tot05   | 2005 Density | 2025 Tot25   | 2025 Density |
| 255                | 3829       | 69           | 1.80%          | 9072         | 2.37         | 11993        | 3.13         | 12837        | 3.35         |
| 257                | 4694       | 4336         | 92.37%         | 3107         | 0.66         | 3386         | 0.72         | 5502         | 1.17         |
| 258                | 50461      | 342          | 0.68%          | 2224         | 0.04         | 2616         | 0.05         | 6640         | 0.13         |
| 263                | 6523       | 31           | 0.48%          | 10302        | 1.58         | 13121        | 2.01         | 21305        | 3.27         |
|                    |            | <b>4778</b>  |                | <b>24705</b> | <b>4.65</b>  | <b>31116</b> | <b>5.92</b>  | <b>46284</b> | <b>7.92</b>  |

| (35)              | (36)          | (37)           | (38)        | (39)                   | (40)                   |
|-------------------|---------------|----------------|-------------|------------------------|------------------------|
| Forecast District | Census Tracts | Total Tr. Area | Area in FD  | 1995 Population /House | 2025 Population /House |
| 255               | 1003          | 2198           | 2198        | 3.30                   | 7253.40                |
|                   | 1050.01       | 1654           | 1654        | 3.49                   | 5772.46                |
|                   |               |                | <b>3852</b> |                        | <b>13025.86</b>        |
| 257               | 1140.03       | 2863           | 2863        | 3.19                   | 9132.97                |
|                   | 1140.04       | 1831           | 1831        | 2.98                   | 5456.38                |
|                   |               | 4694           |             |                        | <b>14589.35</b>        |
| 258               | 1141.01       | 47204          | 47204       | 2.71                   | 127922.84              |
|                   | 1141.02       | 3195           | 3195        | 2.64                   | 8434.80                |
|                   |               | 50399          |             |                        | <b>136357.64</b>       |
| 263               | 1050.05       | 2524           | 2524        | 2.47                   | 6234.28                |
|                   | 1050.06       | 3973           | 3973        | 4.89                   | 19427.97               |
|                   |               |                | 6497        |                        | <b>25662.25</b>        |

| (41)               | (42)            | (43)            | (44)            |                 |                 | (45)            | (46) | (47) |
|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------|------|
|                    |                 |                 | CITY ONLY       |                 |                 |                 |      |      |
| Forecast Districts | 1995 Population | 2005 Population | 2025 Population | 1995 Employment | 2005 Employment | 2025 Employment |      |      |
| 264.12             | 169             | 175             | 186             | 163             | 216             | 231             |      |      |
| 265.12             | 11132           | 19831           | 25048           | 2870            | 3128            | 5082            |      |      |
| 266.12             | 46              | 49              | 93              | 15              | 18              | 45              |      |      |
| 265.01             | 19              | 29              | 122             | 49              | 62              | 101             |      |      |
| <b>TOTAL</b>       | <b>11366</b>    | <b>20084</b>    | <b>25446</b>    | <b>3096</b>     | <b>3424</b>     | <b>5460</b>     |      |      |

Saginaw Ultimate Population 21520

**FUTURE POP. & EMP. LAND USE AREAS**

|                       |       |                       |      |
|-----------------------|-------|-----------------------|------|
| 1995 Population       | 11366 | 1995 Employment       | 3098 |
| 1995 Residential Area | 773   | 1995 Employment Area  | 611  |
| 1995 Density          | 14.70 | 1995 Density          | 3.82 |
| 2005 Residential Area | 1366  | 2005 Residential Area | 896  |
| 2025 Residential Area | 1731  | 2025 Residential Area | 1400 |

|                        | 1995        | 2005        | 2025        |
|------------------------|-------------|-------------|-------------|
| Residential Area       | 773         | 1366        | 1731        |
| Employment Area        | 611         | 896         | 1400        |
| <b>SEWERED AREA</b>    | <b>1584</b> | <b>2262</b> | <b>3160</b> |
| Total Unsewered        | 503         | 718         | 1004        |
| Vacant & Under Constr. | 2691        | 1798        | 614         |
| <b>REMINADER</b>       | <b>3194</b> | <b>2516</b> | <b>1618</b> |
|                        | <b>4778</b> | <b>4779</b> | <b>4778</b> |
| <b>TOTAL AREA</b>      | <b>4778</b> | <b>4778</b> | <b>4778</b> |



## NOTES:

- (1) Census Tracts from NCTCOG Population Database
- (2) Total Census Tract Area (Acres)
- (3) Total Area in City (Acres)
- (4) Percent of Census Tract Area within City
- (5) Total 1995 Population in Census Tract from NCTCOG data
- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City (Acres)
- (14) Percent of Forecast District Total Area within City
- (15) 1995 Total Households in Forecast District
- (16) 2005 Total Households in Forecast District (Projected by NCTCOG)
- (17) 2025 Total Households in Forecast District (Projected by NCTCOG)
- (18) Computed Weighted Average Population per House Density from Col. (40)
- (19) Computed 1995 Forecast District Population = (18) x (15)
- (20) Average 1995 Population Density of Forecast District in People / Acre = (19) / (12)
- (21) Computed 2005 Forecast District Population = (18) x (16)
- (22) Average 2005 Population Density of Forecast District in People / Acre = (21) / (12)
- (23) Computed 2025 Forecast District Population = (18) x (17)
- (24) Average 2025 Population Density of Forecast District in People / Acre = (23) / (12)
- (25) Population Forecast Districts from NCTCOG Database
- (26) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (27) Area of Forecast District within City (Acres)
- (28) Percent of Forecast District Total Area within City
- (29) 1995 Total Employment in Forecast District
- (30) Average 1995 Employment Density of Forecast District in Employees / Acre = (29) / (26)
- (31) 2005 Total Employment in Forecast District
- (32) Average 2005 Employment Density of Forecast District in Employees / Acre = (31) / (26)
- (33) 2025 Total Employment in Forecast District
- (34) Average 2025 Employment Density of Forecast District in Employees / Acre = (33) / (26)
- (35) Population Forecast Districts from NCTCOG Database
- (36) Census Tracts from NCTCOG Population Database
- (37) Total Census Tract Area (Acres)
- (38) Portion of Census Tract Area in Forecast District (Acres)
- (39) Population per House Density from Col. (9)
- (40) (38) x (39), Sum Col (40) / (37) = Weighted Average Population per House in Forecast District
- (41) Population Forecast Districts from NCTCOG Database
- (42) Computed 1995 Forecast District Population in City Limits = (19) x (14)
- (43) Computed 2005 Forecast District Population in City Limits = (19) x (14)
- (44) Computed 2025 Forecast District Population in City Limits = (19) x (14)
- (45) 1995 Total Employment in Forecast District for City Limits = (29) x (28)
- (46) 2005 Total Employment in Forecast District for City Limits = (29) x (28)

**Saginaw (BIG FOSSIL)**

| (1)           | (2)        | (3)               | (4)              | (5)            | (6)               | (7)                | (8)                   | (9)                    | (10)                  |
|---------------|------------|-------------------|------------------|----------------|-------------------|--------------------|-----------------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Pop | Avg. Pop. Density | 1995 Pop. In Wshed | 1995 Total Households | 1995 Population /House | 1995 Total Employment |
| 1140.03       | 2863       | 1004              | 35.07%           | 2852           | 1.00              | 1000               | 894                   | 3.19                   | 2056                  |
| 1141.01       | 47204      | 327               | 0.69%            | 1754           | 0.04              | 12                 | 648                   | 2.71                   | 1510                  |
|               |            | <b>1331</b>       |                  | <b>4606</b>    | <b>1.03</b>       | <b>1012</b>        | <b>1542</b>           | <b>5.90</b>            | <b>3566</b>           |

**POPULATION**

| (11)               | (12)       | (13)              | (14)             | (15)                           | (16)                           | (17)                           | (18)              | (19)                     | (20)                     | (21)                     |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|-------------------|--------------------------|--------------------------|--------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Households In Wshed | Total 2005 Households In Wshed | Total 2025 Households In Wshed | Population /House | 1995 Population in Wshed | 2005 Population In Wshed | 2025 Population In Wshed |
| 257                | 4694       | 1004              | 21.39%           | 829                            | 1476                           | 1865                           | 3.11              | 2578                     | 4592                     | 5800                     |
| 258                | 50461      | 327               | 0.65%            | 16                             | 17                             | 33                             | 2.71              | 44                       | 47                       | 89                       |
|                    |            | <b>1331</b>       |                  | <b>845</b>                     | <b>1494</b>                    | <b>1898</b>                    | <b>2.91</b>       | <b>2621</b>              | <b>4639</b>              | <b>5888</b>              |

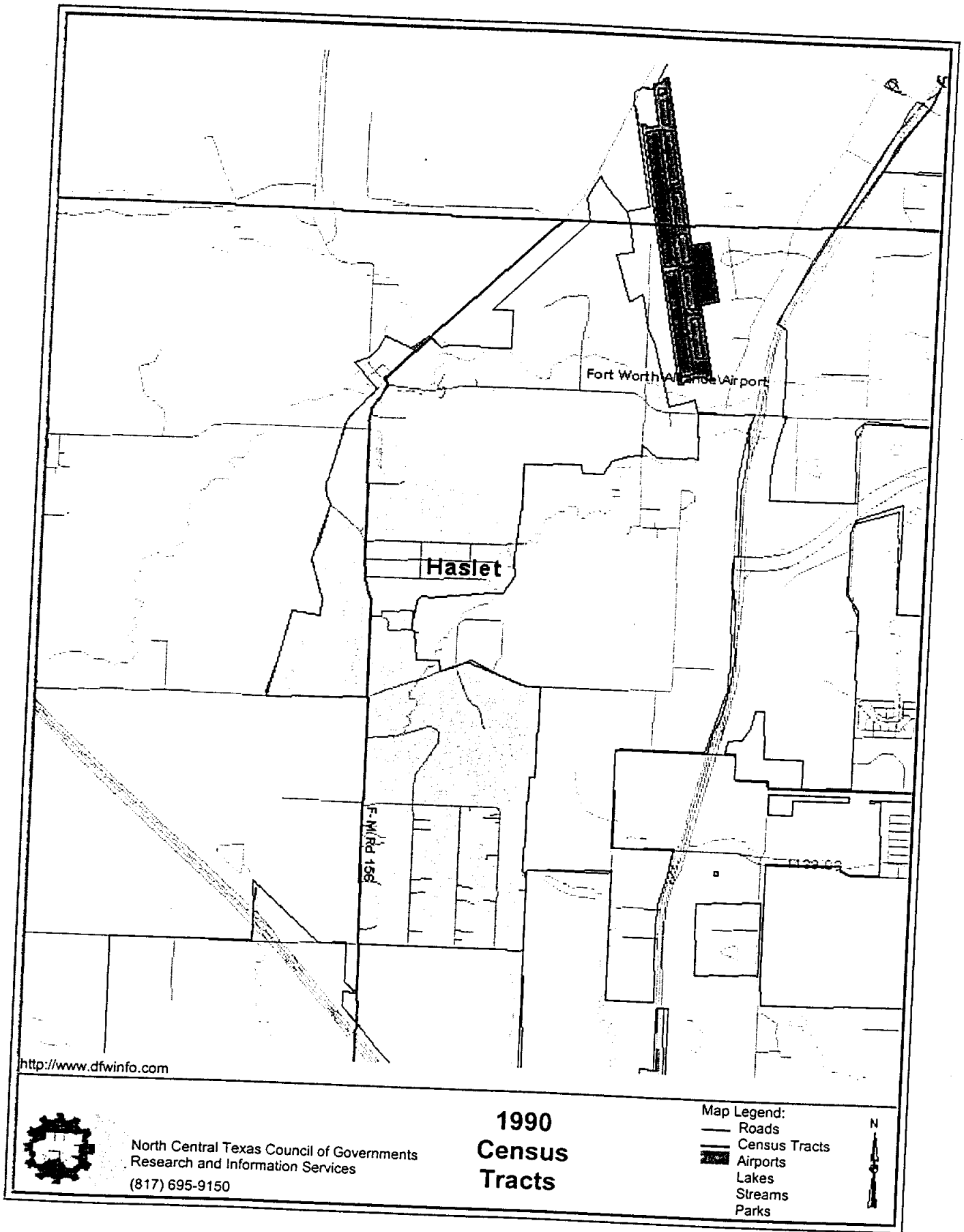
**EMPLOYMENT**

| (22)               | (23)       | (24)              | (25)             | (26)                           | (27)                           | (28)                           |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Employment In Wshed | Total 2005 Employment In Wshed | Total 2025 Employment In Wshed |
| 257                | 4694       | 1004              | 21.39%           | 1940                           | 2565                           | 2746                           |
| 258                | 50461      | 327               | 0.65%            | 20                             | 22                             | 36                             |
|                    |            | <b>1331</b>       |                  | <b>1961</b>                    | <b>2587</b>                    | <b>2781</b>                    |

**NOTES:**

- (1) Census Tracts from NCTCOG Population Database that are contained by the Haltom City limits and contribute to the Big Fossil Watershed
- (2) Total Census Tract Area (Acres)
- (3) Total Area in Haltom City limits that contribute to the Big Fossil Watershed (Acres)
- (4) Percent of Census Tract Area within City Limits that contribute to the Big Fossil Watershed
- (5) Total 1995 Population in Census Tract from NCTCOG data
- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City that contributes to the Big Fossil Watershed = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (14) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (15) 1995 Total Households in Forecast District that contributes to Big Fossil Watershed
- (16) 2005 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (17) 2025 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (18) Computed Weighted Average Population per House Density (previously computed for entire Forecast Districts)
- (19) Computed 1995 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (15)
- (20) Computed 2005 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (16)
- (21) Computed 2025 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (17)
- (22) Population Forecast Districts from NCTCOG Database
- (23) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (24) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (25) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (26) 1995 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (27) 2005 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (28) 2025 Employment in Forecast District in city which contributes to Big Fossil Watershed

**HASLET**



<http://www.dfwinfo.com>

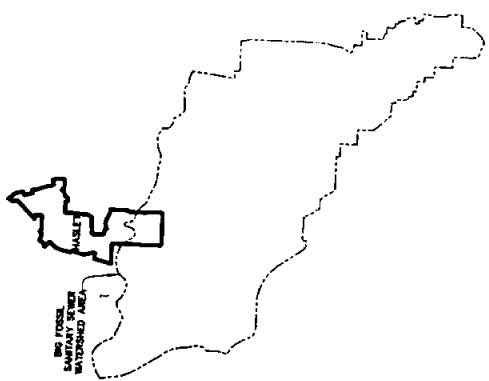


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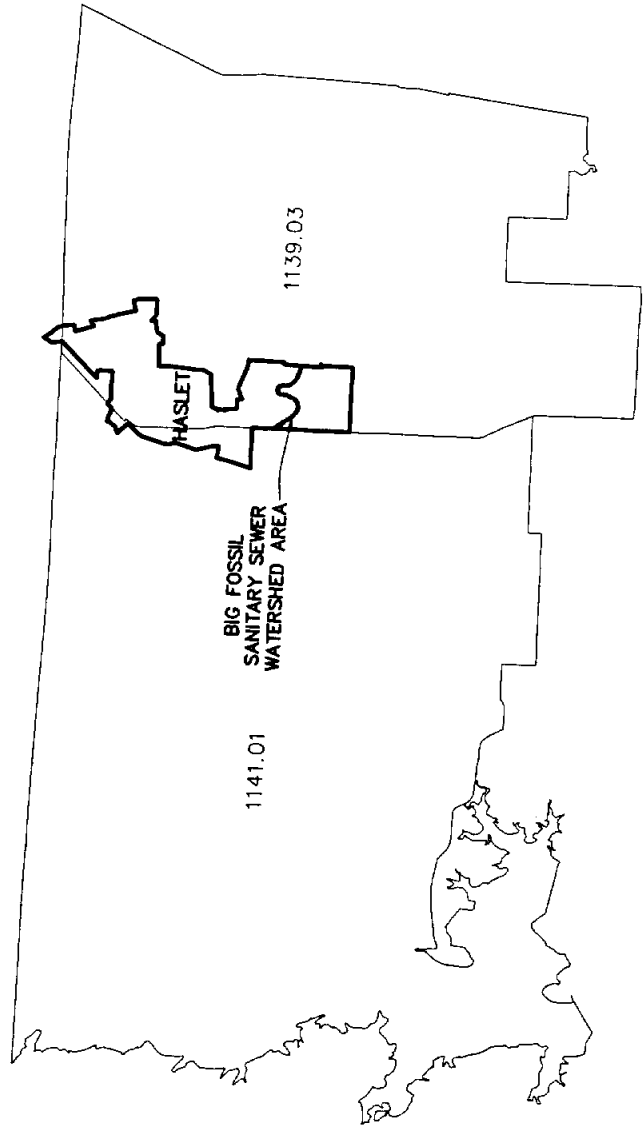
### 1990 Census Tracts

- Map Legend:
- Roads
  - Census Tracts
  - Airports
  - Lakes
  - ~ Streams
  - Parks





BIG FOSSIL INDEX



|   |  |
|---|--|
| <b>BIG FOSSIL SEWER STUDY</b>   |  |
| <b>HASLET CENSUS TRACTS</b>   |  |
| <b>NORTH RICHLAND HILLS</b>   |  |
| <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br><small>CONSULTING ENGINEERS / 1001 North-South</small> |  |
| DRAWN BY: G.S.<br>CHECKED BY: G.S.<br>PROJECT #1  | DATE: NOVEMBER 1988<br>SHEET NO.: 03-104 |

**Haslet**

| (1)           | (2)        | (3)          | (4)            | (5)             | (6)               | (7)               | (8)              | (9)                    | (10)                  |
|---------------|------------|--------------|----------------|-----------------|-------------------|-------------------|------------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in City | % Area In City | Total 1995 Pop. | Avg. Pop. Density | 1995 Pop. In City | Total Households | 1995 Population /House | Total 1995 Employment |
| 1139.03       | 27591      | 2755         | 9.99%          | 8283            | 0.30              | 827               | 1995             | 4.15                   | 4672                  |
| 1141.01       | 47204      | 422          | 0.89%          | 1754            | 0.04              | 16                | 648              | 2.71                   | 1510                  |
|               |            | 3177         |                | 10037           | 0.34              | 843               | 2643             | 6.86                   | 6182                  |

**POPULATION**

| (11)               | (12)       | (13)         | (14)           | (15)  | (16)  | (17)  | (18)              | (19)            | (20)         | (21)            | (22)         | (23)            | (24)         |
|--------------------|------------|--------------|----------------|-------|-------|-------|-------------------|-----------------|--------------|-----------------|--------------|-----------------|--------------|
| Forecast Districts | Total Area | Area in City | % Area In City | Thh95 | Thh05 | Thh25 | Population /House | 1995 Population | 1995 Density | 2005 Population | 2005 Density | 2025 Population | 2025 Density |
| 264.11             | 12661      | 2755         | 21.76%         | 2901  | 4509  | 13517 | 3.09              | 8964.09         | 0.71         | 13932.81        | 1.10         | 41767.53        | 3.30         |
| 258                | 50461      | 422          | 0.84%          | 2484  | 2662  | 5046  | 2.71              | 6731.64         | 0.13         | 7214.02         | 0.14         | 13674.66        | 0.27         |
| Denton Co.         | 28         | 28           | 100.00%        | 0     | 0     | 0     | 0                 | 0               | 0.00         | 0               | 0.00         | 0               | 0.00         |
|                    | 63150      | 3205         |                | 5385  | 7171  | 18563 | 1.93              | 15695.73        | 0.84         | 21146.83        | 1.24         | 55442.19        | 3.57         |

**EMPLOYMENT**

| (25)               | (26)       | (27)         | (28)           | (29)  | (30)         | (31)  | (32)         | (33)  | (34)             |
|--------------------|------------|--------------|----------------|-------|--------------|-------|--------------|-------|------------------|
| Forecast Districts | Total Area | Area in City | % Area In City | Tot95 | 1995 Density | Tot05 | 2005 Density | Tot25 | 2,025.00 Density |
| 264.11             | 12661      | 2755         | 21.76%         | 2679  | 0.21         | 8447  | 0.67         | 16635 | 1.31             |
| 258                | 50461      | 422          | 0.84%          | 2224  | 0.04         | 2616  | 0.05         | 6640  | 0.13             |
| Denton Co.         | 28         | 28           | 100.00%        | 0     | 0.00         | 0     | 0.00         | 0     | 0.00             |
|                    |            | 3205         |                | 4903  | 0.26         | 11063 | 0.72         | 23275 | 1.45             |

| (35)              | (36)          | (37)           | (38)       | (39)                   | (40)         |
|-------------------|---------------|----------------|------------|------------------------|--------------|
| Forecast District | Census Tracts | Total Tr. Area | Area in FD | 1995 Population /House | 1995 Density |
| 264.11            | 1139.03       | 27591          | 11384      | 3.06                   | 34835.04     |
|                   | 1139.05       | 1276           | 1276       | 3.32                   | 4236.32      |
|                   |               |                | 12660      |                        | 39071.36     |
|                   |               |                |            |                        | 3.09         |
| 258               | 1141.01       | 47204          | 47204      | 2.71                   | 127922.84    |
|                   | 1141.02       | 3195           | 3195       | 2.64                   | 8434.80      |
|                   |               |                | 50399      |                        | 136357.64    |
|                   |               |                |            |                        | 2.71         |

| (41)               | (42) | (43) | (44) CITY ONLY  |                 |                 | (45) | (46) | (47) |
|--------------------|------|------|-----------------|-----------------|-----------------|------|------|------|
|                    |      |      | Population 1995 | Population 2005 | Population 2025 |      |      |      |
| Forecast Districts | 1995 | 2005 | 2025            | 1995            | 2005            | 2025 |      |      |
| 264.11             | 1951 | 3032 | 9089            | 583             | 1838            | 3620 |      |      |
| 258                | 56   | 60   | 114             | 19              | 22              | 56   |      |      |
| Denton Co.         | 0    | 0    | 0               | 0               | 0               | 0    |      |      |
| TOTAL              | 2007 | 3092 | 9203            | 602             | 1860            | 3676 |      |      |

Haslet Ultimate Population 2649

**FUTURE POP. & EMP. LAND USE AREAS**

|                       |      |                      |      |
|-----------------------|------|----------------------|------|
| 1995 Population       | 2007 | 1995 Employment      | 602  |
| 1995 Residential Area | 1046 | 1995 Employment Area | 79   |
| 1995 Density          | 1.92 | 1995 Density         | 7.61 |

|                       |      |                       |     |
|-----------------------|------|-----------------------|-----|
| 2005 Residential Area | 1612 | 2005 Residential Area | 244 |
| 2025 Residential Area | 4797 | 2025 Residential Area | 430 |

|                        | 1995        | 2005        | 2025          |
|------------------------|-------------|-------------|---------------|
| Residential Area       | 1046        | 1612        | 4797          |
| Employment Area        | 79          | 244         | 430           |
| <b>SEWERED AREA</b>    | <b>1125</b> | <b>1856</b> | <b>5279</b>   |
| Total Unsewered        | 85          | 140         | 399           |
| Vacant & Under Constr. | 1995        | 1209        | 0             |
| <b>REMINADER</b>       | <b>2080</b> | <b>1349</b> | <b>399</b>    |
|                        | 3205        | 3205        | 5678          |
| <b>TOTAL AREA</b>      | <b>3205</b> | <b>3205</b> | <b>3205</b> ✓ |

**NOTES:**

- (1) Census Tracts from NCTCOG Population Database
- (2) Total Census Tract Area (Acres)
- (3) Total Area in City (Acres)
- (4) Percent of Census Tract Area within City
- (5) Total 1995 Population in Census Tract from NCTCOG data

- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City (Acres)
- (14) Percent of Forecast District Total Area within City
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- (18) Computed Weighted Average Population per House Density from Col. (40)
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- (27) Area of Forecast District within City (Acres)
- (28) Percent of Forecast District Total Area within City
- (29) 1995 Total Employment in Forecast District
- (30) Average 1995 Employment Density of Forecast District in Employees / Acre = (29) / (26)
- (31) 2005 Total Employment in Forecast District
- (32) Average 2005 Employment Density of Forecast District in Employees / Acre = (31) / (26)
- (33) 2025 Total Employment in Forecast District
- (34) Average 2025 Employment Density of Forecast District in Employees / Acre = (33) / (26)
- (35) Population Forecast Districts from NCTCOG Database
- (36) Census Tracts from NCTCOG Population Database
- (37) Total Census Tract Area (Acres)
- (38) Portion of Census Tract Area in Forecast District (Acres)
- (39) Population per House Density from Col. (9)
- (40) (38) x (39). Sum Col (40) / (37) = Weighted Average Population per House in Forecast District
- (41) Population Forecast Districts from NCTCOG Database
- (42) Computed 1995 Forecast District Population in City Limits = (19) x (14)
- (43) Computed 2005 Forecast District Population in City Limits = (19) x (14)
- (44) Computed 2025 Forecast District Population in City Limits = (19) x (14)
- (45) 1995 Total Employment in Forecast District for City Limits = (29) x (28)
- (46) 2005 Total Employment in Forecast District for City Limits = (29) x (28)
- (47) 2025 Total Employment in Forecast District for City Limits = (29) x (28)

**Haslet (BIG FOSSIL)**

| (1)           | (2)        | (3)               | (4)              | (5)             | (6)               | (7)                | (8)                   | (9)                    | (10)                  |
|---------------|------------|-------------------|------------------|-----------------|-------------------|--------------------|-----------------------|------------------------|-----------------------|
| Census Tracts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Pop. | Avg. Pop. Density | 1995 Pop. In Wshed | 1995 Total Households | 1995 Population /House | 1995 Total Employment |
| 1140.03       | 2863       | 1004              | 35.07%           | 2852            | 1.00              | 1000               | 894                   | 3.19                   | 2056                  |
| 1141.01       | 47204      | 327               | 0.69%            | 1754            | 0.04              | 12                 | 648                   | 2.71                   | 1510                  |
|               |            | <b>1331</b>       |                  | <b>4606</b>     | <b>1.03</b>       | <b>1012</b>        | <b>1542</b>           | <b>5.90</b>            | <b>3566</b>           |

**POPULATION**

| (11)               | (12)       | (13)              | (14)             | (15)                           | (16)                           | (17)                           | (18)              | (19)                     | (20)                     | (21)                     |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|-------------------|--------------------------|--------------------------|--------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Households In Wshed | Total 2005 Households In Wshed | Total 2025 Households In Wshed | Population /House | 1995 Population in Wshed | 2005 Population In Wshed | 2025 Population In Wshed |
| 257                | 4694       | 1004              | 21.39%           | #REF!                          | #REF!                          | #REF!                          | 3.11              | #REF!                    | #REF!                    | #REF!                    |
| 258                | 50461      | 327               | 0.65%            | 16                             | 17                             | 33                             | 2.71              | 44                       | 47                       | 89                       |
|                    |            | <b>1331</b>       |                  | <b>#REF!</b>                   | <b>#REF!</b>                   | <b>#REF!</b>                   | <b>2.91</b>       | <b>#REF!</b>             | <b>#REF!</b>             | <b>#REF!</b>             |

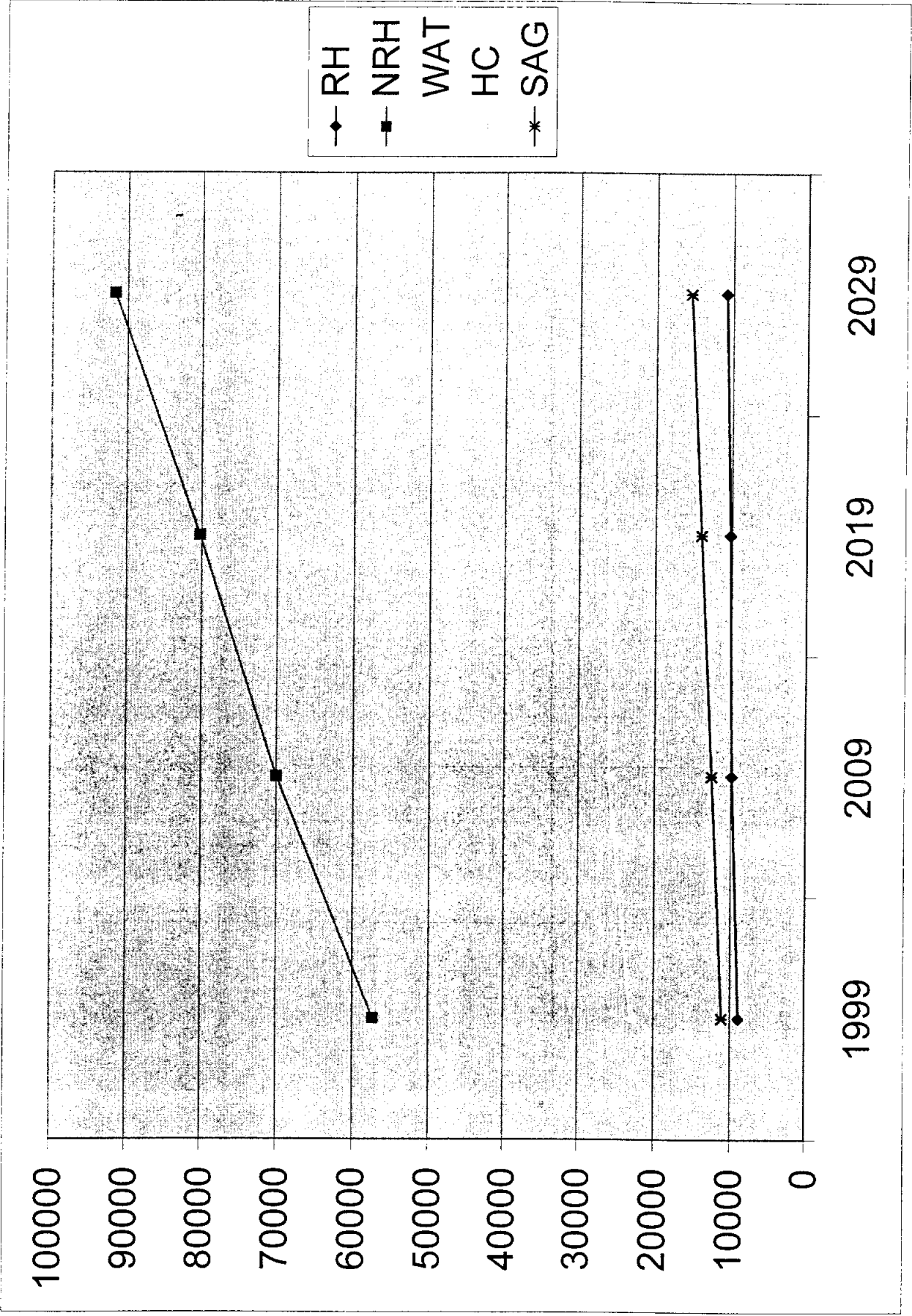
**EMPLOYMENT**

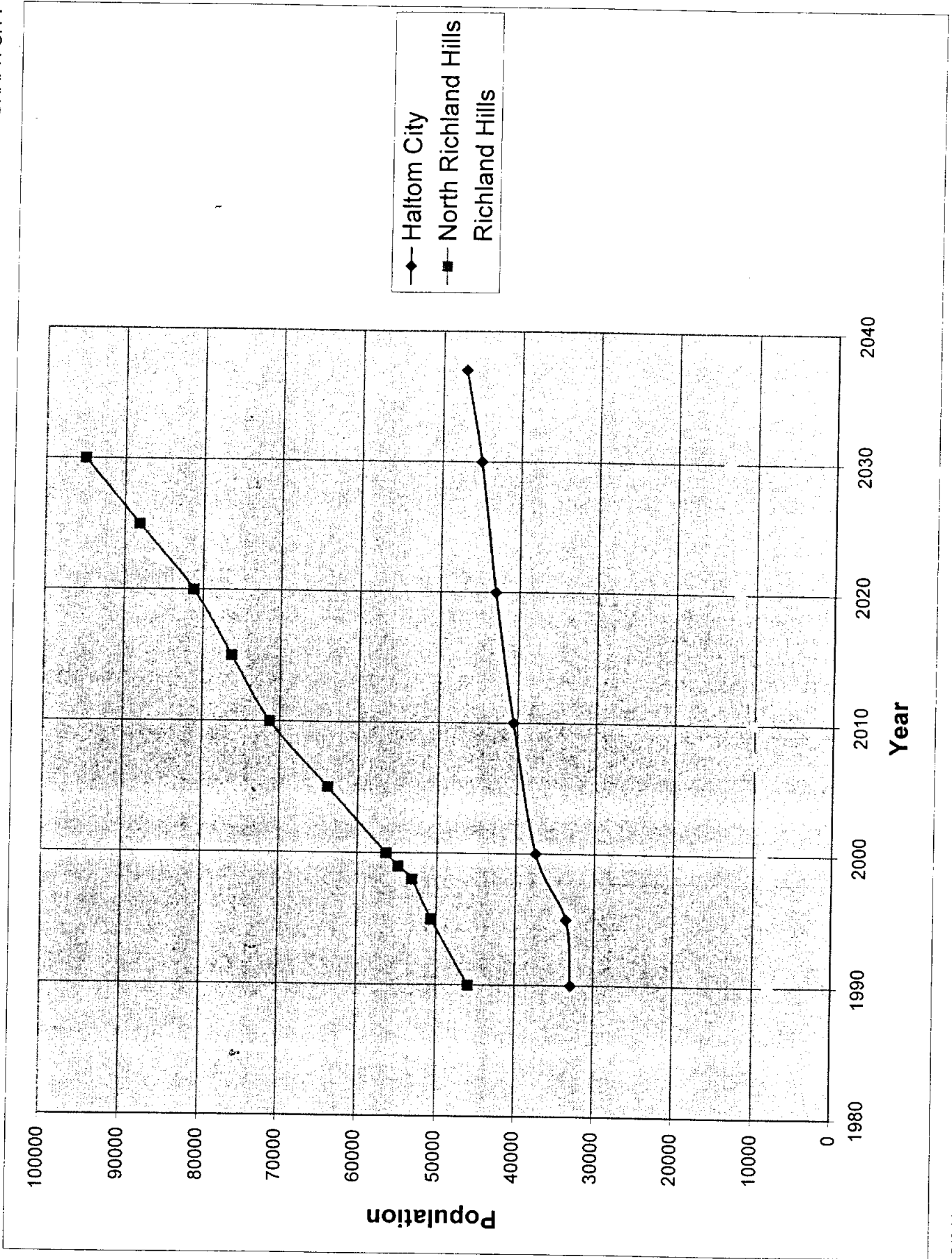
| (22)               | (23)       | (24)              | (25)             | (26)                           | (27)                           | (28)                           |
|--------------------|------------|-------------------|------------------|--------------------------------|--------------------------------|--------------------------------|
| Forecast Districts | Total Area | Area in Watershed | % Area Watershed | Total 1995 Employment In Wshed | Total 2005 Employment In Wshed | Total 2025 Employment In Wshed |
| 257                | 4694       | 1004              | 21.39%           | 573                            | 1807                           | 3558                           |
| 258                | 50461      | 327               | 0.65%            | #REF!                          | #REF!                          | #REF!                          |
|                    |            | <b>1331</b>       |                  | <b>#REF!</b>                   | <b>#REF!</b>                   | <b>#REF!</b>                   |

**NOTES:**

- (1) Census Tracts from NCTCOG Population Database that are contained by the Haltom City limits and contribute to the Big Fossil Watershed
- (2) Total Census Tract Area (Acres)
- (3) Total Area in Haltom City limits that contribute to the Big Fossil Watershed (Acres)
- (4) Percent of Census Tract Area within City Limits that contribute to the Big Fossil Watershed
- (5) Total 1995 Population in Census Tract from NCTCOG data
- (6) Average Population Density in People/Acre = (5) / (2)
- (7) 1995 Population within City that contributes to the Big Fossil Watershed = (5) x (4)
- (8) 1995 Total Households from NCTCOG Database
- (9) 1995 Population per House = (5) / (8)
- (10) 1995 Total Employment from NCTCOG Database
- (11) Population Forecast Districts from NCTCOG Database
- (12) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (13) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (14) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (15) 1995 Total Households in Forecast District that contributes to Big Fossil Watershed
- (16) 2005 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (17) 2025 Total Households in Forecast District that contributes to Big Fossil Watershed (Projected by NCTCOG)
- (18) Computed Weighted Average Population per House Density (previously computed for entire Forecast Districts)
- (19) Computed 1995 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (15)
- (20) Computed 2005 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (16)
- (21) Computed 2025 Forecast District Population in city which contributes to Big Fossil Watershed = (18) x (17)
- (22) Population Forecast Districts from NCTCOG Database
- (23) Total Computed Area within Forecast District from AutoCAD map (Acres)
- (24) Area of Forecast District within City that contributes to Big Fossil Watershed (Acres)
- (25) Percent of Forecast District Total Area within City that contributes to Big Fossil Watershed
- (26) 1995 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (27) 2005 Employment in Forecast District in city which contributes to Big Fossil Watershed
- (28) 2025 Employment in Forecast District in city which contributes to Big Fossil Watershed







**PART 1**  
**CITY OF FORT WORTH**  
**LAND USE ASSUMPTIONS DATABASE**  
**POPULATION PROJECTIONS**  
**AND LAND USE AREAS**  
**EXTRACTED FOR BIG FOSSIL CREEK AREA**

***FORT WORTH POPULATION PROJECTIONS***

***TABLE "LUAPOP-1"***

***(See TAB 9)***

***FORT WORTH POPULATION PROJECTIONS***

***TABLE "LUAPOP-2"***

***(See TAB 9)***

**TAB 6**

**BIG FOSSIL SEWER STUDY  
FLOW DISCHARGE CALCULATIONS**

**FORMULA FOR CALIBRATION OF WATERSHED FLOW MODEL  
BASED ON EQUIVALENT POPULATION AND SEWERED AREAS  
USING RESULTS OF FORT WORTH MASTER PLAN HYDROWORKS MODEL**

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Year 2000 Model:  $A \times (\text{2000 Equiv. Pop.}) + B \times (\text{2000 Sewered Area}) = \text{2000 Peak Modeled Flow}$

Year 2020 Model:  $A \times (\text{2020 Equiv. Pop.}) + B \times (\text{2020 Sewered Area}) = \text{2020 Peak Modeled Flow}$

| <b>City of Fort Worth Outfall Line:</b> | <u>Year 2000</u> | <u>Year 2020</u> |   |
|---|------------------|------------------|---|
| Equiv. Population:                      | 57207.5          | 93287.5          |   |
| Total Sewered Acres:                    | 9004.81          | 20981.33         |   |
| Peak Flow (MGD):                        | 32.22            | 80.17            | NOTE: 10 MGD Intel Q Subtracted from Year 2020 Peak Flow. Marine Creek area included in 2020 Flows. |
| A EP2000 + B SA2000 = PF2000            |                  |                  |   |
| A EP2020 + B SA2020 = PF2020            |                  |                  |   |

$$A = [ (PF2020/SA2020) - (PF2000/SA2000) ] / [ (EP2020/SA2020) - (EP2000/SA2000) ]$$

$$B = ( PF2000 - A EP2000 ) / SA 2000$$

$$A = -0.000127 \quad B = 0.0043875$$

CHECK:

$$PF2000 = A \times EP2000 + B \times SA2000 \quad PF2020 = A \times EP2020 + B \times SA2020$$

$$PF2000 = 32.22 \quad PF 2020 = 80.17$$

| <b>T.C.W.S.C. Outfall Line:</b> | <u>Year 2000</u> | <u>Year 2020</u> |
|---------------------------------|------------------|------------------|
|---------------------------------|------------------|------------------|

|                    |           |           |
|--------------------|-----------|-----------|
| Equiv. Population: | 17,430.50 | 20,657.50 |
|--------------------|-----------|-----------|

|                      |          |          |
|----------------------|----------|----------|
| Total Sewered Acres: | 2,550.82 | 2,764.11 |
|----------------------|----------|----------|

|                  |       |       |
|------------------|-------|-------|
| Peak Flow (MGD): | 11.39 | 19.42 |
|------------------|-------|-------|

$$A EP2000 + B SA2000 = PF2000$$

$$A EP2020 + B SA2020 = PF2020$$

$$A = [ (PF2020/SA2020) - (PF2000/SA2000) ] / [ (EP2020/SA2020) - (EP2000/SA2000) ]$$

$$B = ( PF2000 - A EP2000 ) / SA 2000$$

$$A = 0.004 \quad B = -0.022866$$

CHECK:

$$PF2000 = A \times EP2000 + B \times SA2000 \quad PF2020 = A \times EP2020 + B \times SA2020$$

$$PF2000 = 11.39 \quad PF 2020 = 19.42$$

## PEAK DISCHARGE SUMMARY

TABLE PEAKS-1

| Flow Scenario | Scenario Description  | Peak Flow Rates Based on Ft. Worth Master Plan Model (MGD) |       |       |       |       |        |        |  |
|---------------|---|--|-------|-------|-------|-------|--------|--------|--|
|               |   | 2000   | 2005  | 2010  | 2015  | 2020  | 2050   | 2070   |  |
| 1             | C.O.F.W. Outfall, Master Plan Not including Intel flows, BFX or Marine Creek Areas until 2020 | 32.22  | 34.66 | 36.62 | 40.64 | 80.17 | 95.20  | 103.56 |  |
| 2             | C.O.F.W. Outfall, Including BFX but not MC and Intel  | 41.17  | 45.96 | 49.93 | 60.76 | 64.67 | 73.77  | 78.39  |  |
| 3             | C.O.F.W. Outfall, Including BFX and MC Areas, but Not Intel                                   | 51.32  | 56.43 | 60.71 | 73.86 | 80.17 | 95.20  | 103.56 |  |
| 4             | Scenario 3 + 6.0 MGD Intel  | 57.32  | 62.43 | 66.71 | 79.86 | 86.17 | 101.20 | 109.56 |  |
| 5             | T.C.W.S.C. Outfall, Master Plan Includes Richland Hills & NRH                                 | 11.39  | 12.10 | 15.20 | 17.31 | 19.42 | 23.38  | 23.38  |  |
| 6             | T.C.W.S.C. Outfall, Revised to Include Additional NRH Area                                    | 23.18  | 24.42 | 28.05 | 30.67 | 33.28 | 33.97  | 33.97  |  |
| 7             | North Richland Hills Total Flows based on TCWSC Calibrated Model                              | 18.01  | 18.93 | 21.16 | 22.81 | 24.47 | 24.98  | 24.98  |  |
| 8             | Richland Hills Total Flows based on TCWSC Calibrated Model                                    | 5.17   | 5.49  | 6.90  | 7.85  | 8.81  | 8.99   | 8.99   |  |
| 9             | North Richland Hills Total Flows based on COFW Calibrated Model                               | 6.81   | 7.20  | 7.35  | 7.39  | 7.44  | 7.36   | 7.36   |  |
| 10            | Richland Hills Total Flows based on COFW Calibrated Model                                     | 4.07   | 4.32  | 4.37  | 4.34  | 4.31  | 4.07   | 4.07   |  |
| 11            | Haltom City Total Flows in BF based on COFW Calibrated Model                                  | 4.77   | 5.07  | 5.36  | 5.72  | 6.07  | 7.92   | 9.09   |  |
| 12            | Haltom City Flows in Little Fossil Area which can be served by BF                             | 6.92   | 6.93  | 6.93  | 6.94  | 6.94  | 6.97   | 7.00   |  |
| 13            | Combined Haltom City BF Flows and Little Fossil Flows   | 11.69  | 11.99 | 12.30 | 12.66 | 13.01 | 14.89  | 16.08  |  |



| Flow Scenario | Scenario Description  | Coef. A  | Coef. B  | Year 2000 |           |        |        |       |      |       | Year 2005 |       |           |           |        |        |       |      |       |       |       |
|---------------|---|----------|----------|-----------|-----------|--------|--------|-------|------|-------|-----------|-------|-----------|-----------|--------|--------|-------|------|-------|-------|-------|
|               |   |          |          | Eq. Pop   | Sew. Ac.  | Base Q | H.P.F. | Pk. Q | GWI  | RDII  | Total     | P.F.  | Eq. Pop   | Sew. Ac.  | Base Q | H.P.F. | Pk. Q | GWI  | RDII  | Total | P.F.  |
| 1             | C.O.F.W. Outfall, Master Plan Not including intel flows, BFX or Marine Creek Areas until 2020 | -0.00013 | 0.00439  | 57,207.50 | 9,004.81  | 4.58   | 2.21   | 10.12 | 0.80 | 21.30 | 32.22     | 5.99  | 61,604.75 | 9,689.21  | 4.93   | 2.18   | 10.75 | 0.86 | 23.05 | 34.66 | 5.99  |
| 2             | C.O.F.W. Outfall, including BFX but not MC and Intel  | -0.00013 | 0.00439  | 60,118.25 | 11,128.39 | 4.81   | 2.19   | 10.54 | 0.84 | 28.79 | 41.17     | 7.28  | 65,522.63 | 12,377.97 | 5.24   | 2.16   | 11.31 | 0.92 | 33.73 | 45.96 | 7.46  |
| 3             | C.O.F.W. Outfall, including BFX and MC Areas, but Not Intel                                   | -0.00013 | 0.00439  | 63,500.75 | 13,540.54 | 5.08   | 2.17   | 11.02 | 0.89 | 39.41 | 51.32     | 8.60  | 68,915.63 | 14,861.78 | 5.51   | 2.14   | 11.79 | 0.96 | 43.67 | 56.43 | 8.71  |
| 4             | Scenario 3 + 6.0 MGD Intel  | -0.00013 | 0.00439  | 63,500.75 | 13,540.54 | 11.08  | 2.17   | 24.04 | 0.89 | 32.39 | 57.32     | 4.79  | 68,915.63 | 14,861.78 | 11.51  | 2.14   | 24.62 | 0.96 | 36.84 | 62.43 | 5.00  |
| 5             | T.C.W.S.C. Outfall, Master Plan Includes Richland Hills & NRH                                 | 0.00400  | -0.02287 | 17,430.50 | 2,550.82  | 1.39   | 2.71   | 3.78  | 0.24 | 7.36  | 11.39     | 6.95  | 18,516.00 | 2,709.67  | 1.48   | 2.69   | 3.98  | 0.26 | 7.86  | 12.10 | 6.95  |
| 6             | T.C.W.S.C. Outfall, Revised to Include Additional NRH Area                                    | 0.00400  | -0.02287 | 23,952.45 | 3,176.17  | 1.92   | 2.57   | 4.93  | 0.34 | 17.91 | 23.18     | 10.29 | 25,333.66 | 3,363.38  | 2.03   | 2.55   | 5.17  | 0.35 | 18.90 | 24.42 | 10.25 |
| 7             | North Richland Hills Total Flows based on TCWSC Calibrated Model                              | 0.00400  | -0.02287 | 16,042.49 | 2,018.61  | 1.28   | 2.75   | 3.53  | 0.22 | 14.26 | 18.01     | 11.94 | 16,931.10 | 2,133.73  | 1.35   | 2.73   | 3.69  | 0.24 | 15.00 | 18.93 | 11.89 |
| 8             | Richland Hills Total Flows based on TCWSC Calibrated Model                                    | 0.00400  | -0.02287 | 7,909.96  | 1,157.56  | 0.63   | 3.06   | 1.93  | 0.11 | 3.12  | 5.17      | 6.95  | 8,402.56  | 1,229.65  | 0.67   | 3.03   | 2.04  | 0.12 | 3.34  | 5.49  | 6.95  |
| 9             | North Richland Hills Total Flows based on COFW Calibrated Model                               | -0.00013 | 0.00439  | 16,042.49 | 2,018.61  | 1.28   | 2.75   | 3.53  | 0.22 | 3.06  | 6.81      | 4.52  | 16,931.10 | 2,133.73  | 1.35   | 2.73   | 3.69  | 0.24 | 3.28  | 7.20  | 4.53  |
| 10            | Richland Hills Total Flows based on COFW Calibrated Model                                     | -0.00013 | 0.00439  | 7,909.96  | 1,157.56  | 0.63   | 3.06   | 1.93  | 0.11 | 2.03  | 4.07      | 5.48  | 8,402.56  | 1,229.65  | 0.67   | 3.03   | 2.04  | 0.12 | 2.17  | 4.32  | 5.48  |
| 11            | Haltom City Total Flows in BF based on COFW Calibrated Model                                  | -0.00013 | 0.00439  | 13,953.23 | 1,492.22  | 1.12   | 2.81   | 3.14  | 0.20 | 1.44  | 4.77      | 3.64  | 14,820.75 | 1,585.27  | 1.19   | 2.78   | 3.30  | 0.21 | 1.56  | 5.07  | 3.64  |
| 12            | Haltom City Flows in Little Fossil Area which can be served by BF                             | -0.00013 | 0.00439  | 14,419.88 | 1,995.25  | 1.15   | 2.80   | 3.22  | 0.20 | 3.49  | 6.92      | 5.10  | 14,351.78 | 1,985.25  | 1.15   | 2.80   | 3.21  | 0.20 | 3.51  | 6.93  | 5.13  |
| 13            | Combined Haltom City BF Flows and Little Fossil Flows   | -0.00013 | 0.00439  | 28,373.11 | 3,487.46  | 2.27   | 2.50   | 5.68  | 0.40 | 5.61  | 11.69     | 4.38  | 29,172.53 | 3,580.52  | 2.33   | 2.49   | 5.81  | 0.41 | 5.78  | 11.99 | 4.37  |

NOTES: Coef. A and B are derived from a calibration of the City of Fort Worth HydroWorks Flow Model based on Peak Discharges in Years 2000 and 2020  
 Eq. Pop. = Equivalent Population = Residential Population + 0.5 x Employment Population  
 Sew. Ac. = Sewered Acres  
 Base Q = Base Flow = 80 gpcd x Eq. Pop.  
 H.P.F. = Hammon's Peaking Factor =  $1 + 14 / (4 + (Pop./1000)^{0.5})$   
 Pk. Q = Peak Base Flow = Base Q x H.P.F.  
 GWI = Ground Water Inflow = 14 gpcd x Eq. Pop.  
 RDII = Rain Depend Infiltration/Inflow = Total Discharge - Peak Q - GWI  
 Total = Peak Discharge Computed from Calibration Formula = A x Eq. Pop. + B x Sew. Ac.  
 P.F. = Peaking Factor Check = Total / (Pk. Q + GWI)

| Flow Scenario | Scenario Description  | Coef. A  | Coef. B  | Year 2010 |           |        |        |       |      | Year 2015 |       |       |           |           |        |        |       |      |       |       |       |
|---------------|---|----------|----------|-----------|-----------|--------|--------|-------|------|-----------|-------|-------|-----------|-----------|--------|--------|-------|------|-------|-------|-------|
|               |   |          |          | Eq. Pop.  | Sew. Ac.  | Base Q | H.P.F. | Pk. Q | GWl  | RDIll     | Total | P.F.  | Eq. Pop.  | Sew. Ac.  | Base Q | H.P.F. | Pk. Q | GWl  | RDIll | Total | P.F.  |
| 1             | C.O.F.W. Outfall, Master Plan Not including Intel flows, BFX or Mainline Creek Areas until 2020 | -0.00013 | 0.00439  | 66,002.00 | 10,262.30 | 5.28   | 2.15   | 11.38 | 0.92 | 24.32     | 36.62 | 5.90  | 72,946.25 | 11,382.01 | 5.84   | 2.12   | 12.35 | 1.02 | 27.27 | 40.64 | 5.93  |
| 2             | C.O.F.W. Outfall, including BFX but not MC and Intel  | -0.00013 | 0.00439  | 70,927.00 | 13,439.85 | 5.67   | 2.13   | 12.07 | 0.99 | 36.87     | 49.93 | 7.49  | 80,011.75 | 16,171.40 | 5.40   | 2.06   | 13.32 | 1.12 | 46.31 | 60.76 | 8.08  |
| 3             | C.O.F.W. Outfall, including BFX and MC Areas, but Not Intel                                     | -0.00013 | 0.00439  | 74,330.50 | 15,995.33 | 5.95   | 2.11   | 12.54 | 1.04 | 47.13     | 60.71 | 8.69  | 83,809.00 | 19,268.02 | 5.70   | 2.06   | 13.84 | 1.17 | 58.85 | 73.86 | 9.38  |
| 4             | Scenario 3 + 6.0 MGD Intel  | -0.00013 | 0.00439  | 74,330.50 | 15,995.33 | 11.95  | 2.11   | 25.20 | 1.04 | 40.47     | 66.71 | 5.14  | 83,809.00 | 19,268.02 | 12.70  | 2.06   | 26.23 | 1.17 | 52.46 | 79.86 | 5.75  |
| 5             | T.C.W.S.C. Outfall, Master Plan Includes Richland Hills & NRH                                   | 0.00400  | -0.02287 | 19,601.50 | 2,764.11  | 1.57   | 2.66   | 4.17  | 0.27 | 10.75     | 15.20 | 8.25  | 20,129.50 | 2,764.11  | 1.61   | 2.65   | 4.27  | 0.28 | 12.76 | 17.31 | 9.15  |
| 6             | T.C.W.S.C. Outfall, Revised to Include Additional NRH Area                                      | 0.00400  | -0.02287 | 26,714.86 | 3,446.17  | 2.14   | 2.53   | 5.40  | 0.37 | 22.28     | 28.05 | 11.17 | 27,521.61 | 3,472.90  | 2.20   | 2.51   | 5.54  | 0.39 | 24.75 | 30.67 | 11.85 |
| 7             | North Richland Hills Total Flows based on TCWSC Calibrated Model                                | 0.00400  | -0.02287 | 17,819.70 | 2,191.82  | 1.43   | 2.70   | 3.85  | 0.25 | 17.05     | 21.16 | 12.63 | 18,386.85 | 2,218.54  | 1.47   | 2.69   | 3.96  | 0.26 | 18.60 | 22.81 | 13.20 |
| 8             | Richland Hills Total Flows based on TCWSC Calibrated Model                                      | 0.00400  | -0.02287 | 8,895.16  | 1,254.35  | 0.71   | 3.01   | 2.14  | 0.12 | 4.63      | 6.90  | 8.25  | 9,134.77  | 1,254.35  | 0.73   | 2.99   | 2.19  | 0.13 | 5.54  | 7.85  | 9.15  |
| 9             | North Richland Hills Total Flows based on COFW Calibrated Model                                 | -0.00013 | 0.00439  | 17,819.70 | 2,191.82  | 1.43   | 2.70   | 3.85  | 0.25 | 3.24      | 7.35  | 4.39  | 18,386.85 | 2,218.54  | 1.47   | 2.69   | 3.96  | 0.26 | 3.18  | 7.39  | 4.28  |
| 10            | Richland Hills Total Flows based on COFW Calibrated Model                                       | -0.00013 | 0.00439  | 8,895.16  | 1,254.35  | 0.71   | 3.01   | 2.14  | 0.12 | 2.11      | 4.37  | 5.23  | 9,134.77  | 1,254.35  | 0.73   | 2.99   | 2.19  | 0.13 | 2.02  | 4.34  | 5.05  |
| 11            | Haltom City Total Flows in BF based on COFW Calibrated Model                                    | -0.00013 | 0.00439  | 15,688.26 | 1,678.32  | 1.26   | 2.76   | 3.46  | 0.22 | 1.68      | 5.36  | 3.64  | 16,720.04 | 1,789.18  | 1.34   | 2.73   | 3.65  | 0.23 | 1.83  | 5.72  | 3.64  |
| 12            | Haltom City Flows in Little Fossil Area which can be served by BF                               | -0.00013 | 0.00439  | 14,283.68 | 1,995.25  | 1.14   | 2.80   | 3.20  | 0.20 | 3.54      | 6.93  | 5.16  | 14,275.34 | 1,995.25  | 1.14   | 2.80   | 3.20  | 0.20 | 3.54  | 6.94  | 5.17  |
| 13            | Combined Haltom City BF Flows and Little Fossil Flows   | -0.00013 | 0.00439  | 29,971.94 | 3,673.57  | 2.40   | 2.48   | 5.94  | 0.42 | 5.94      | 12.30 | 4.37  | 30,995.39 | 3,784.42  | 2.48   | 2.46   | 6.11  | 0.43 | 6.11  | 12.66 | 4.34  |

NOTES: Coef. A and B are derived from a calibration of the City of Ft. Worth Model based on Peak Discharges in Years 2000 and :  
 Eq. Pop. = Equivalent Population = Residential Population + Sew. Ac. = Sewered Acres  
 Base Q = Base Flow = 80 gpcd x Eq. Pop.  
 H.P.F. = Harmon's Peaking Factor =  $1 + 14 / (4 + (Pop/1000))$   
 Pk. Q = Peak Base Flow = Base Q x H.P.F.  
 GWl = Ground Water Inflow = 14 gpcd x Eq. Pop.  
 RDIll = Rain Depend Infiltration/Inflow = Total Discharge - Pe Total = Peak Discharge Computed from Calibration Formula  
 P.F. = Peaking Factor Check = Total / (Pk. Q + GWl)

| Flow Scenario | Scenario Description   | Coef. A  | Coef. B  | Year 2020 |           |        |        |       | Year 2050 |       |       |       |            |           |        |        |       |      |       |        |       |
|---------------|--|----------|----------|-----------|-----------|--------|--------|-------|-----------|-------|-------|-------|------------|-----------|--------|--------|-------|------|-------|--------|-------|
|               |  |          |          | Eq. Pop.  | Sew. Ac.  | Base Q | H.P.F. | Pk. Q | GWI       | RDII  | Total | P.F.  | Eq. Pop.   | Sew. Ac.  | Base Q | H.P.F. | Pk. Q | GWI  | RDII  | Total  | P.F.  |
| 1             | C.O.F.W. Outfall, Master Plan Not including Intel flows, BFX or Maine Creek Areas until 2020 | -0.00013 | 0.00439  | 93,287.50 | 20,981.33 | 7.46   | 2.02   | 15.11 | 1.31      | 63.75 | 80.17 | 9.14  | 124,280.00 | 25,306.50 | 9.94   | 1.92   | 19.13 | 1.74 | 74.33 | 95.20  | 8.15  |
| 2             | C.O.F.W. Outfall, including BFX but not MC and Intel   | -0.00013 | 0.00439  | 89,096.50 | 17,325.75 | 7.13   | 2.04   | 14.55 | 1.25      | 48.86 | 64.67 | 7.72  | 119,259.50 | 20,276.73 | 3.54   | 1.94   | 18.49 | 1.67 | 53.61 | 73.77  | 6.58  |
| 3             | C.O.F.W. Outfall, including BFX and MC Areas, but Not Intel                                  | -0.00013 | 0.00439  | 93,287.50 | 20,981.33 | 7.46   | 2.02   | 15.11 | 1.31      | 63.75 | 80.17 | 9.14  | 124,280.00 | 25,306.50 | 9.94   | 1.92   | 19.13 | 1.74 | 74.33 | 95.20  | 8.15  |
| 4             | Scenario 3 + 6.0 MGD Intel   | -0.00013 | 0.00439  | 93,287.50 | 20,981.33 | 13.46  | 2.02   | 27.26 | 1.31      | 57.60 | 86.17 | 5.83  | 124,280.00 | 25,306.50 | 15.94  | 1.92   | 30.68 | 1.74 | 68.78 | 101.20 | 5.72  |
| 5             | T.C.W.S.C. Outfall, Master Plan Includes Richland Hills & NRH                                | 0.00400  | -0.02287 | 20,657.50 | 2,764.11  | 1.65   | 2.64   | 4.36  | 0.29      | 14.77 | 19.42 | 10.00 | 24,876.99  | 2,764.11  | 1.99   | 2.56   | 5.09  | 0.35 | 17.95 | 23.38  | 10.00 |
| 6             | T.C.W.S.C. Outfall, Revised to Include Additional NRH Area                                   | 0.00400  | -0.02287 | 28,328.36 | 3,489.63  | 2.27   | 2.50   | 5.67  | 0.40      | 27.22 | 33.28 | 12.50 | 32,547.85  | 3,549.06  | 2.60   | 2.44   | 6.36  | 0.46 | 27.15 | 33.97  | 11.10 |
| 7             | North Richland Hills Total Flows based on TCWSC Calibrated Model                             | 0.00400  | -0.02287 | 18,953.99 | 2,245.27  | 1.52   | 2.68   | 4.06  | 0.27      | 20.15 | 24.47 | 13.73 | 21,258.67  | 2,294.71  | 1.70   | 2.63   | 4.47  | 0.30 | 20.22 | 24.98  | 12.50 |
| 8             | Richland Hills Total Flows based on TCWSC Calibrated Model                                   | 0.00400  | -0.02287 | 9,374.37  | 1,254.35  | 0.75   | 2.98   | 2.24  | 0.13      | 6.44  | 8.81  | 10.00 | 11,289.18  | 1,254.35  | 0.90   | 2.90   | 2.62  | 0.16 | 6.21  | 8.99   | 8.47  |
| 9             | North Richland Hills Total Flows based on COFW Calibrated Model                              | -0.00013 | 0.00439  | 18,953.99 | 2,245.27  | 1.52   | 2.68   | 4.06  | 0.27      | 3.11  | 7.44  | 4.17  | 21,258.67  | 2,294.71  | 1.70   | 2.63   | 4.47  | 0.30 | 2.60  | 7.36   | 3.68  |
| 10            | Richland Hills Total Flows based on COFW Calibrated Model                                    | -0.00013 | 0.00439  | 9,374.37  | 1,254.35  | 0.75   | 2.98   | 2.24  | 0.13      | 1.94  | 4.31  | 4.89  | 11,289.18  | 1,254.35  | 0.90   | 2.90   | 2.62  | 0.16 | 1.29  | 4.07   | 3.83  |
| 11            | Hallom City Total Flows in BF based on COFW Calibrated Model                                 | -0.00013 | 0.00439  | 17,751.83 | 1,900.03  | 1.42   | 2.70   | 3.84  | 0.25      | 1.99  | 6.07  | 3.64  | 22,927.83  | 2,469.82  | 1.83   | 2.59   | 4.76  | 0.32 | 2.84  | 7.92   | 3.67  |
| 12            | Hallom City Flows in Little Fossil Area which can be served by BF                            | -0.00013 | 0.00439  | 14,267.00 | 1,995.25  | 1.14   | 2.80   | 3.20  | 0.20      | 3.54  | 6.94  | 5.17  | 13,977.93  | 1,995.25  | 1.12   | 2.81   | 3.14  | 0.20 | 3.64  | 6.97   | 5.31  |
| 13            | Combined Hallom City BF Flows and Little Fossil Flows  | -0.00013 | 0.00439  | 32,018.83 | 3,895.28  | 2.56   | 2.45   | 6.27  | 0.45      | 6.29  | 13.01 | 4.32  | 36,905.75  | 4,465.06  | 2.95   | 2.39   | 7.06  | 0.52 | 7.32  | 14.89  | 4.29  |

NOTES: Coef. A and B are derived from a calibration of the City of Ft. Flow Model based on Peak Discharges in Years 2000 and:  
 Eq. Pop. = Equivalent Population = Residential Population + Sewer. Ac. = Sewered Acres  
 Base Q = Base Flow = 80 gpcd x Eq. Pop.  
 H.P.F. = Harmon's Peaking Factor =  $1 + 14 / (4 + (Pop./1000))$   
 Pk. Q = Peak Base Flow = Base Q x H.P.F.  
 GWI = Ground Water Inflow = 14 gpcd x Eq. Pop.  
 RDII = Rain Depend Infiltration/Inflow = Total Discharge - Pe  
 Total = Peak Discharge Computed from Calibration Formula  
 P.F. = Peaking Factor Check = Total / (Pk. Q + GWI)

| Flow Scenario | Scenario Description  | Coef. A  | Coef. B  | Eq. Pop.   | Sew. Ac.  | Year 2070 |        |       |      |       | Total  | P.F.  |
|---------------|---|----------|----------|------------|-----------|-----------|--------|-------|------|-------|--------|-------|
|               |   |          |          |            |           | Base Q    | H.P.F. | Pk. Q | GWl  | RDII  |        |       |
| 1             | C.O.F.W. Outfall, Master Plan Not including Inlet flows, BFX or Marine Creek Areas until 2020 | -0.00013 | 0.00439  | 143,526.11 | 27,771.31 | 11.48     | 1.88   | 21.54 | 2.01 | 80.01 | 103.56 | 7.68  |
| 2             | C.O.F.W. Outfall, including BFX but not MC and Inlet  | -0.00013 | 0.00439  | 137,952.61 | 21,873.32 | 11.04     | 1.89   | 20.85 | 1.93 | 55.61 | 78.39  | 6.05  |
| 3             | C.O.F.W. Outfall, including BFX and MC Areas, but Not Inlet                                   | -0.00013 | 0.00439  | 143,526.11 | 27,771.31 | 11.48     | 1.88   | 21.54 | 2.01 | 80.01 | 103.56 | 7.68  |
| 4             | Scenario 3 + 6.0 MGD Inlet  | -0.00013 | 0.00439  | 143,526.11 | 27,771.31 | 17.48     | 1.88   | 32.80 | 2.01 | 74.75 | 109.56 | 5.62  |
| 5             | T.C.W.S.C. Outfall, Master Plan Includes Richland Hills & NRH                                 | 0.00400  | -0.02287 | 24,876.99  | 2,764.11  | 1.99      | 2.56   | 5.09  | 0.35 | 17.95 | 23.38  | 10.00 |
| 6             | T.C.W.S.C. Outfall, Revised to Include Additional NRH Area                                    | 0.00400  | -0.02287 | 32,547.85  | 3,549.06  | 2.60      | 2.44   | 6.36  | 0.46 | 27.15 | 33.97  | 11.10 |
| 7             | North Richland Hills Total Flows based on TCWSC Calibrated Model                              | 0.00400  | -0.02287 | 21,258.67  | 2,294.71  | 1.70      | 2.63   | 4.47  | 0.30 | 20.22 | 24.98  | 12.50 |
| 8             | Richland Hills Total Flows based on TCWSC Calibrated Model                                    | 0.00400  | -0.02287 | 11,289.18  | 1,254.35  | 0.90      | 2.90   | 2.62  | 0.16 | 6.21  | 8.99   | 8.47  |
| 9             | North Richland Hills Total Flows based on COFW Calibrated Model                               | -0.00013 | 0.00439  | 21,258.67  | 2,294.71  | 1.70      | 2.63   | 4.47  | 0.30 | 2.60  | 7.36   | 3.68  |
| 10            | Richland Hills Total Flows based on COFW Calibrated Model                                     | -0.00013 | 0.00439  | 11,289.18  | 1,254.35  | 0.90      | 2.90   | 2.62  | 0.16 | 1.29  | 4.07   | 3.83  |
| 11            | Haltom City Total Flows in BF based on COFW Calibrated Model                                  | -0.00013 | 0.00439  | 26,378.49  | 2,836.78  | 2.11      | 2.53   | 5.34  | 0.37 | 3.37  | 9.09   | 3.66  |
| 12            | Haltom City Flows in Little Fossil Area which can be served by BF                             | -0.00013 | 0.00439  | 13,785.21  | 1,995.25  | 1.10      | 2.82   | 3.10  | 0.19 | 3.70  | 7.00   | 5.40  |
| 13            | Combined Haltom City BF Flows and Little Fossil Flows   | -0.00013 | 0.00439  | 40,163.70  | 4,832.03  | 3.21      | 2.35   | 7.56  | 0.56 | 7.96  | 16.08  | 4.26  |

NOTES: Coef. A and B are derived from a calibration of the City of Ft. Worth Flow Model based on Peak Discharges in Years 2000 and :  
 Eq. Pop. = Equivalent Population = Residential Population + Sew. Ac. = Sewered Acres  
 Base Q = Base Flow = 80 gpcd x Eq. Pop.  
 H.P.F. = Harmon's Peaking Factor =  $1 + 14 / (4 + (Pop/1000))$   
 Pk. Q = Peak Base Flow = Base Q x H.P.F.  
 GWl = Ground Water Inflow = 14 gpcd x Eq. Pop.  
 RDII = Rain Depend Infiltration/Inflow = Total Discharge - Pe Total = Peak Discharge Computed from Calibration Formula  
 P.F. = Peaking Factor Check = Total / (Pk. Q + GWl)

| Landuse Code  | Matrix ID | Index Number | Area  | Dry GWI | 2 Year GWI | 5 Year GWI | 10 Year GWI | Zero Index | One Index | Wastewater Index | Rainfall Index | Runoff Index |
|---------------|-----------|--------------|-------|---------|------------|------------|-------------|------------|-----------|------------------|----------------|--------------|
| 10 IN-1       |           | 1            | Large | 0       | 150        | 220        | 260         | 0          | 1         | 1                | 1              | 1            |
| 20 IS-1       |           | 2            | Large | 0       | 150        | 230        | 260         | 0          | 1         | 1                | 2              | 2            |
| 30 OR-1       |           | 3            | Large | 0       | 140        | 220        | 270         | 0          | 1         | 1                | 3              | 3            |
| 40 HD-1       |           | 4            | Large | 0       | 150        | 210        | 250         | 0          | 1         | 1                | 7              | 4            |
| 50 MX-1       |           | 5            | Large | 0       | 170        | 240        | 280         | 0          | 1         | 1                | 7              | 5            |
| 60 SF-1A      |           | 6            | Large | 0       | 280        | 360        | 400         | 0          | 1         | 1                | 7              | 6            |
| 70 SF-1B      |           | 7            | Large | 0       | 220        | 320        | 360         | 0          | 1         | 1                | 7              | 7            |
| 80 IN-2       |           | 8            | Large | 0       | 160        | 230        | 270         | 0          | 1         | 1                | 7              | 8            |
| 90 IS-2       |           | 9            | Large | 0       | 160        | 240        | 270         | 0          | 1         | 1                | 7              | 9            |
| 100 OR-2      |           | 10           | Large | 0       | 160        | 240        | 290         | 0          | 1         | 1                | 7              | 10           |
| 110 HD-2      |           | 11           | Large | 0       | 160        | 220        | 260         | 0          | 1         | 1                | 7              | 11           |
| 120 MX-2      |           | 12           | Large | 0       | 180        | 260        | 300         | 0          | 1         | 1                | 7              | 12           |
| 130 IN-3      |           | 13           | Large | 0       | 170        | 240        | 290         | 0          | 1         | 1                | 7              | 13           |
| 140 IS-3      |           | 14           | Large | 0       | 190        | 250        | 300         | 0          | 1         | 1                | 7              | 14           |
| 150 OR-3      |           | 15           | Large | 0       | 180        | 260        | 310         | 0          | 1         | 1                | 7              | 15           |
| 160 HD-3      |           | 16           | Large | 0       | 170        | 230        | 290         | 0          | 1         | 1                | 7              | 16           |
| 170 MX-3      |           | 17           | Large | 0       | 200        | 280        | 320         | 0          | 1         | 1                | 7              | 17           |
| 180 IN-1      |           | 18           | Small | 0       | 150        | 220        | 260         | 0          | 1         | 1                | 18             | 18           |
| 190 IS-1      |           | 19           | Small | 0       | 150        | 230        | 260         | 0          | 1         | 1                | 19             | 19           |
| 200 OR-1      |           | 20           | Small | 0       | 140        | 220        | 270         | 0          | 1         | 1                | 20             | 20           |
| 210 HD-1      |           | 21           | Small | 0       | 150        | 210        | 250         | 0          | 1         | 1                | 7              | 21           |
| 220 MX-1      |           | 22           | Small | 0       | 170        | 240        | 280         | 0          | 1         | 1                | 7              | 22           |
| 230 SF-1A     |           | 23           | Small | 0       | 280        | 360        | 400         | 0          | 1         | 1                | 7              | 23           |
| 240 SF-1B     |           | 24           | Small | 0       | 220        | 320        | 360         | 0          | 1         | 1                | 7              | 24           |
| 250 IN-2      |           | 25           | Small | 0       | 160        | 230        | 270         | 0          | 1         | 1                | 7              | 25           |
| 260 IS-2      |           | 26           | Small | 0       | 160        | 240        | 270         | 0          | 1         | 1                | 7              | 26           |
| 270 OR-2      |           | 27           | Small | 0       | 160        | 240        | 290         | 0          | 1         | 1                | 7              | 27           |
| 280 HD-2      |           | 28           | Small | 0       | 160        | 220        | 260         | 0          | 1         | 1                | 7              | 28           |
| 290 MX-2      |           | 29           | Small | 0       | 180        | 260        | 300         | 0          | 1         | 1                | 7              | 29           |
| 300 IN-3      |           | 30           | Small | 0       | 170        | 240        | 290         | 0          | 1         | 1                | 7              | 30           |
| 310 IS-3      |           | 31           | Small | 0       | 190        | 250        | 300         | 0          | 1         | 1                | 7              | 31           |
| 320 OR-3      |           | 32           | Small | 0       | 180        | 260        | 310         | 0          | 1         | 1                | 7              | 32           |
| 330 HD-3      |           | 33           | Small | 0       | 170        | 230        | 290         | 0          | 1         | 1                | 7              | 33           |
| 340 MX-3      |           | 34           | Small | 0       | 200        | 280        | 320         | 0          | 1         | 1                | 7              | 34           |
| 350 High GPCD |           | 99           | NA    | 0       | 180        | 280        | 320         | 0          | 1         | 1                | 35             | 35           |
| 360 High I/I  |           | 98           | NA    | 0       | 220        | 360        | 400         | 0          | 1         | 1                | 35             | 35           |

**2 Year GWI**

280 GPAD - 100 GPAD DRY = 180 GPAD ADDITIONAL

| Matrix ID | GPAD | Sum of Acres | % of Total Acres | Sum of GWI     |
|-----------|------|--------------|------------------|----------------|
| HD-1      | 150  | 1849.32      | 1.20%            | 1,805,423,769  |
| HD-2      | 160  | 9837.11      | 6.40%            | 10,243,853,07  |
| HD-3      | 170  | 1287.23      | 0.84%            | 1,424,232,541  |
| IN-1      | 150  | 18065.29     | 11.76%           | 17,636,484,74  |
| IN-2      | 160  | 8802.42      | 5.73%            | 9,166,380,893  |
| IN-3      | 170  | 4928.7       | 3.21%            | 5,453,271,697  |
| IS-1      | 150  | 6164.61      | 4.01%            | 6,018,284,245  |
| IS-2      | 160  | 2318.27      | 1.51%            | 2,414,125,415  |
| IS-3      | 190  | 4940.98      | 3.22%            | 6,110,018,528  |
| MX-1      | 170  | 10253.05     | 6.67%            | 11,344,303,24  |
| MX-2      | 180  | 18522.96     | 12.06%           | 21,699,949,955 |
| MX-3      | 200  | 17221.82     | 11.21%           | 22,417,380,93  |
| OR-1      | 140  | 2939.5       | 1.91%            | 2,678,411,682  |
| OR-2      | 160  | 15924.48     | 10.36%           | 16,582,922,56  |
| OR-3      | 180  | 5179.33      | 3.37%            | 6,067,669,515  |
| SF-1A     | 280  | 6800.7       | 4.43%            | 12,393,314,73  |
| SF-1B     | 220  | 18611.26     | 12.11%           | 26,648,593,21  |
| SUMS      |      | 153647.03    | 100.00%          | 180,104,6203   |

**5 Year GWI**

358 GPAD - 100 GPAD DRY = 258 GPAD ADDITIONAL

| Matrix ID | GPAD | Sum of Acres | % of Total Acres | Sum of GWI    |
|-----------|------|--------------|------------------|---------------|
| HD-1      | 210  | 1849.32      | 1.20%            | 2,527,593,277 |
| HD-2      | 220  | 9837.11      | 6.40%            | 14,085,297,97 |
| HD-3      | 230  | 1287.23      | 0.84%            | 1,926,902,85  |
| IN-1      | 220  | 18065.29     | 11.76%           | 25,866,844,29 |
| IN-2      | 230  | 8802.42      | 5.73%            | 13,176,672,53 |
| IN-3      | 240  | 4928.7       | 3.21%            | 7,698,736,513 |
| IS-1      | 230  | 6164.61      | 4.01%            | 9,228,035,843 |
| IS-2      | 240  | 2318.27      | 1.51%            | 3,621,188,122 |
| IS-3      | 250  | 4940.98      | 3.22%            | 8,039,498,063 |
| MX-1      | 240  | 10253.05     | 6.67%            | 16,015,486,92 |
| MX-2      | 260  | 18522.96     | 12.06%           | 31,344,371,58 |
| MX-3      | 280  | 17221.82     | 11.21%           | 31,384,333,3  |
| OR-1      | 220  | 2939.5       | 1.91%            | 4,208,932,643 |
| OR-2      | 240  | 15924.48     | 10.36%           | 24,874,383,84 |
| OR-3      | 260  | 5179.33      | 3.37%            | 8,764,411,522 |
| SF-1A     | 360  | 6800.7       | 4.43%            | 15,934,261,79 |
| SF-1B     | 320  | 18611.26     | 12.11%           | 38,761,590,12 |
| SUMS      |      | 153647.03    | 100.00%          | 257,458,5412  |

**10 Year GWI**

400 GPAD - 100 GPAD DRY = 300 GPAD ADDITIONAL

| Matrix ID | GPAD | Sum of Acres | % of Total Acres | Sum of GWI    |
|-----------|------|--------------|------------------|---------------|
| HD-1      | 250  | 1849.32      | 1.20%            | 3,009,039,615 |
| HD-2      | 260  | 9837.11      | 6.40%            | 16,646,261,24 |
| HD-3      | 290  | 1287.23      | 0.84%            | 2,429,573,159 |
| IN-1      | 260  | 18065.29     | 11.76%           | 30,569,906,88 |
| IN-2      | 270  | 8802.42      | 5.73%            | 15,468,267,76 |
| IN-3      | 290  | 4928.7       | 3.21%            | 9,302,639,953 |
| IS-1      | 260  | 6164.61      | 4.01%            | 10,431,692,69 |
| IS-2      | 270  | 2318.27      | 1.51%            | 4,073,836,637 |
| IS-3      | 300  | 4940.98      | 3.22%            | 9,647,397,675 |
| MX-1      | 280  | 10253.05     | 6.67%            | 18,684,734,75 |
| MX-2      | 300  | 18522.96     | 12.06%           | 36,166,582,59 |
| MX-3      | 320  | 17221.82     | 11.21%           | 35,867,809,49 |
| OR-1      | 270  | 2939.5       | 1.91%            | 5,165,508,243 |
| OR-2      | 290  | 15924.48     | 10.36%           | 30,056,547,14 |
| OR-3      | 310  | 5179.33      | 3.37%            | 10,449,875,28 |
| SF-1A     | 400  | 6800.7       | 4.43%            | 17,704,735,33 |
| SF-1B     | 360  | 18611.26     | 12.11%           | 43,606,788,68 |
| SUMS      |      | 153647.03    | 100.00%          | 299,281,1973  |

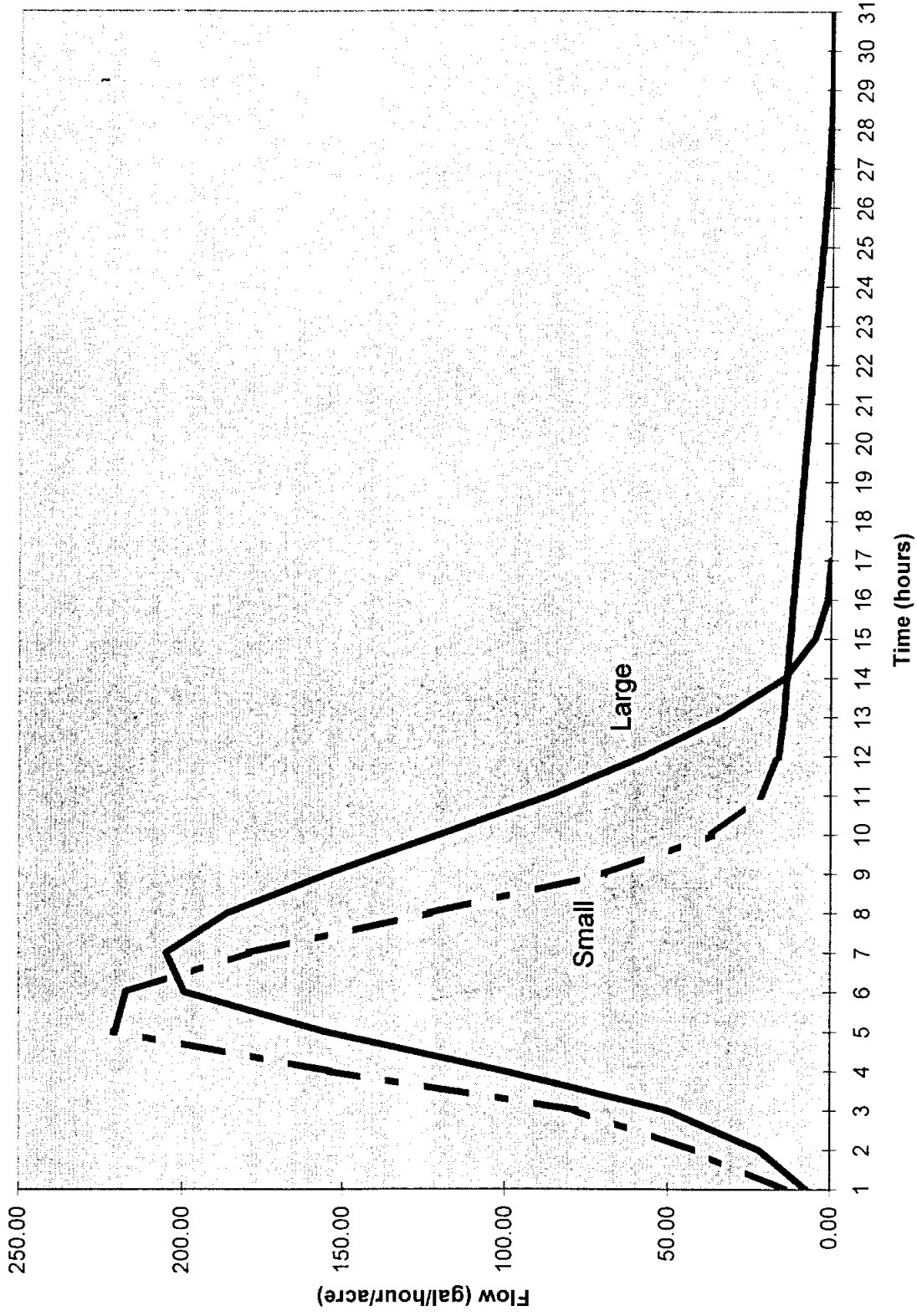
**25 Year GWI**

455 GPAD - 100 GPAD DRY = 355 GPAD ADDITIONAL

| Matrix ID | GPAD | Sum of Acres | % of Total Acres | Sum of GWI    |
|-----------|------|--------------|------------------|---------------|
| HD-1      | 290  | 1849.32      | 1.20%            | 3,490,485,953 |
| HD-2      | 300  | 9837.11      | 6.40%            | 19,207,224,51 |
| HD-3      | 340  | 1287.23      | 0.84%            | 2,848,465,083 |
| IN-1      | 290  | 18065.29     | 11.76%           | 34,097,203,83 |
| IN-2      | 310  | 8802.42      | 5.73%            | 17,759,862,98 |
| IN-3      | 340  | 4928.7       | 3.21%            | 10,906,543,39 |
| IS-1      | 290  | 6164.61      | 4.01%            | 11,635,349,54 |
| IS-2      | 310  | 2318.27      | 1.51%            | 4,677,367,991 |
| IS-3      | 340  | 4940.98      | 3.22%            | 10,933,717,37 |
| MX-1      | 330  | 10253.05     | 6.67%            | 22,021,294,52 |
| MX-2      | 360  | 18522.96     | 12.06%           | 43,399,899,11 |
| MX-3      | 390  | 17221.82     | 11.21%           | 43,713,892,81 |
| OR-1      | 320  | 2939.5       | 1.91%            | 6,122,083,844 |
| OR-2      | 350  | 15924.48     | 10.36%           | 36,275,143,1  |
| OR-3      | 380  | 5179.33      | 3.37%            | 12,809,524,53 |
| SF-1A     | 470  | 6800.7       | 4.43%            | 20,803,064,01 |
| SF-1B     | 440  | 18611.26     | 12.11%           | 53,297,186,41 |
| SUMS      |      | 153647.03    | 100.00%          | 353,998,309   |

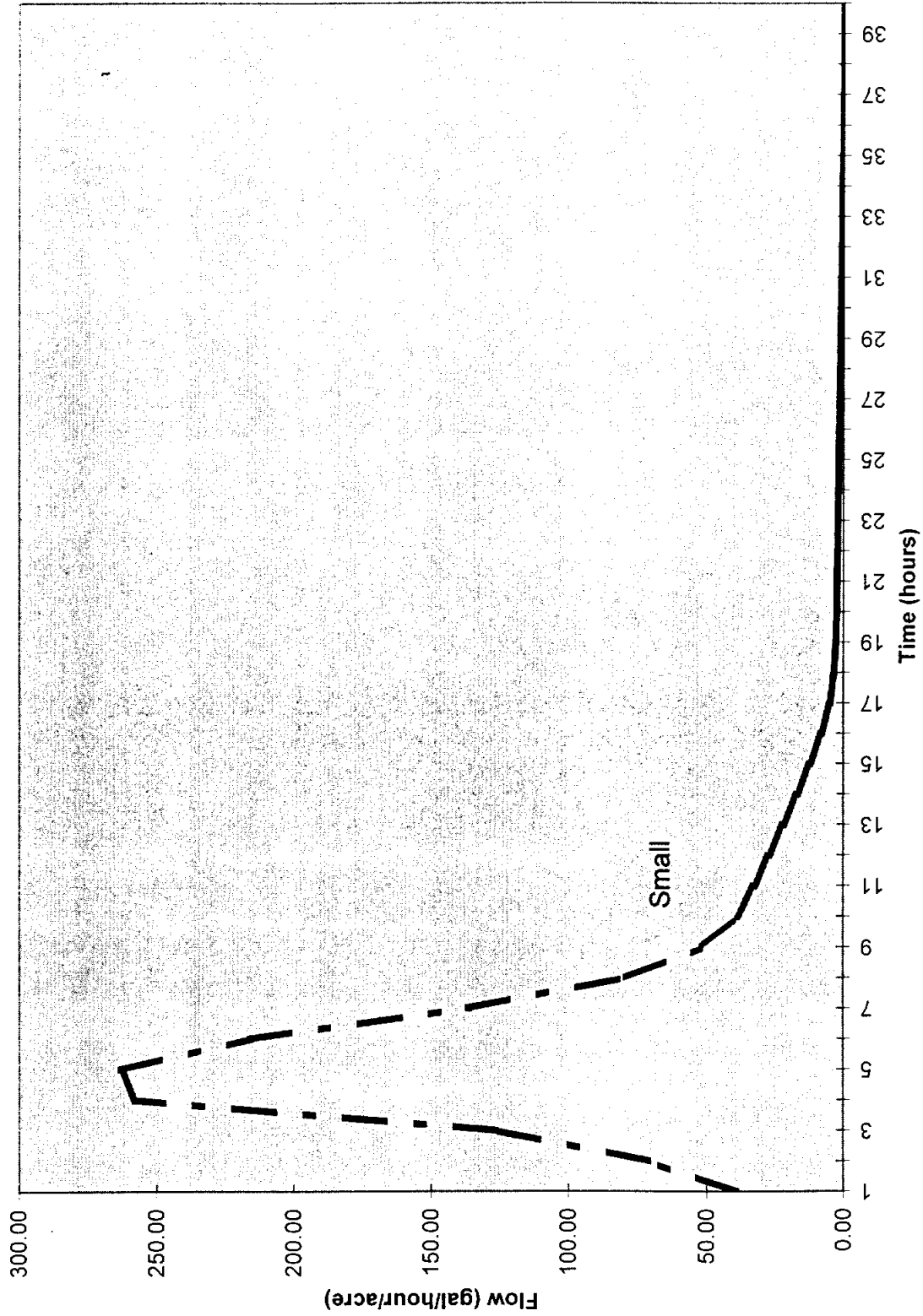
| Matrix ID | Gallons/hour of inflow (RATE)  |                              |                                |                              |                                |                              |                                |                              |                                |                              |                                |                              |                                |                              |                                |                              |                                |                              |
|-----------|--------------------------------|------------------------------|--------------------------------|------------------------------|--------------------------------|------------------------------|--------------------------------|------------------------------|--------------------------------|------------------------------|--------------------------------|------------------------------|--------------------------------|------------------------------|--------------------------------|------------------------------|--------------------------------|------------------------------|
|           | HD-1                           | HD-1                         | HD-2                           | HD-3                         | HD-3                           | HD-3                         | HD-3                           | HD-3                         | HD-3                           | HD-3                         | HD-3                           | HD-3                         | HD-3                           | HD-3                         | HD-3                           | HD-3                         | HD-3                           | HD-3                         |
|           | large<br>1,649.00<br>Gain/acre | small<br>182.00<br>Gain/acre | large<br>1,695.00<br>Gain/acre | small<br>192.00<br>Gain/acre | large<br>1,695.00<br>Gain/acre | small<br>192.00<br>Gain/acre | large<br>1,695.00<br>Gain/acre | small<br>192.00<br>Gain/acre | large<br>1,695.00<br>Gain/acre | small<br>192.00<br>Gain/acre | large<br>1,695.00<br>Gain/acre | small<br>192.00<br>Gain/acre | large<br>1,695.00<br>Gain/acre | small<br>192.00<br>Gain/acre | large<br>1,695.00<br>Gain/acre | small<br>192.00<br>Gain/acre | large<br>1,695.00<br>Gain/acre | small<br>192.00<br>Gain/acre |
| 1         | 7.09                           | 13.92                        | 39.46                          | 7.11                         | 11.38                          | 34.76                        | 20.70                          | 9.72                         | 16.67                          | 52.57                        | 5.99                           | 35.39                        | 61.02                          | 15.78                        | 29.13                          | 29.13                        | 29.13                          | 29.13                        |
| 2         | 21.68                          | 42.54                        | 71.26                          | 49.99                        | 21.73                          | 71.52                        | 20.70                          | 9.72                         | 16.67                          | 52.57                        | 5.99                           | 35.39                        | 61.02                          | 15.78                        | 29.13                          | 29.13                        | 29.13                          | 29.13                        |
| 3         | 49.86                          | 78.22                        | 128.64                         | 83.40                        | 41.75                          | 129.87                       | 68.01                          | 54.66                        | 96.67                          | 170.57                       | 18.31                          | 129.28                       | 191.55                         | 92.11                        | 103.37                         | 43.81                        | 84.95                          | 49.35                        |
| 4         | 100.26                         | 153.90                       | 257.61                         | 183.76                       | 82.91                          | 265.89                       | 137.16                         | 107.59                       | 186.47                         | 350.11                       | 84.44                          | 297.76                       | 389.82                         | 275.05                       | 211.46                         | 86.74                        | 171.56                         | 103.50                       |
| 5         | 154.97                         | 220.84                       | 362.77                         | 229.53                       | 122.09                         | 280.45                       | 206.29                         | 154.36                       | 273.96                         | 565.98                       | 130.16                         | 397.82                       | 509.82                         | 309.82                       | 233.29                         | 127.99                       | 252.61                         | 159.59                       |
| 6         | 205.00                         | 271.11                       | 415.78                         | 270.99                       | 131.03                         | 311.88                       | 233.88                         | 151.53                       | 268.24                         | 595.16                       | 140.23                         | 429.39                       | 542.85                         | 328.85                       | 252.29                         | 127.99                       | 252.61                         | 159.59                       |
| 7         | 265.00                         | 342.00                       | 495.00                         | 342.00                       | 171.00                         | 396.00                       | 284.00                         | 171.00                       | 342.00                         | 714.00                       | 180.00                         | 540.00                       | 680.00                         | 420.00                       | 315.00                         | 157.50                       | 315.00                         | 190.00                       |
| 8         | 330.00                         | 440.00                       | 660.00                         | 440.00                       | 220.00                         | 495.00                       | 363.00                         | 220.00                       | 440.00                         | 880.00                       | 220.00                         | 660.00                       | 840.00                         | 510.00                       | 382.50                         | 191.25                       | 382.50                         | 231.00                       |
| 9         | 395.00                         | 520.00                       | 780.00                         | 520.00                       | 260.00                         | 585.00                       | 435.00                         | 260.00                       | 520.00                         | 1040.00                      | 260.00                         | 780.00                       | 990.00                         | 615.00                       | 461.25                         | 230.62                       | 461.25                         | 287.00                       |
| 10        | 460.00                         | 610.00                       | 915.00                         | 610.00                       | 305.00                         | 682.50                       | 502.50                         | 305.00                       | 610.00                         | 1220.00                      | 305.00                         | 915.00                       | 1155.00                        | 742.50                       | 556.87                         | 278.44                       | 556.87                         | 346.00                       |
| 11        | 525.00                         | 695.00                       | 1042.50                        | 695.00                       | 350.00                         | 787.50                       | 577.50                         | 350.00                       | 695.00                         | 1385.00                      | 350.00                         | 1042.50                      | 1307.50                        | 861.67                       | 646.25                         | 323.12                       | 646.25                         | 405.00                       |
| 12        | 590.00                         | 785.00                       | 1185.00                        | 785.00                       | 395.00                         | 892.50                       | 652.50                         | 395.00                       | 785.00                         | 1550.00                      | 395.00                         | 1185.00                      | 1470.00                        | 970.00                       | 727.50                         | 363.75                       | 727.50                         | 464.00                       |
| 13        | 655.00                         | 875.00                       | 1327.50                        | 875.00                       | 440.00                         | 1000.00                      | 730.00                         | 440.00                       | 875.00                         | 1715.00                      | 440.00                         | 1327.50                      | 1640.00                        | 1070.00                      | 802.50                         | 401.25                       | 802.50                         | 513.00                       |
| 14        | 720.00                         | 965.00                       | 1470.00                        | 965.00                       | 485.00                         | 1105.00                      | 807.50                         | 485.00                       | 965.00                         | 1880.00                      | 485.00                         | 1470.00                      | 1800.00                        | 1185.00                      | 888.75                         | 444.37                       | 888.75                         | 572.00                       |
| 15        | 785.00                         | 1050.00                      | 1612.50                        | 1050.00                      | 530.00                         | 1210.00                      | 890.00                         | 530.00                       | 1050.00                        | 2045.00                      | 530.00                         | 1612.50                      | 1960.00                        | 1290.00                      | 967.50                         | 483.75                       | 967.50                         | 621.00                       |
| 16        | 850.00                         | 1135.00                      | 1755.00                        | 1135.00                      | 575.00                         | 1315.00                      | 972.50                         | 575.00                       | 1135.00                        | 2210.00                      | 575.00                         | 1755.00                      | 2120.00                        | 1395.00                      | 1046.25                        | 523.12                       | 1046.25                        | 670.00                       |
| 17        | 915.00                         | 1220.00                      | 1897.50                        | 1220.00                      | 620.00                         | 1420.00                      | 1055.00                        | 620.00                       | 1220.00                        | 2375.00                      | 620.00                         | 1897.50                      | 2300.00                        | 1500.00                      | 1125.00                        | 562.50                       | 1125.00                        | 729.00                       |
| 18        | 980.00                         | 1305.00                      | 2040.00                        | 1305.00                      | 665.00                         | 1525.00                      | 1137.50                        | 665.00                       | 1305.00                        | 2540.00                      | 665.00                         | 2040.00                      | 2440.00                        | 1590.00                      | 1200.00                        | 600.00                       | 1200.00                        | 778.00                       |
| 19        | 1045.00                        | 1390.00                      | 2182.50                        | 1390.00                      | 710.00                         | 1630.00                      | 1230.00                        | 710.00                       | 1390.00                        | 2705.00                      | 710.00                         | 2182.50                      | 2580.00                        | 1680.00                      | 1260.00                        | 630.00                       | 1260.00                        | 827.00                       |
| 20        | 1110.00                        | 1475.00                      | 2325.00                        | 1475.00                      | 755.00                         | 1735.00                      | 1322.50                        | 755.00                       | 1475.00                        | 2870.00                      | 755.00                         | 2325.00                      | 2740.00                        | 1770.00                      | 1330.00                        | 665.00                       | 1330.00                        | 876.00                       |
| 21        | 1175.00                        | 1560.00                      | 2467.50                        | 1560.00                      | 800.00                         | 1840.00                      | 1415.00                        | 800.00                       | 1560.00                        | 3035.00                      | 800.00                         | 2467.50                      | 2880.00                        | 1860.00                      | 1385.00                        | 692.50                       | 1385.00                        | 925.00                       |
| 22        | 1240.00                        | 1645.00                      | 2610.00                        | 1645.00                      | 845.00                         | 1945.00                      | 1507.50                        | 845.00                       | 1645.00                        | 3200.00                      | 845.00                         | 2610.00                      | 2960.00                        | 1950.00                      | 1440.00                        | 720.00                       | 1440.00                        | 974.00                       |
| 23        | 1305.00                        | 1730.00                      | 2752.50                        | 1730.00                      | 890.00                         | 2050.00                      | 1600.00                        | 890.00                       | 1730.00                        | 3365.00                      | 890.00                         | 2752.50                      | 3040.00                        | 2040.00                      | 1495.00                        | 745.00                       | 1495.00                        | 1023.00                      |
| 24        | 1370.00                        | 1815.00                      | 2895.00                        | 1815.00                      | 935.00                         | 2155.00                      | 1692.50                        | 935.00                       | 1815.00                        | 3530.00                      | 935.00                         | 2895.00                      | 3160.00                        | 2130.00                      | 1550.00                        | 770.00                       | 1550.00                        | 1072.00                      |
| 25        | 1435.00                        | 1900.00                      | 3037.50                        | 1900.00                      | 980.00                         | 2260.00                      | 1785.00                        | 980.00                       | 1900.00                        | 3695.00                      | 980.00                         | 3037.50                      | 3280.00                        | 2220.00                      | 1605.00                        | 795.00                       | 1605.00                        | 1121.00                      |
| 26        | 1500.00                        | 1985.00                      | 3180.00                        | 1985.00                      | 1025.00                        | 2365.00                      | 1877.50                        | 1025.00                      | 1985.00                        | 3860.00                      | 1025.00                        | 3180.00                      | 3400.00                        | 2310.00                      | 1660.00                        | 820.00                       | 1660.00                        | 1170.00                      |
| 27        | 1565.00                        | 2070.00                      | 3322.50                        | 2070.00                      | 1070.00                        | 2470.00                      | 1970.00                        | 1070.00                      | 2070.00                        | 4025.00                      | 1070.00                        | 3322.50                      | 3520.00                        | 2400.00                      | 1715.00                        | 845.00                       | 1715.00                        | 1219.00                      |
| 28        | 1630.00                        | 2155.00                      | 3465.00                        | 2155.00                      | 1115.00                        | 2575.00                      | 2062.50                        | 1115.00                      | 2155.00                        | 4190.00                      | 1115.00                        | 3465.00                      | 3640.00                        | 2490.00                      | 1770.00                        | 870.00                       | 1770.00                        | 1268.00                      |
| 29        | 1695.00                        | 2240.00                      | 3607.50                        | 2240.00                      | 1160.00                        | 2680.00                      | 2155.00                        | 1160.00                      | 2240.00                        | 4355.00                      | 1160.00                        | 3607.50                      | 3760.00                        | 2580.00                      | 1825.00                        | 895.00                       | 1825.00                        | 1317.00                      |
| 30        | 1760.00                        | 2325.00                      | 3750.00                        | 2325.00                      | 1205.00                        | 2785.00                      | 2247.50                        | 1205.00                      | 2325.00                        | 4520.00                      | 1205.00                        | 3750.00                      | 3880.00                        | 2670.00                      | 1880.00                        | 920.00                       | 1880.00                        | 1366.00                      |
| 31        | 1825.00                        | 2410.00                      | 3892.50                        | 2410.00                      | 1250.00                        | 2890.00                      | 2340.00                        | 1250.00                      | 2410.00                        | 4685.00                      | 1250.00                        | 3892.50                      | 4000.00                        | 2760.00                      | 1935.00                        | 945.00                       | 1935.00                        | 1415.00                      |
| 32        | 1890.00                        | 2495.00                      | 4035.00                        | 2495.00                      | 1295.00                        | 2995.00                      | 2432.50                        | 1295.00                      | 2495.00                        | 4850.00                      | 1295.00                        | 4035.00                      | 4120.00                        | 2850.00                      | 2000.00                        | 970.00                       | 2000.00                        | 1464.00                      |
| 33        | 1955.00                        | 2580.00                      | 4177.50                        | 2580.00                      | 1340.00                        | 3100.00                      | 2525.00                        | 1340.00                      | 2580.00                        | 5015.00                      | 1340.00                        | 4177.50                      | 4240.00                        | 2940.00                      | 2055.00                        | 995.00                       | 2055.00                        | 1513.00                      |
| 34        | 2020.00                        | 2665.00                      | 4320.00                        | 2665.00                      | 1385.00                        | 3205.00                      | 2617.50                        | 1385.00                      | 2665.00                        | 5180.00                      | 1385.00                        | 4320.00                      | 4360.00                        | 3030.00                      | 2110.00                        | 1020.00                      | 2110.00                        | 1562.00                      |
| 35        | 2085.00                        | 2750.00                      | 4462.50                        | 2750.00                      | 1430.00                        | 3310.00                      | 2710.00                        | 1430.00                      | 2750.00                        | 5345.00                      | 1430.00                        | 4462.50                      | 4480.00                        | 3120.00                      | 2165.00                        | 1045.00                      | 2165.00                        | 1611.00                      |
| 36        | 2150.00                        | 2835.00                      | 4605.00                        | 2835.00                      | 1475.00                        | 3415.00                      | 2802.50                        | 1475.00                      | 2835.00                        | 5510.00                      | 1475.00                        | 4605.00                      | 4600.00                        | 3210.00                      | 2220.00                        | 1070.00                      | 2220.00                        | 1660.00                      |
| 37        | 2215.00                        | 2920.00                      | 4747.50                        | 2920.00                      | 1520.00                        | 3520.00                      | 2895.00                        | 1520.00                      | 2920.00                        | 5675.00                      | 1520.00                        | 4747.50                      | 4720.00                        | 3300.00                      | 2275.00                        | 1095.00                      | 2275.00                        | 1709.00                      |
| 38        | 2280.00                        | 3005.00                      | 4890.00                        | 3005.00                      | 1565.00                        | 3625.00                      | 2987.50                        | 1565.00                      | 3005.00                        | 5840.00                      | 1565.00                        | 4890.00                      | 4840.00                        | 3390.00                      | 2330.00                        | 1120.00                      | 2330.00                        | 1758.00                      |
| 39        | 2345.00                        | 3090.00                      | 5032.50                        | 3090.00                      | 1610.00                        | 3730.00                      | 3080.00                        | 1610.00                      | 3090.00                        | 6005.00                      | 1610.00                        | 5032.50                      | 4960.00                        | 3480.00                      | 2385.00                        | 1145.00                      | 2385.00                        | 1807.00                      |
| 40        | 2410.00                        | 3175.00                      | 5175.00                        | 3175.00                      | 1655.00                        | 3835.00                      | 3172.50                        | 1655.00                      | 3175.00                        | 6170.00                      | 1655.00                        | 5175.00                      | 5120.00                        | 3570.00                      | 2440.00                        | 1170.00                      | 2440.00                        | 1856.00                      |
| 41        | 2475.00                        | 3260.00                      | 5317.50                        | 3260.00                      | 1700.00                        | 3940.00                      | 3265.00                        | 1700.00                      | 3260.00                        | 6335.00                      | 1700.00                        | 5317.50                      | 5240.00                        | 3660.00                      | 2495.00                        | 1195.00                      | 2495.00                        | 1905.00                      |
| 42        | 2540.00                        | 3345.00                      | 5460.00                        | 3345.00                      | 1745.00                        | 4045.00                      | 3357.50                        | 1745.00                      | 3345.00                        | 6500.00                      | 1745.00                        | 5460.00                      | 5360.00                        | 3750.00                      | 2550.00                        | 1220.00                      | 2550.00                        | 1954.00                      |
| 43        | 2605.00                        | 3430.00                      | 5602.50                        | 3430.00                      | 1790.00                        | 4150.00                      | 3450.00                        | 1790.00                      | 3430.00                        | 6665.00                      | 1790.00                        | 5602.50                      | 5480.00                        | 3840.00                      | 2605.00                        | 1245.00                      | 2605.00                        | 2003.00                      |
| 44        | 2670.00                        | 3515.00                      | 5745.00                        | 3515.00                      | 1835.00                        | 4255.00                      | 3542.50                        | 1835.00                      | 3515.00                        | 6830.00                      | 1835.00                        | 5745.00                      | 5600.00                        | 3930.00                      | 2660.00                        | 1270.00                      | 2660.00                        | 2052.00                      |

RDII - Heavy High Density Residential, HD-1

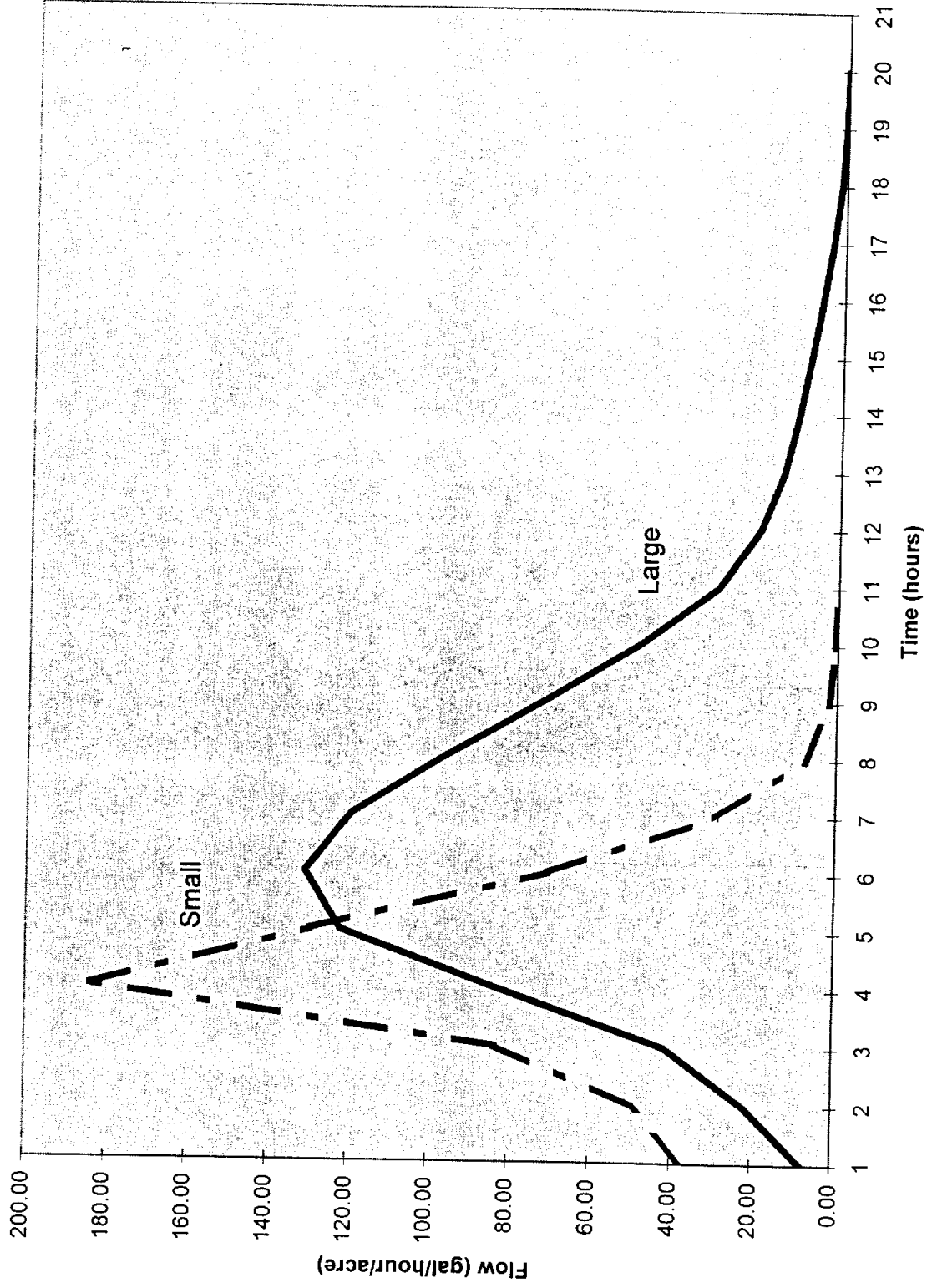




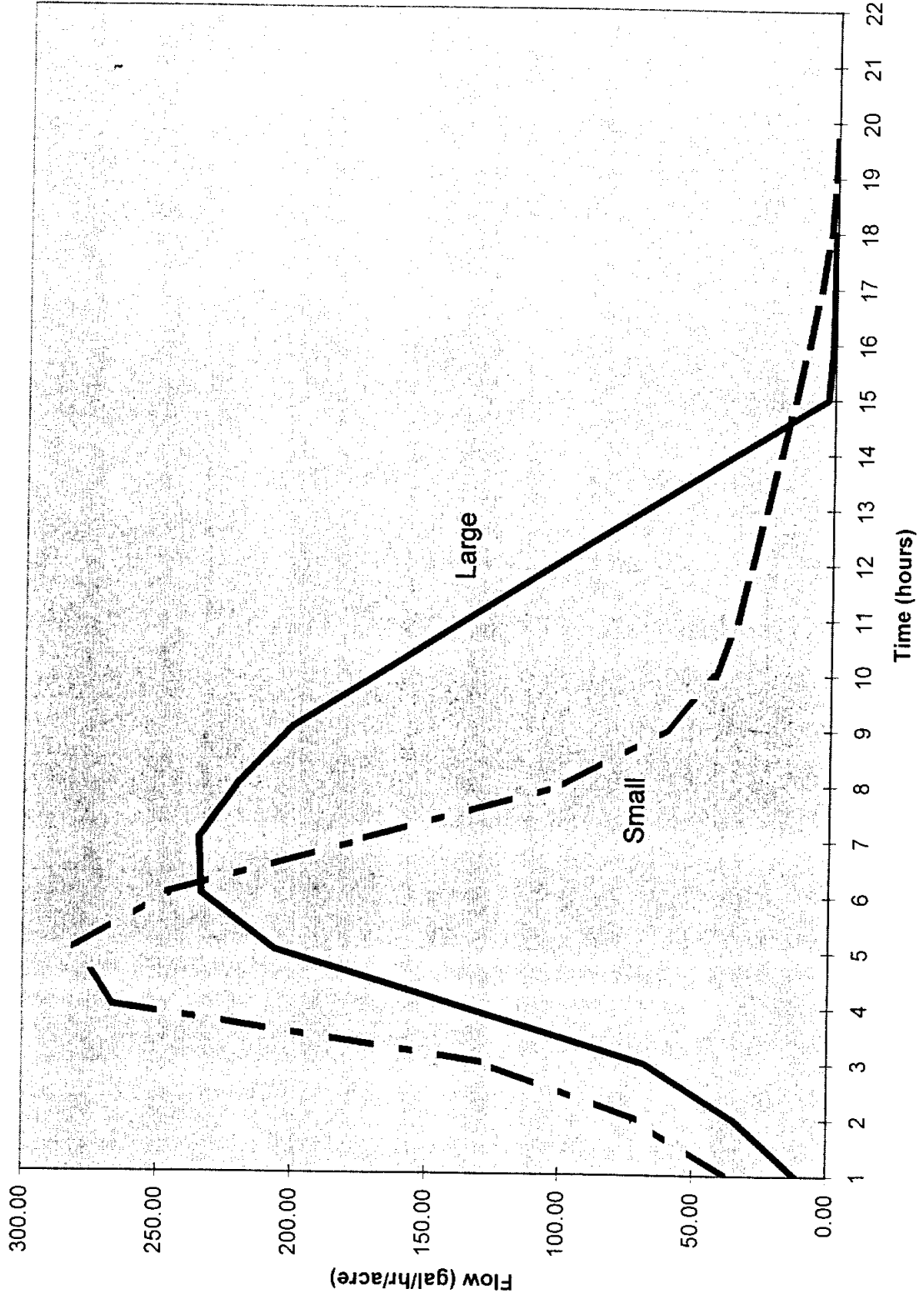
### RDII - Moderate High Density Residential, HD-2



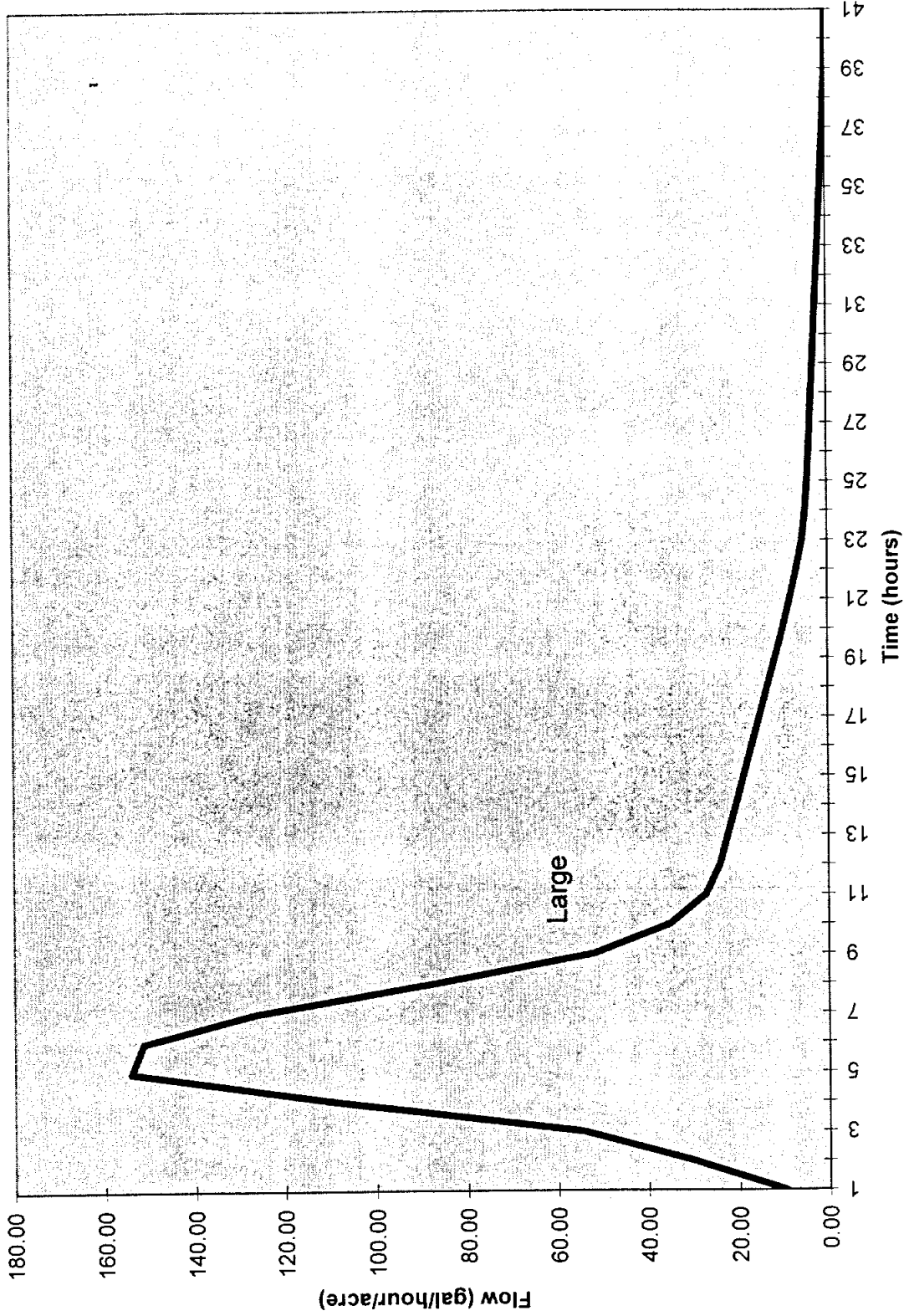
RDII - Light High Density Residential, HD-3



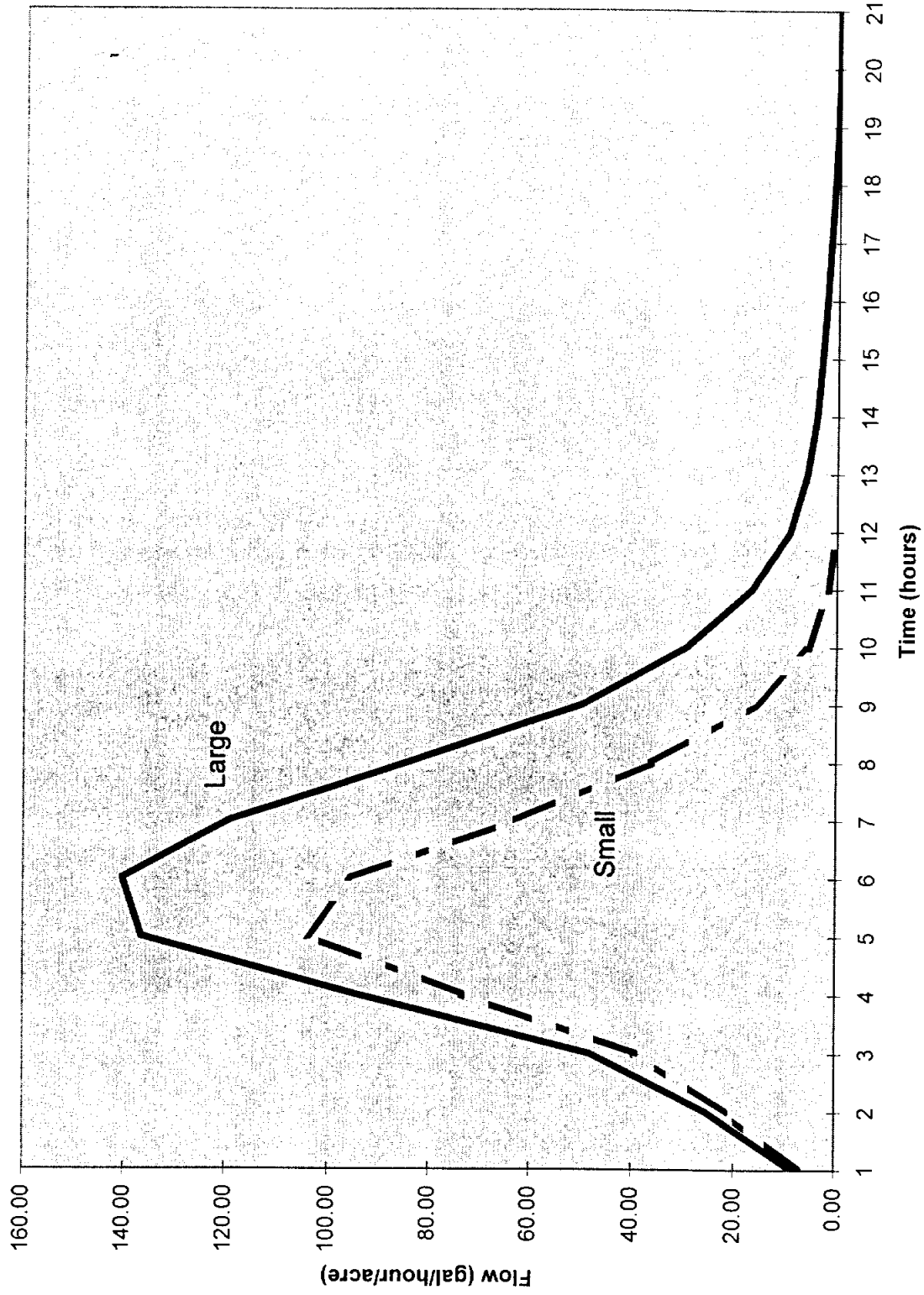
RDII - Heavy Industrial, IN-1



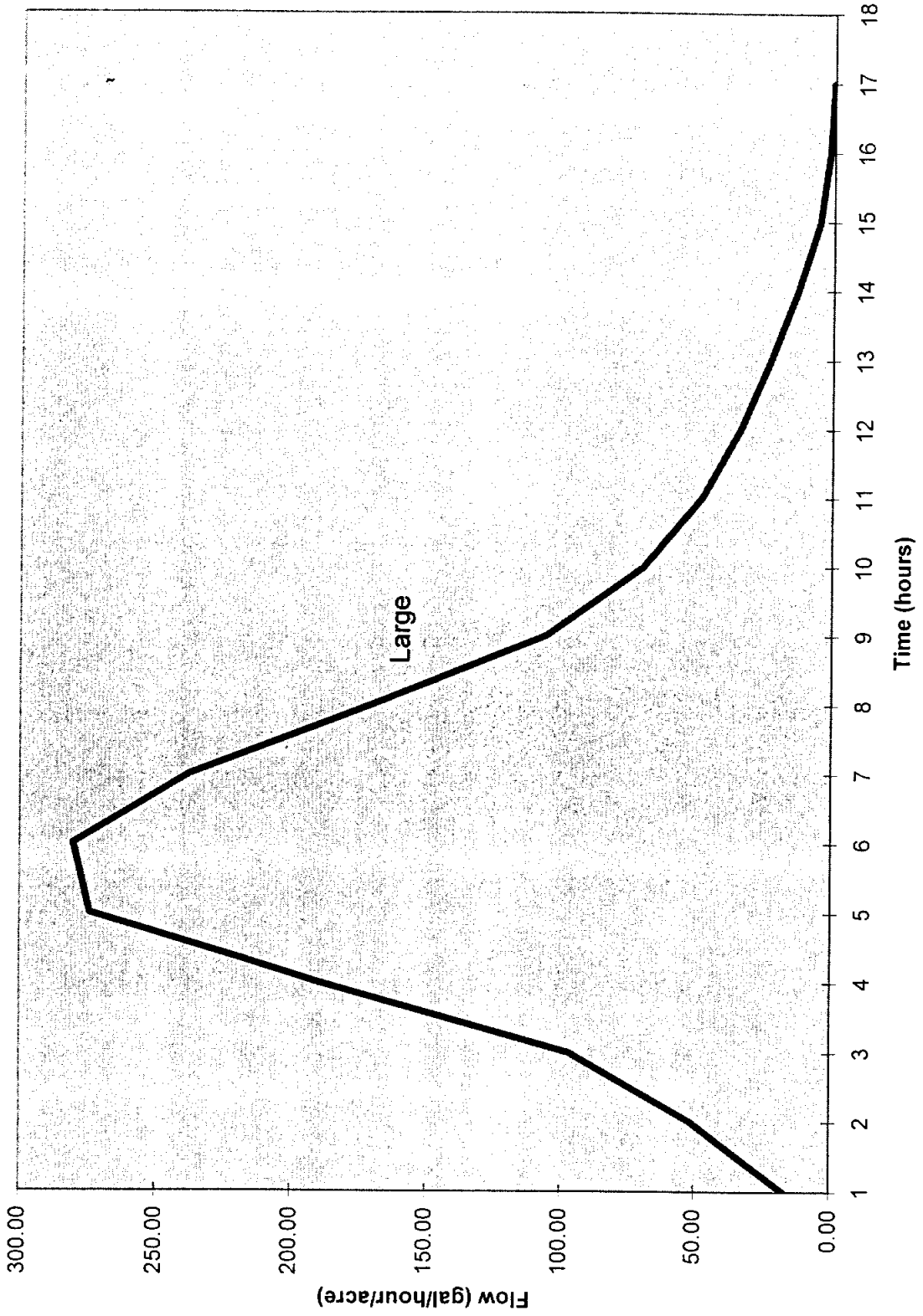
RDII - Moderate Industrial, IN-2



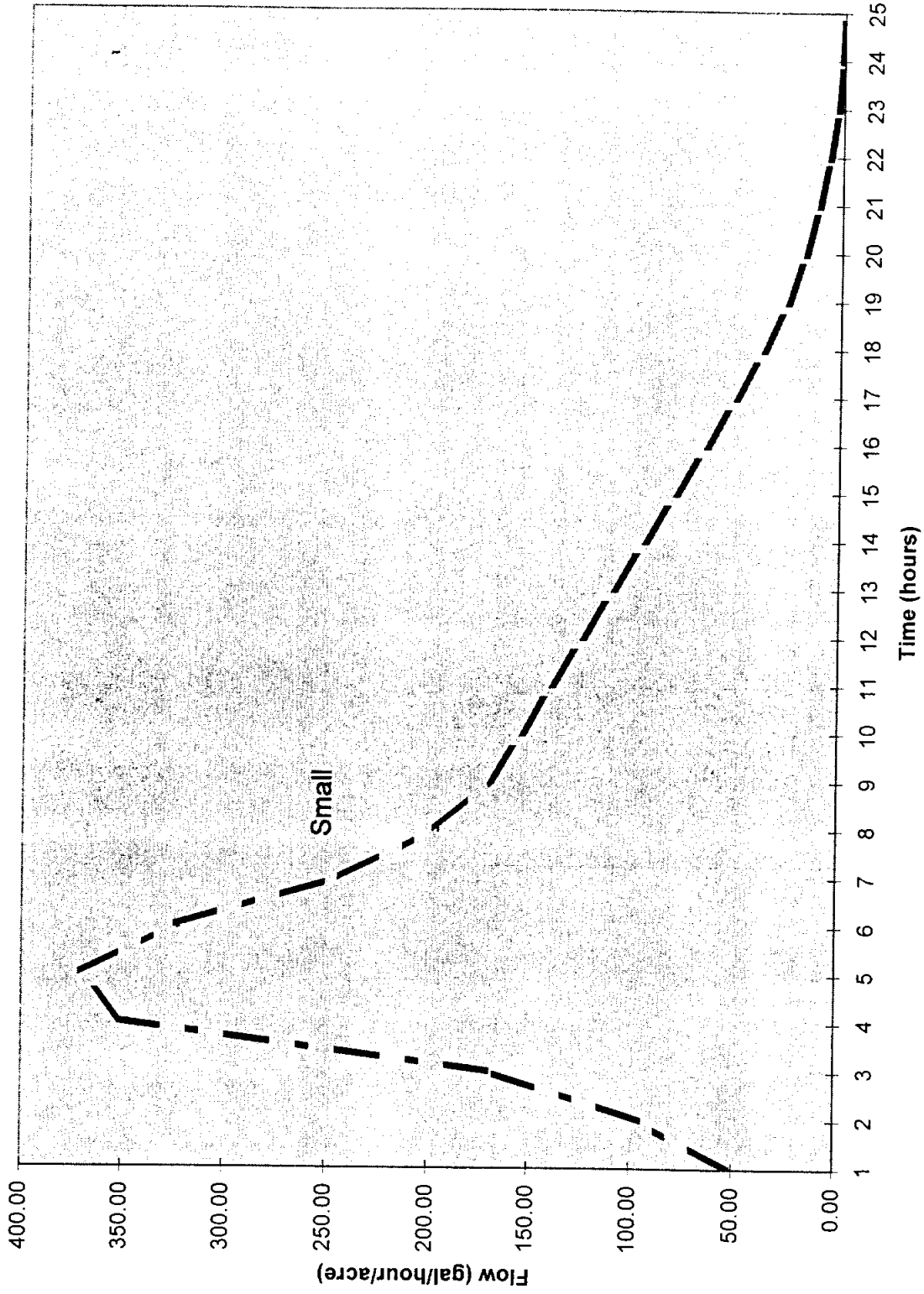
### RDII - Heavy Institutional, IS-1



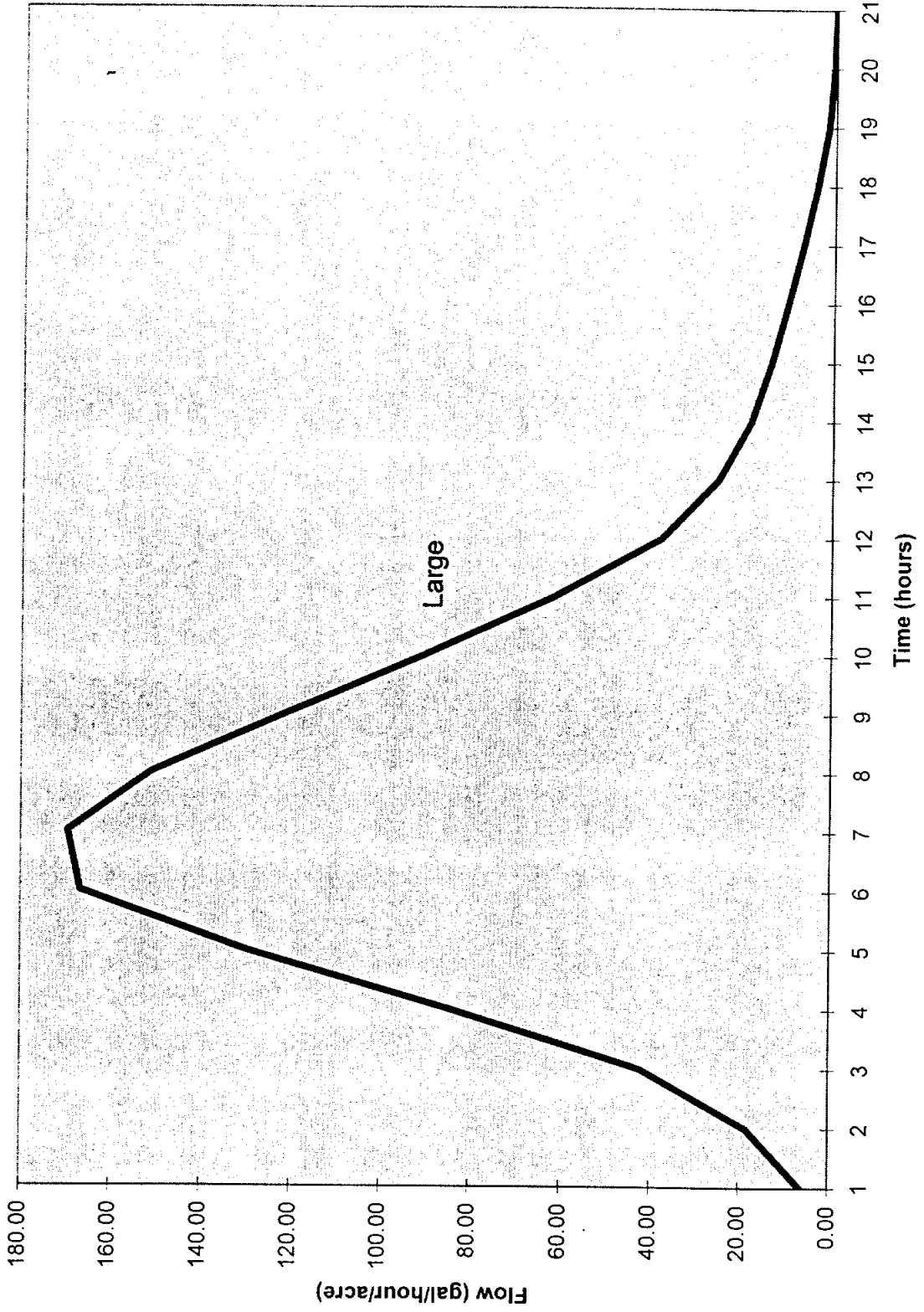
**RDII - Moderate Institutional, IS-2**



### RDII - Light Institutional, IS-3

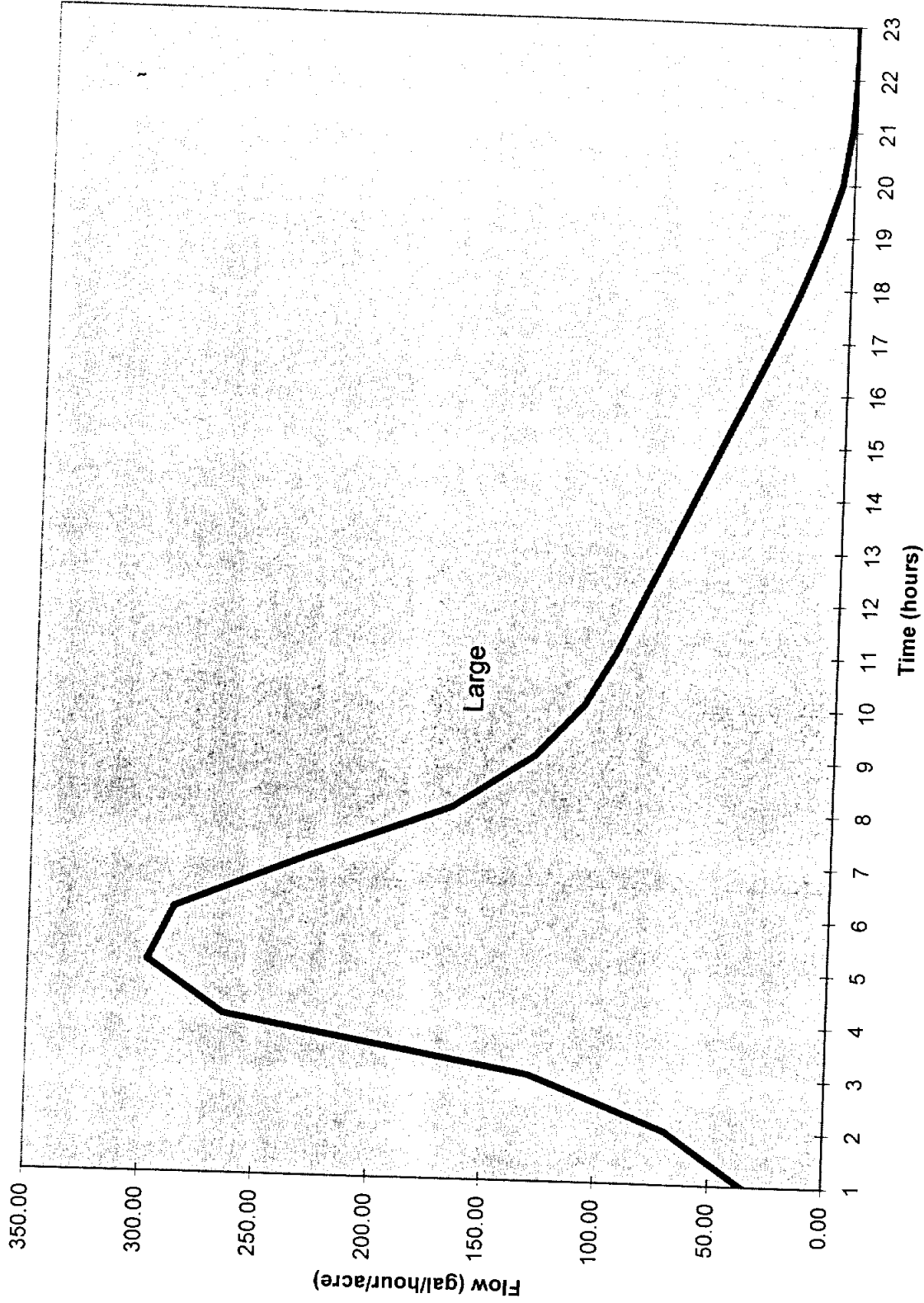


RDII - Mixed (Light Single Family), MX-1

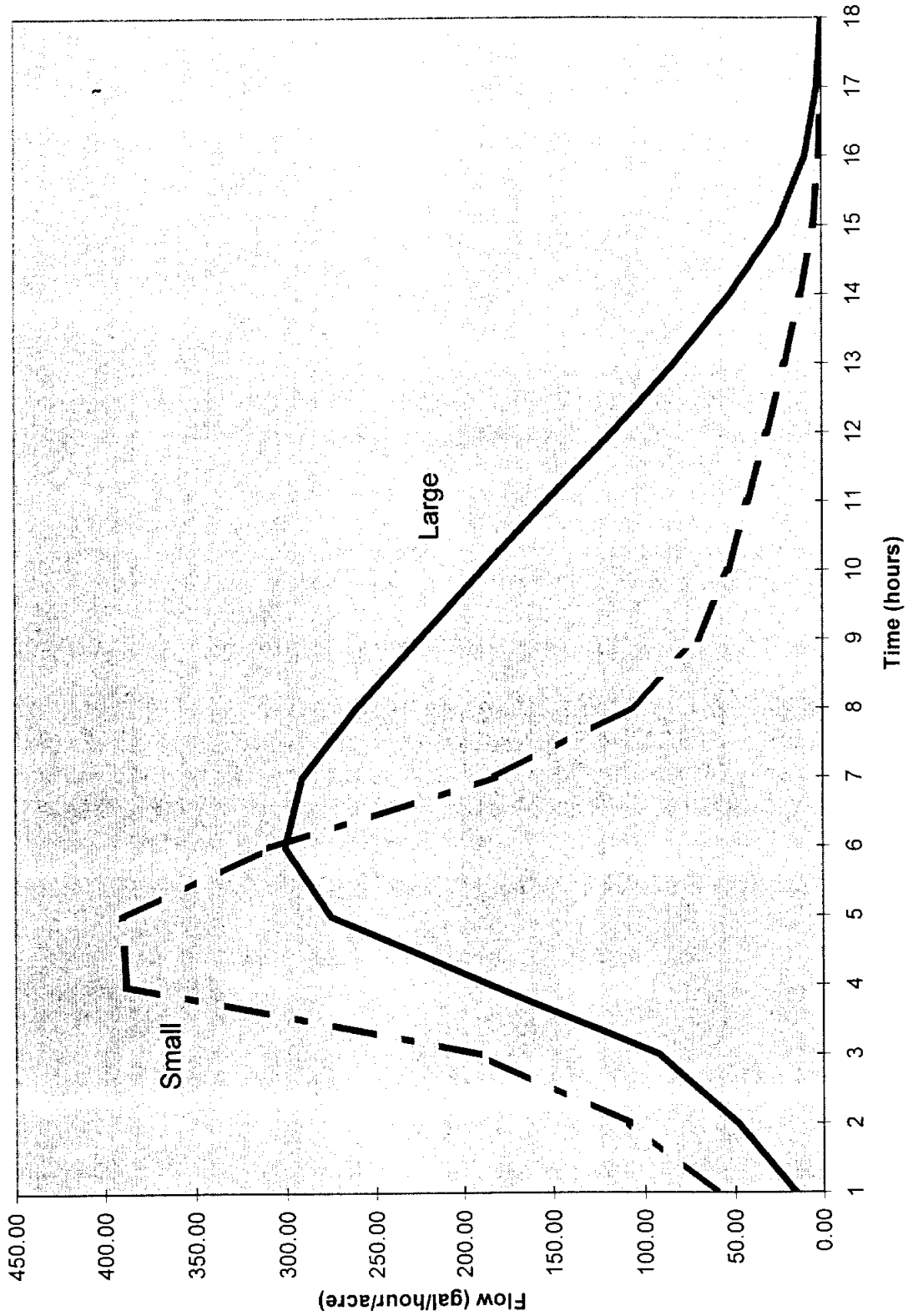




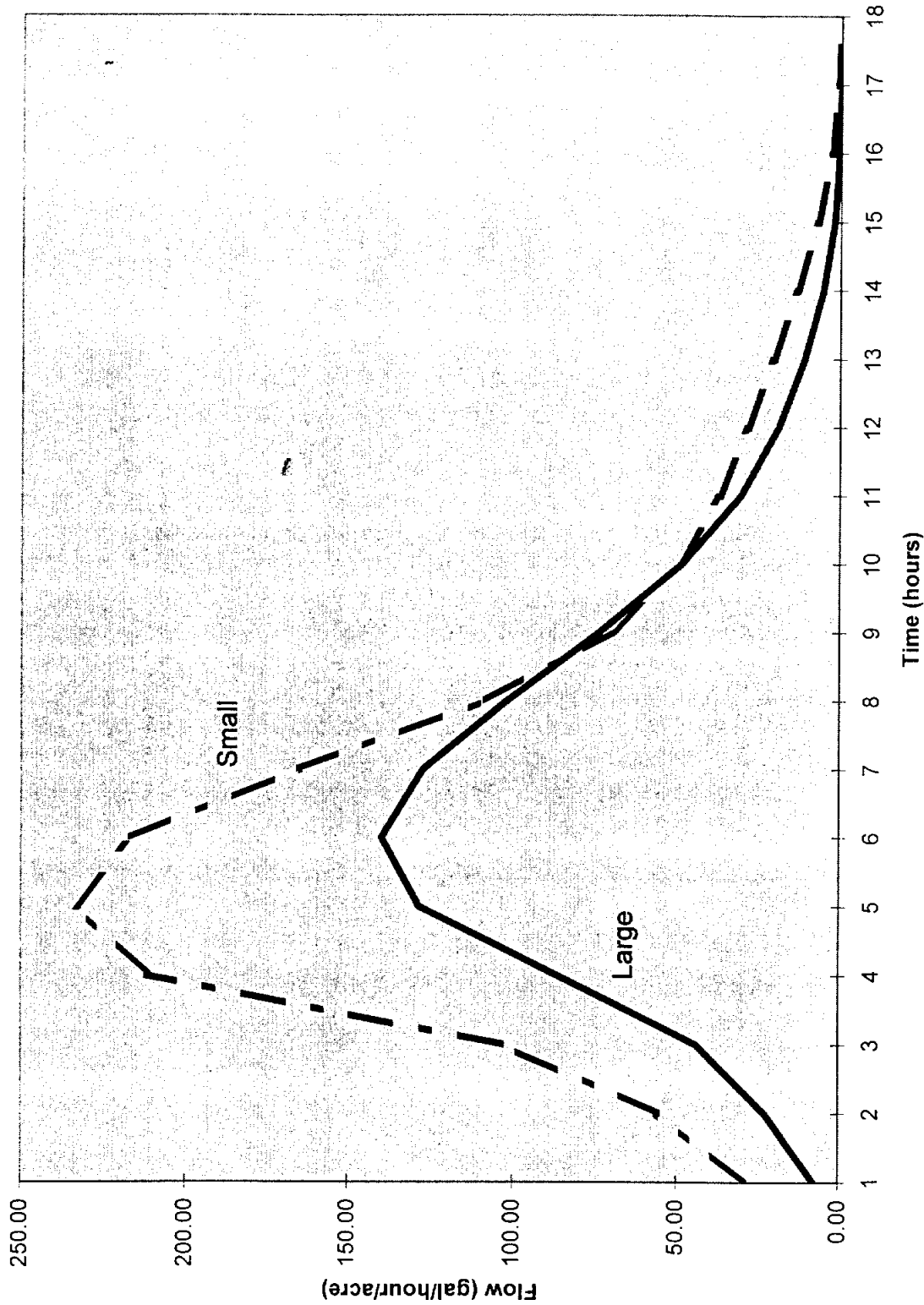
**RDII - Mixed (Moderate Single Family), MX-2**



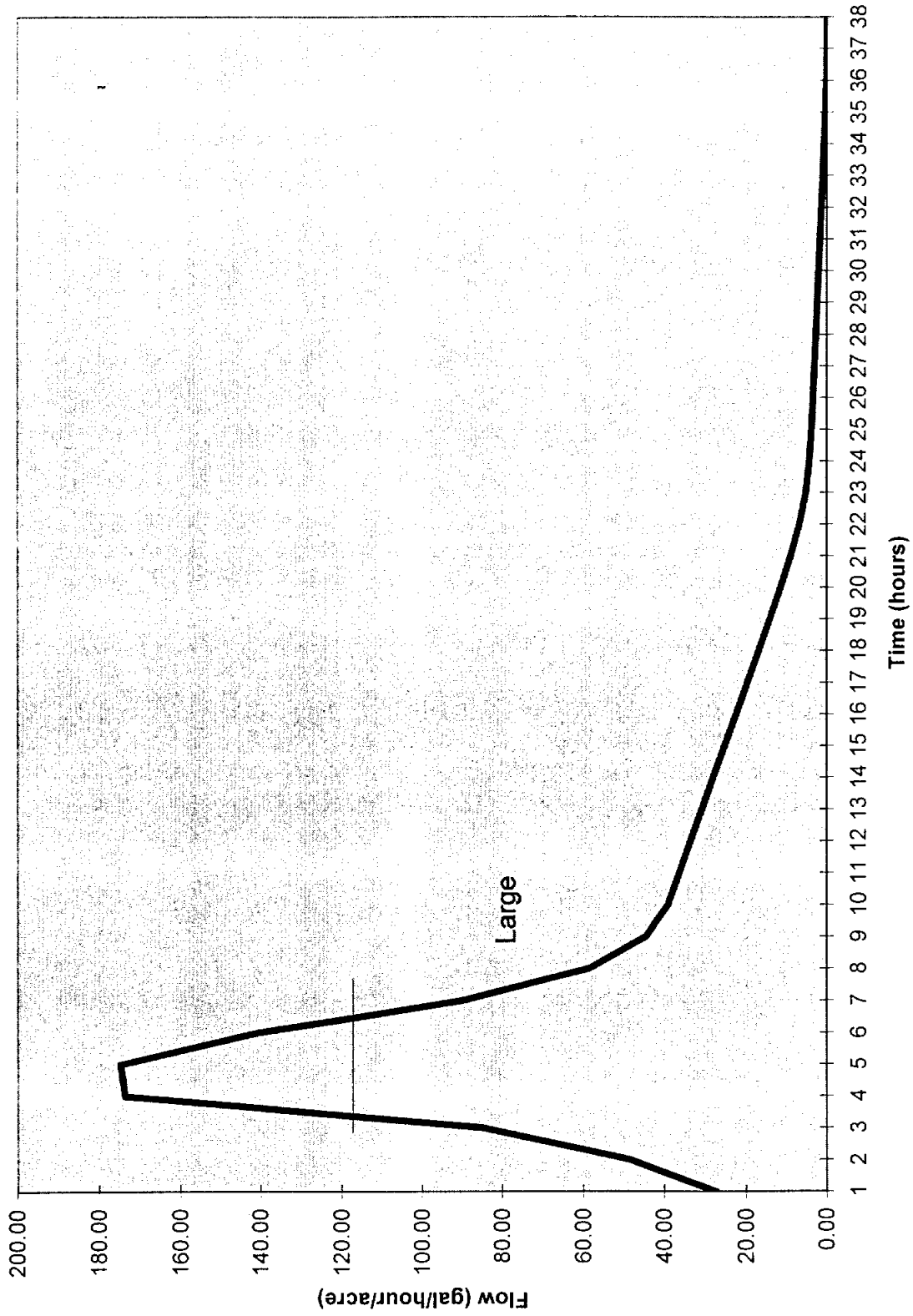
RDII - Mixed (Heavy Single Family), MX-3



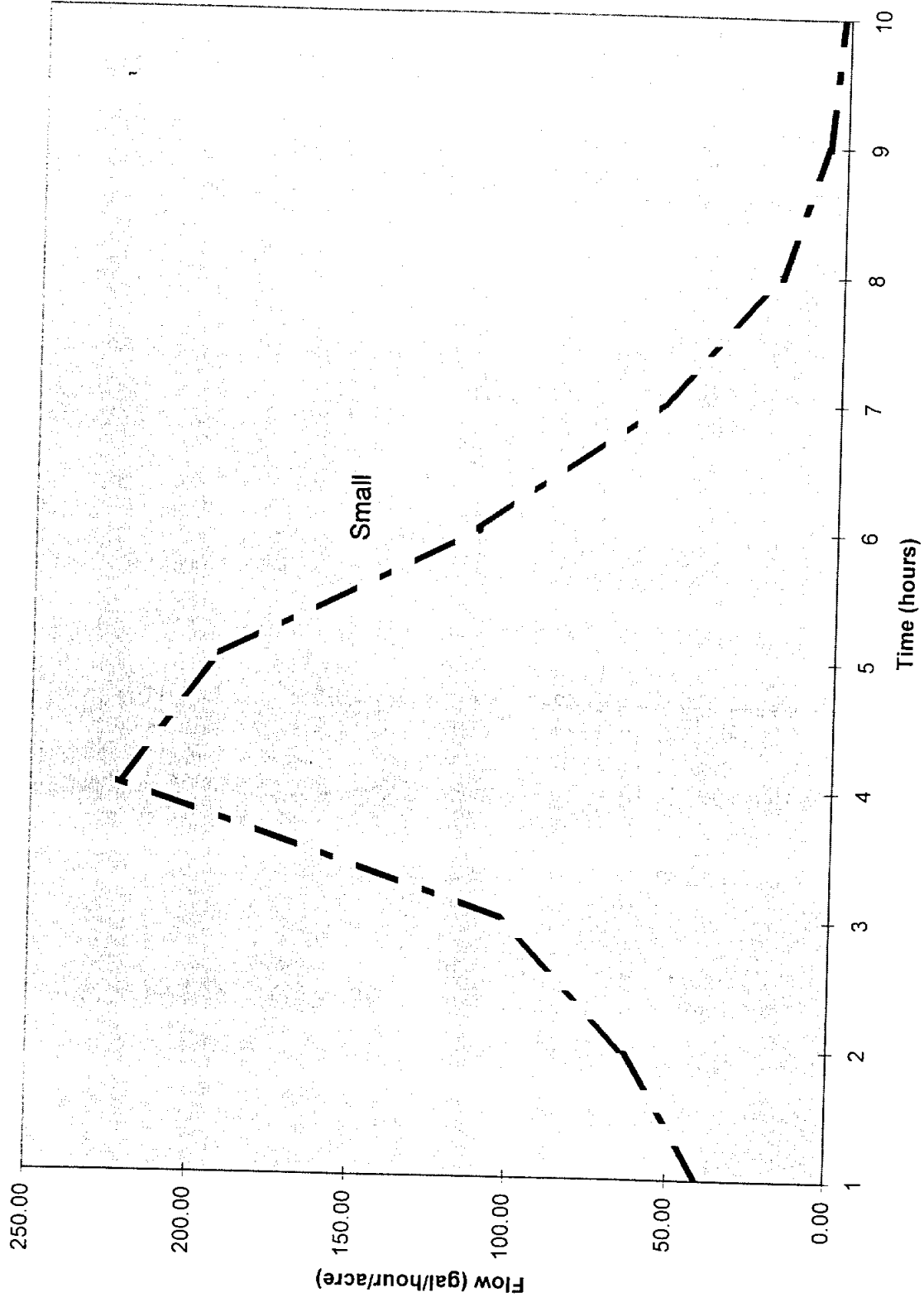
RDII - Heavy Office/ Retail, OR-1



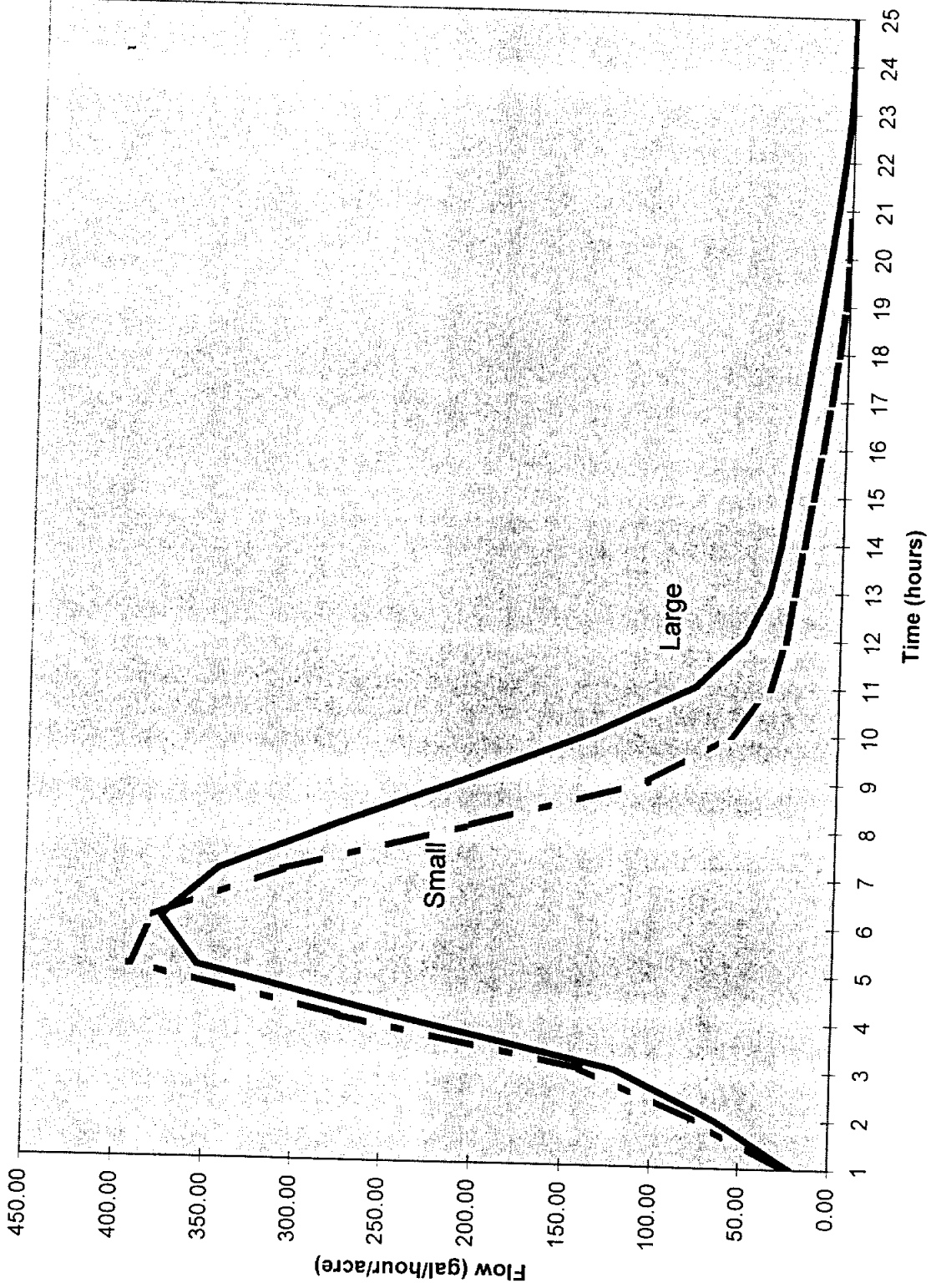
RDII - Moderate Office/ Retail, OR-2



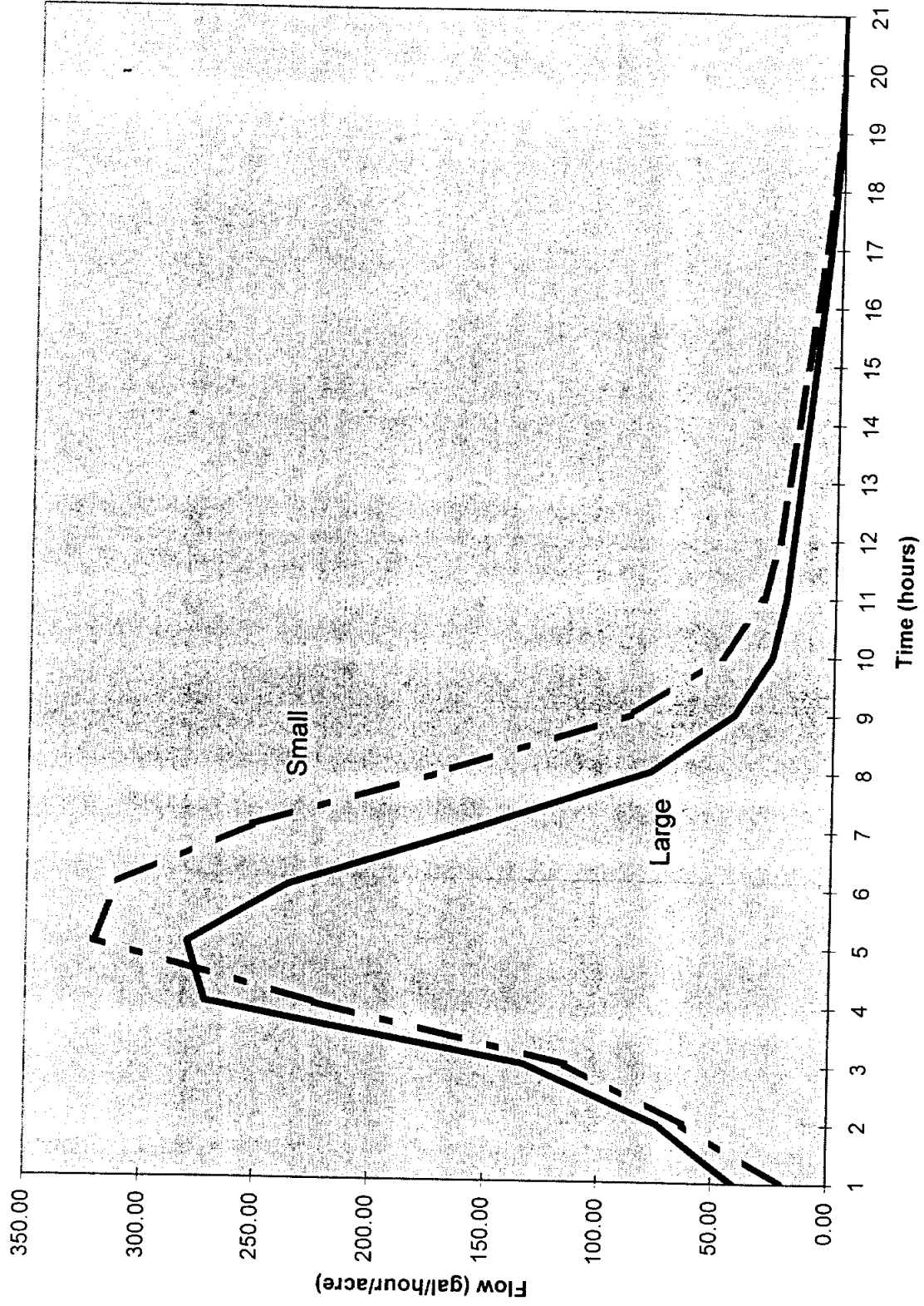
RDII - Light Office/ Retail, OR-3



RDII - Single Family Residential Pre-1950, SF-1A



RDII - Single Family Residential Post -1950



**TAB 7**

**BIG FOSSIL SEWER STUDY  
PROPOSED SEWER PIPE SIZES,  
HYDRAULIC TABLES, AND  
PRELIMINARY COST ESTIMATES**



### **Flow Calibration Methodology:**

Table "CALIB-1", which follows this page, shows the equations used for calibrating the flow discharge projections for the years 2000, 2005, 2010, 2015, 2020, 2050, and 2070 to the Fort Worth Sanitary Sewer Master Plan based on existing year 2000 conditions, and projected year 2020 conditions.

The equivalent populations and sewered areas are presented in the "Fort Worth Sub-Area Projections" table under TAB 5 of the report. The equivalent population used for year 2000 is 57,207.5, and the sewered area is 9,004.81 acres. These population and area values are associated with only the existing Big Fossil Watershed area which the City of Fort Worth Outfall Sewer line currently serves. This area included Fort Worth and Haltom City, but does not include North Richland Hills or Richland Hills which are currently served by the T.C.W.S.C. Outfall Line.

The year 2000 peak flow rate of 32.22 used in the calibration model is based on a peak flow of 42.22 MGD, (less 10 MGD for the Intel Site), shown in the Fort Worth Master Plan hydraulics table labeled "Appendix D, 2020 Model Results, 5 Year Storm, 5 Year Gwi", pages 192 and 193, under the column labeled "Existing Piping 2000 Maxflow (MGD)". A copy of this table is attached.

The equivalent population used for the year 2020 is 93,287.50, and the associated sewered area is 20,881.33. These population and area values are based on the entire Big Fossil Watershed area, less the NRH and Richland Hills areas, plus the Marine Creek area.

The year 2020 peak flow rate of 80.17 used in the calibration model is based on a peak flow of 90.17, (less 10 MGD for the Intel Site), shown in the attached Master Plan hydraulics table.

The calibration equations developed using the methods discussed herein are used for all the other hydraulic tables included in the Big Fossil Sanitary Sewer System report for design conditions which differ from the baseline conditions shown.

Population and area values for the T.C.W.S.C. line are also shown on Table "CALIB-1". Following this table, a detailed discussion of Tables "7-0" and "7-0a" is presented.

**FORMULA FOR CALIBRATION OF WATERSHED FLOW MODEL  
BASED ON EQUIVALENT POPULATION AND SEWERED AREAS  
USING RESULTS OF FORT WORTH MASTER PLAN HYDROWORKS MODEL**

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Year 2000 Model:  $A \times (2000 \text{ Equiv. Pop.}) + B \times (2000 \text{ Sewered Area}) = 2000 \text{ Peak Modeled Flow}$

Year 2020 Model:  $A \times (2020 \text{ Equiv. Pop.}) + B \times (2020 \text{ Sewered Area}) = 2020 \text{ Peak Modeled Flow}$

**City of Fort Worth Outfall Line:**

|                      | <u>Year 2000</u> | <u>Year 2020</u> |
|----------------------|------------------|------------------|
| Equiv. Population:   | 57207.5          | 93287.5          |
| Total Sewered Acres: | 9004.81          | 20981.33         |

Peak Flow (MGD): 32.22 80.17

$$A \text{ EP}2000 + B \text{ SA}2000 = \text{PF}2000$$

$$A \text{ EP}2020 + B \text{ SA}2020 = \text{PF}2020$$

NOTE: 10 MGD Intel Q Subtracted  
from Year 2020 Peak Flow.  
Marine Creek area included  
in 2020 Flows.

$$A = [ (\text{PF}2020/\text{SA}2020) - (\text{PF}2000/\text{SA}2000) ] / [ (\text{EP}2020/\text{SA}2020) - (\text{EP}2000/\text{SA}2000) ]$$

$$B = ( \text{PF}2000 - A \text{ EP}2000 ) / \text{SA} 2000$$

$$A = -0.000127 \quad B = 0.0043875$$

CHECK:

$$\text{PF}2000 = A \times \text{EP}2000 + B \times \text{SA}2000$$

$$\text{PF}2020 = A \times \text{EP}2020 + B \times \text{SA}2020$$

$$\text{PF}2000 = 32.22$$

$$\text{PF} 2020 = 80.17$$

**T.C.W.S.C. Outfall Line:**

|                      | <u>Year 2000</u> | <u>Year 2020</u> |
|----------------------|------------------|------------------|
| Equiv. Population:   | 17,430.50        | 20,657.50        |
| Total Sewered Acres: | 2,550.82         | 2,764.11         |
| Peak Flow (MGD):     | 11.39            | 19.42            |

$$A \text{ EP}2000 + B \text{ SA}2000 = \text{PF}2000$$

$$A \text{ EP}2020 + B \text{ SA}2020 = \text{PF}2020$$

$$A = [ (\text{PF}2020/\text{SA}2020) - (\text{PF}2000/\text{SA}2000) ] / [ (\text{EP}2020/\text{SA}2020) - (\text{EP}2000/\text{SA}2000) ]$$

$$B = ( \text{PF}2000 - A \text{ EP}2000 ) / \text{SA} 2000$$

$$A = 0.004 \quad B = -0.022866$$

CHECK:

$$\text{PF}2000 = A \times \text{EP}2000 + B \times \text{SA}2000$$

$$\text{PF}2020 = A \times \text{EP}2020 + B \times \text{SA}2020$$

$$\text{PF}2000 = 11.39$$

$$\text{PF} 2020 = 19.42$$

Discussion of the year 2000 baseline calibration table, "7-0":

**Upstream and Downstream Stations** -- these stations correspond to the same station numbers used in the Fort Worth Master Plan report and are shown on the attached Appendix "D" table on pages 192, and 193, for the line segment between the Fort Worth West Fork 96" S.S. and Broadway Blvd. The Richland Hills meter is located below Station M402A/0040+28, which is delineated with a horizontal line.

**Length (ft.)** -- The length of each line segment is shown, and corresponds to the Master Plan length. It is assumed that the proposed parallel line will be roughly equivalent in length to the existing line.

**Existing Diameter (in)** -- The existing pipe diameter is noted. The siphon section has been changed to show the revised pipe diameter of 50.71-inches which is equivalent to the existing parallel 24-inch and 48-inch diameter siphon pipes. The Fort Worth Master Plan table only shows the 24-inch pipe.

**Existing Pipe Capacity (MGD)** -- This is the computed capacity of the existing pipe based on the Colbrook-White equations. Capacities of the proposed replacement and parallel pipes are based on the Mannings Equation, and compare favorably with the results of the Colbrook-White equation when using existing pipe flowline grades for the hydraulic slope and a Mannings "n" factor of 0.0145.

**2000 Model Flow (MGD)** -- This column shows the flow rates presented in the Fort Worth Master Plan for the year 2000. These flows include a uniform 10 MGD rate for the Intel Plant Site. The 10 MGD is subtracted from each flow value before computing the calibration coefficients "A" and "B", which are based only on equivalent population and sewered areas. The equivalent population of 57,207.5 and sewered area of 9,004.81 are shown at the bottom of this column.

**2020 Model Flow (MGD)** -- These flow rates correspond to the projected flows in the year 2020 from the Fort Worth Master Plan. The equivalent population of 93,287.50 and sewered area of 20,981.33 are shown at the bottom of this column. The flow rates vary from a minimum of 18.71 MGD to a maximum flow of **42.22 MGD**. The value of **42.22 MGD** was the basis for the calibration equation.

**2000 Coefficient "A"** -- This is the first coefficient in the calibration equation and is computed for each line segment based on the year 2000 Master Plan modeled flow using the formula presented in Table "CALIB-1".

**2000 Coefficient "B"** -- This is the second coefficient in the calibration equation and is computed for each line segment based on the year 2000 Master Plan modeled flow using the formula presented in Table "CALIB-1".

**Model Proposed Diameter (In.)** -- This is the proposed replacement pipe diameter for the year 2020 condition as presented in the Fort Worth Master Plan Appendix "D" table.

**Design Hydraulic Gradient Slope (Ft./Foot)** -- This is the average flowline grade of the existing pipe between major line segments. It is assumed that the proposed replacement and parallel pipes will follow the approximate grade of the existing line. This grade is based on pipe flowline elevations and line segment lengths presented in the Fort Worth Master Plan Appendix "D" table.

**2000 Design Flow (MGD)** -- The year 2000 design flow values are computed using the calibration equations discussed above, and are equivalent to the existing year 2000 flows listed in the column "2000 Model Flow". The value used for equivalent population of 57,207.50 and sewered area of 9,004.81 acres is the same as the model 2000 flow values, and the results of the flow rate calculations confirms that the calibration equations are correct. The flow rates vary from a minimum of 18.71 MGD to a maximum flow of **42.22 MGD**, which agree with the year 2000 model flows.

**Proposed Replacement Pipe Diameter (In.)** -- The proposed replacement pipe diameters shown are set equal to the existing pipe diameters for purposes of comparing the existing pipe capacities shown in the Master Plan versus the computed capacities calculated using the Mannings Equation and existing pipe flowline slopes.

**Replacement Pipe Capacity (MGD)** -- This column shows the computed replacement pipe capacity using the existing pipe flowline grade and a Mannings Equation "n" factor of 0.0145. Note that these capacities compare favorably with the existing pipe capacities shown in the Master Plan using the Colbrook-White equations, except for the very downstream end and the siphon section. Average grades through these two line segments are used for calculations in this column.

**Proposed Parallel Pipe Diameter (In.)** -- No proposed parallel pipe is recommended for the existing year 2000 conditions since the existing pipe has sufficient capacity to handle existing flow rates based on the Fort Worth year 2000 model flows shown.

**Parallel Pipe Capacity (MGD)** -- This column shows the computed parallel pipe capacity using the existing pipe flowline grade and a Mannings Equation "n" factor of 0.0145. See the year 2020 table for capacity calculations for the 2020 design conditions.

**Combined Capacity of Both Pipes (MGD)** -- This is the sum of the existing pipe capacity, from the Master Plan, plus the proposed replacement pipe capacity. This value should generally exceed the Design Flow rate, which it does for most line segments within the study limits.

**Estimated Replacement Pipe Costs** -- This is the estimated pipe replacement costs in current year 2000 dollars based on an average estimated unit price of \$0.125 per square inch of pipe diameter.

**Estimated Parallel Pipe Costs** -- This is the estimated pipe replacement costs in current year 2000 dollars based on an average estimated unit price of \$0.125 per square inch of pipe diameter.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA (in) | DESIGN H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PROF. PIPE (in) | P.A.R.L. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|-----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------|--------------------------|-----------------|------------------------|-------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0013        | 0.0094         | 90                   | 0.000800                    | 18.94                  | 54                    | 32.38                 | 0               | 0.00            | 0.00                     | 222.11          | \$29,200.29            | \$0.00                  |
| M402A0020+17          | M402A0000+50            | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0014        | 0.0099         | 90                   | 0.000800                    | 18.71                  | 54                    | 32.38                 | 0               | 0.00            | 0.00                     | 34.03           | 494,114.77             | 0.00                    |
| M402A0020+17          | M402A0020+17            | 73            | 50.71           | -70.57                 | 18.71                 | 86.61                 | -0.0014        | 0.0099         | 90                   | 0.000800                    | 18.71                  | 50.71                 | 27.38                 | 0               | 0.00            | 0.00                     | -70.57          | 18,429.33              | 0.00                    |
| M402A0022+40 (24+48)  | M402A0000+50            | 150           | 50.71           | 0.00                   | 18.71                 | 86.61                 | -0.0014        | 0.0099         | 90                   | 0.000800                    | 18.71                  | 50.71                 | 27.38                 | 0               | 0.00            | 0.00                     | 0.00            | 37,668.49              | 0.00                    |
| M402A0022+40 (24+48)  | M402A0022+40            | 69            | 50.71           | 74.31                  | 18.71                 | 86.64                 | -0.0014        | 0.0099         | 90                   | 0.000800                    | 18.71                  | 50.71                 | 27.38                 | 0               | 0.00            | 0.00                     | 74.31           | 17,419.51              | 0.00                    |
| M402A0023+09 (24+48)  | M402A0023+09            | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0014        | 0.0100         | 90                   | 0.000800                    | 18.78                  | 54                    | 32.38                 | 0               | 10.00           | 0.00                     | 25.04           | 249,061.33             | 0.00                    |
| M402A0032+40          | M402A0028+40            | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0014        | 0.0101         | 90                   | 0.000800                    | 18.81                  | 54                    | 32.38                 | 0               | 0.00            | 0.00                     | 35.67           | 114,224.68             | 0.00                    |
| M402A0036+79          | M402A0032+40            | 433           | 54              | 32.38                  | 18.87                 | 87.84                 | -0.0014        | 0.0101         | 90                   | 0.000800                    | 18.87                  | 54                    | 33.01                 | 0               | 0.00            | 0.00                     | 32.38           | 123,958.11             | 0.00                    |
| M402A0040+28          | M402A0036+79            | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0014        | 0.0101         | 84                   | 0.000665                    | 18.92                  | 54                    | 29.52                 | 0               | 0.00            | 0.00                     | 29.03           | 103,346.14             | 0.00                    |
| M402A0045+95          | M402A0040+28            | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0014        | 0.0101         | 84                   | 0.000694                    | 18.97                  | 54                    | 34.24                 | 0               | 0.00            | 0.00                     | 33.82           | 160,029.06             | 0.00                    |
| M402A0049+00          | M402A0045+95            | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0014        | 0.0101         | 84                   | 0.000651                    | 18.99                  | 54                    | 29.22                 | 0               | 0.00            | 0.00                     | 28.71           | 87,867.16              | 0.00                    |
| M402A0051+91          | M402A0049+00            | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0014        | 0.0101         | 84                   | 0.000794                    | 18.99                  | 54                    | 32.25                 | 0               | 0.00            | 0.00                     | 31.72           | 72,141.90              | 0.00                    |
| M402A0054+21          | M402A0051+91            | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0014        | 0.0101         | 84                   | 0.000980                    | 19.06                  | 54                    | 35.85                 | 0               | 0.00            | 0.00                     | 35.19           | 73,000.73              | 0.00                    |
| M402A0060+68          | M102A0054+21            | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0007        | 0.0068         | 84                   | 0.000698                    | 31.63                  | 54                    | 30.24                 | 0               | 0.00            | 0.00                     | 29.72           | 184,648.92             | 0.00                    |
| M402A0061+67          | M402A0060+68            | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0007        | 0.0069         | 84                   | 0.000824                    | 31.61                  | 54                    | 32.54                 | 0               | 0.00            | 0.00                     | 31.88           | 28,341.46              | 0.00                    |
| M402A0065+95          | M402A0061+67            | 691           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0007        | 0.0069         | 84                   | 0.000781                    | 31.54                  | 54                    | 32.85                 | 0               | 0.00            | 0.00                     | 32.39           | 146,001.47             | 0.00                    |
| M402A0072+77          | M402A0065+95            | 808           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0007        | 0.0069         | 84                   | 0.000817                    | 31.50                  | 54                    | 32.72                 | 0               | 0.00            | 0.00                     | 31.52           | 197,817.68             | 0.00                    |
| M402A0080+78          | M402A0072+77            | 400           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0007        | 0.0070         | 84                   | 0.000817                    | 31.45                  | 54                    | 32.72                 | 0               | 0.00            | 0.00                     | 32.23           | 231,312.13             | 0.00                    |
| M402A0085+50          | M402A0080+78            | 151           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0007        | 0.0070         | 84                   | 0.000800                    | 31.43                  | 54                    | 32.38                 | 0               | 0.00            | 0.00                     | 35.67           | 114,510.96             | 0.00                    |
| M402A0086+56          | M402A0085+50            | 168           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0007        | 0.0070         | 84                   | 0.000800                    | 31.43                  | 54                    | 24.98                 | 0               | 0.00            | 0.00                     | 29.26           | 43,227.89              | 0.00                    |
| M402A0088+51          | M402A0086+56            | 188           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0007        | 0.0070         | 84                   | 0.000476                    | 31.45                  | 54                    | 24.98                 | 0               | 0.00            | 0.00                     | 24.42           | 48,094.60              | 0.00                    |
| M402A0096+65          | M402A0088+51            | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0007        | 0.0070         | 84                   | 0.000793                    | 31.56                  | 54                    | 32.23                 | 0               | 0.00            | 0.00                     | 31.72           | 234,747.46             | 0.00                    |
| M402A0103+76          | M402A0096+65            | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0007        | 0.0070         | 84                   | 0.000380                    | 31.63                  | 54                    | 22.31                 | 0               | 0.00            | 0.00                     | 21.89           | 203,543.22             | 0.00                    |
| M402A0105+11          | M402A0103+76            | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0007        | 0.0070         | 84                   | 0.001360                    | 31.66                  | 54                    | 42.22                 | 0               | 0.00            | 0.00                     | 53.47           | 38,647.45              | 0.00                    |
| M402A0109+91          | M402A0105+11            | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0007        | 0.0070         | 84                   | 0.001360                    | 31.70                  | 54                    | 42.22                 | 0               | 0.00            | 0.00                     | 25.08           | 31,025.85              | 0.00                    |
| M402A0113+81          | M402A0109+91            | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0007        | 0.0070         | 84                   | 0.001217                    | 31.77                  | 54                    | 39.94                 | 0               | 0.00            | 0.00                     | 39.39           | 98,765.70              | 0.00                    |
| M402A0117+43          | M402A0113+81            | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | -0.0001        | 0.0044         | 84                   | 0.001309                    | 42.22                  | 54                    | 41.43                 | 0               | 0.00            | 0.00                     | 40.78           | 198,962.79             | 0.00                    |
| M402A0120+25          | M402A0117+43            | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | -0.0001        | 0.0044         | 84                   | 0.001349                    | 42.22                  | 54                    | 42.05                 | 0               | 0.00            | 0.00                     | 41.74           | 36,070.95              | 0.00                    |
| M402B0123+40          | M402A0120+25            | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0001        | 0.0044         | 84                   | 0.001071                    | 42.20                  | 54                    | 37.47                 | 0               | 0.00            | 0.00                     | 36.97           | 88,173.44              | 0.00                    |
| M402B0136+74          | M402B0123+40            | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0005        | 0.0055         | 66                   | 0.002647                    | 33.78                  | 48                    | 43.02                 | 0               | 0.00            | 0.00                     | 31.40           | 262,385.60             | 0.00                    |

DESIGN CONDITION: OPTION NO. 0  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50  
 F.W. Model Sew. Ac. = 9,004.81  
 Constant Intel Flow = 10.00  
 2000 Eq. Pop. = 57,207.50  
 2000 Sew. Ac. = 9,004.81  
 Constant Intel Flow = 10.00  
 TOTAL ESTIM. CONST. COST = \$3,966,959.05  
 + Engr., ROW, Financ., Conting. (1.5x) = \$5,950,438.57  
 Avg. Estimated Per Foot Cost = \$420.97

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 DESIGN H.G. SLOPE  
 DESIGN FLOW  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGD =  $[D^4(8/3) \times s^{1/2}] / 1629.6 \times n / 1.54$   
 PROPOSED PARALLEL PIPE CAPACITY IN MGD =  $[D^4(8/3) \times s^{1/2}] / 1629.6 \times n / 1.54$   
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) X \$0.125/SQ. IN. X LENGTH (FT)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) X \$0.125/SQ. IN. X LENGTH (FT)

OPTION 0  
 Exist. 2000 Conditions Big Fossil C.O.F.W. Line  
 Serving Fort Worth, Haltom City (not including Little Fossil), and estimated 10.0 MGD flow from the Intel Facility Plant. Future BFX area and Marine Creek areas not included in this scenario.  
 This is baseline 2000 Condition from the Fort Worth Sanitary Sewer Master Plan.  
 Estim. Cost Above R.H. Meter = \$2,779,336.40  
 Estim. Cost Below R.H. Meter = \$1,187,622.65  
 Percent R.H. Cost of Total Line = 29.94%  
 Estim. Richland Hills Cost Share = \$1,781,433.98

**Discussion of the year 2020 baseline calibration table, "7-0a":**

**Upstream and Downstream Stations** -- these stations correspond to the same station numbers used in the Fort Worth Master Plan report and are shown on the attached Appendix "D" table on pages 192, and 193, for the line segment between the Fort Worth West Fork 96" S.S. and Broadway Blvd. The Richland Hills meter is located below Station M402A/0040+28, which is delineated with a horizontal line.

**Length (ft.)** -- The length of each line segment is shown, and corresponds to the Master Plan length. It is assumed that the proposed parallel line will be roughly equivalent in length to the existing line.

**Existing Diameter (in)** -- The existing pipe diameter is noted. The siphon section has been changed to show the revised pipe diameter of 50.71-inches which is equivalent to the existing parallel 24-inch and 48-inch diameter siphon pipes. The Fort Worth Master Plan table only shows the 24-inch pipe.

**Existing Pipe Capacity (MGD)** -- This is the computed capacity of the existing pipe based on the Colbrook-White equations. Capacities of the proposed replacement and parallel pipes are based on the Mannings Equation, and compare favorably with the results of the Colbrook-White equation when using existing pipe flowline grades for the hydraulic slope and a Mannings "n" factor of 0.0145.

**2000 Model Flow (MGD)** -- This column shows the flow rates presented in the Fort Worth Master Plan for the year 2000. These flows include a uniform 10 MGD rate for the Intel Plant Site. The 10 MGD is subtracted from each flow value before computing the calibration coefficients "A" and "B", which are based only on equivalent population and sewered areas. The equivalent population of 57,207.5 and sewered area of 9,004.81 are shown at the bottom of this column.

**2020 Model Flow (MGD)** -- These flow rates correspond to the projected flows in the year 2020 from the Fort Worth Master Plan. The equivalent population of 93,287.50 and sewered area of 20,981.33 are shown at the bottom of this column. The flow rates vary from a minimum of 18.71 MGD to a maximum flow of **42.22 MGD**. The value of **42.22 MGD** was the basis for the calibration equation.

**2020 Coefficient "A"** -- This is the first coefficient in the calibration equation and is computed for each line segment based on the year 2020 Master Plan modeled flow using the formula presented in Table "CALIB-1".

**2020 Coefficient "B"** -- This is the second coefficient in the calibration equation and is computed for each line segment based on the year 2020 Master Plan modeled flow using the formula presented in Table "CALIB-1".

**Model Proposed Diameter (In.)** -- This is the proposed replacement pipe diameter for the year 2020 condition as presented in the Fort Worth Master Plan Appendix "D" table.

**Design Hydraulic Gradient Slope (Ft./Foot)** -- This is the average flowline grade of the existing pipe between major line segments. It is assumed that the proposed replacement and parallel pipes will follow the approximate grade of the existing line. This grade is based on pipe flowline elevations and line segment lengths presented in the Fort Worth Master Plan Appendix "D" table.

**2020 Design Flow (MGD)** -- The year 2020 design flow values are computed using the calibration equations discussed above, and are equivalent to the year 2020 flows listed in the column "2020 Maxflow (MGD)". The value used for equivalent population of 93,287.50 and sewered area of 20,981.33 acres is the same as the model 2020 flow values, and the results of the flow rate calculations confirms that the calibration equations are correct. The flow rates vary from a minimum of 83.61 MGD to a maximum flow of **90.17 MGD**, which agree with the year 2020 model flows.

**Proposed Replacement Pipe Diameter (In.)** -- The proposed replacement pipe diameters shown are set equal to the proposed Master Plan pipe diameters for purposes of comparing the design pipe capacities shown in the Master Plan versus the computed capacities calculated using the Mannings Equation and existing pipe flowline slopes.

**Replacement Pipe Capacity (MGD)** -- This column shows the computed replacement pipe capacity using the existing pipe flowline grade and a Mannings Equation "n" factor of 0.0145. Note that these capacities compare favorably with the design pipe capacities shown in the Master Plan using the Colbrook-White equations, except for the very downstream end and the siphon section. Average grades through these two line segments are used for calculations in this column.

**Proposed Parallel Pipe Diameter (In.)** -- The proposed parallel pipe diameters recommended for the year 2020 design conditions are the same as those shown in the Master Plan for purposes of comparison.

**Parallel Pipe Capacity (MGD)** -- This column shows the computed parallel pipe capacity using the existing pipe flowline grade and a Mannings Equation "n" factor of 0.0145. These values compare favorably with the values shown in the Fort Worth Master plan Appendix "D" table.

**Combined Capacity of Both Pipes (MGD)** -- This is the sum of the existing pipe capacity, from the Master Plan, plus the proposed replacement pipe capacity. This value should generally exceed the Design Flow rate, which it does for most line segments within the study limits.

**Estimated Replacement Pipe Costs** -- This is the estimated pipe replacement costs in current year 2000 dollars based on an average estimated unit price of \$0.125 per square inch of pipe diameter.

**Estimated Parallel Pipe Costs** -- This is the estimated pipe replacement costs in current year 2000 dollars based on an average estimated unit price of \$0.125 per square inch of pipe diameter.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | DESIGN H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. PIPE (in) | REPL. PIPE (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|-----------------------------|------------------------|-----------------|------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0013        | 0.0094         | 90                    | 0.000800                    | 83.62                  | 90              | 126.44           | 78              | 86.33                 | 308.44          | \$81,111.93            | \$60,924.07            |
| M402A0020+17          | M402A0000+50            | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0014        | 0.0099         | 90                    | 0.000800                    | 86.59                  | 90              | 126.44           | 78              | 86.33                 | 120.36          | 1,372,541.04           | 1,030,930.82           |
| M402A0020+90 (24+48)  | M402A0020+17            | 73            | 50.71            | -70.57                 | 18.71                 | 86.61                 | -0.0014        | 0.0099         | 90                    | 0.000800                    | 86.61                  | 90              | 126.44           | 90              | 126.44                | 55.87           | 58,050.69              | 58,050.69              |
| M402A0022+40 (24+48)  | M402A0020+90            | 150           | 50.71            | 0.00                   | 18.71                 | 86.61                 | -0.0014        | 0.0099         | 90                    | 0.000800                    | 86.61                  | 90              | 126.44           | 90              | 126.44                | 126.44          | 119,282.25             | 119,282.25             |
| M402A0023+09 (24+48)  | M402A0022+40            | 69            | 50.71            | 74.31                  | 18.71                 | 86.64                 | -0.0014        | 0.0099         | 90                    | 0.000800                    | 86.64                  | 90              | 126.44           | 90              | 126.44                | 200.75          | 54,869.83              | 54,869.83              |
| M402A0028+40          | M402A0023+09            | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0014        | 0.0100         | 90                    | 0.000800                    | 87.43                  | 90              | 126.44           | 78              | 86.33                 | 111.37          | 691,837.02             | 519,646.47             |
| M402A0032+40          | M402A0028+40            | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0014        | 0.0101         | 90                    | 0.000800                    | 87.66                  | 90              | 126.44           | 78              | 86.33                 | 122.00          | 317,290.77             | 238,320.62             |
| M402A0036+79          | M402A0032+40            | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0014        | 0.0101         | 84                    | 0.000831                    | 87.84                  | 84              | 107.24           | 66              | 55.37                 | 88.76           | 299,948.02             | 185,171.99             |
| M402A0040+28          | M402A0036+79            | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0014        | 0.0101         | 84                    | 0.000655                    | 87.96                  | 84              | 95.89            | 66              | 50.41                 | 79.44           | 250,072.13             | 154,381.27             |
| M402A0045+95          | M402A0040+28            | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0014        | 0.0101         | 84                    | 0.000894                    | 88.07                  | 84              | 111.23           | 66              | 58.47                 | 92.29           | 387,230.81             | 239,055.76             |
| M402A0049+00          | M402A0045+95            | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0014        | 0.0101         | 84                    | 0.000651                    | 88.14                  | 84              | 94.93            | 66              | 49.90                 | 78.61           | 212,665.22             | 131,286.22             |
| M402A0051+91          | M402A0049+00            | 252           | 54               | 31.72                  | 18.98                 | 88.19                 | -0.0014        | 0.0101         | 84                    | 0.000794                    | 88.19                  | 84              | 104.77           | 66              | 55.08                 | 86.80           | 174,565.59             | 107,767.53             |
| M402A0054+21          | M402A0051+91            | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0014        | 0.0101         | 84                    | 0.000980                    | 88.23                  | 84              | 116.45           | 66              | 61.21                 | 96.40           | 176,643.75             | 108,050.48             |
| M402A0060+68          | M402A0054+21            | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0007        | 0.0068         | 84                    | 0.000698                    | 88.35                  | 84              | 98.24            | 66              | 51.64                 | 81.36           | 446,804.78             | 275,633.57             |
| M402A0061+67          | M402A0060+68            | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0007        | 0.0068         | 84                    | 0.000824                    | 88.37                  | 84              | 105.72           | 66              | 55.57                 | 87.45           | 68,579.34              | 42,337.24              |
| M402A0065+95          | M402A0061+67            | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0007        | 0.0069         | 84                    | 0.000824                    | 88.46                  | 84              | 106.73           | 66              | 56.10                 | 88.49           | 353,287.50             | 218,100.96             |
| M402A0072+77          | M402A0065+95            | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0007        | 0.0069         | 84                    | 0.000781                    | 88.60                  | 84              | 103.97           | 66              | 54.65                 | 86.17           | 478,669.93             | 295,505.42             |
| M402A0080+78          | M402A0072+77            | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0007        | 0.0070         | 84                    | 0.000817                    | 88.80                  | 84              | 106.29           | 66              | 55.30                 | 88.10           | 559,718.24             | 345,540.34             |
| M402A0085+50          | M402A0080+78            | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0007        | 0.0070         | 84                    | 0.000800                    | 88.89                  | 84              | 105.19           | 66              | 55.30                 | 90.97           | 277,088.24             | 171,059.58             |
| M402A0086+56          | M402A0085+50            | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0007        | 0.0070         | 84                    | 0.000800                    | 88.94                  | 84              | 105.19           | 66              | 55.30                 | 84.56           | 104,600.81             | 64,574.99              |
| M402A0088+51          | M402A0086+56            | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0007        | 0.0070         | 84                    | 0.000476                    | 88.99                  | 84              | 81.16            | 66              | 42.66                 | 67.08           | 116,377.06             | 71,845.02              |
| M402A0096+65          | M402A0088+51            | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0007        | 0.0070         | 84                    | 0.000793                    | 89.19                  | 84              | 104.71           | 66              | 55.04                 | 86.76           | 568,030.89             | 350,672.13             |
| M402A0103+76          | M402A0096+65            | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0007        | 0.0070         | 84                    | 0.000380                    | 89.37                  | 84              | 72.48            | 66              | 38.10                 | 59.99           | 492,524.34             | 304,058.40             |
| M402A0105+11          | M402A0103+76            | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0007        | 0.0070         | 84                    | 0.001360                    | 89.42                  | 84              | 137.15           | 66              | 72.10                 | 125.57          | 93,517.28              | 57,732.61              |
| M402A0109+91          | M402A0105+11            | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0007        | 0.0070         | 84                    | 0.001360                    | 89.67                  | 84              | 137.15           | 66              | 72.10                 | 97.18           | 559,025.52             | 345,112.69             |
| M402A0113+81          | M402A0109+91            | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0007        | 0.0070         | 84                    | 0.001217                    | 89.76                  | 84              | 129.76           | 66              | 68.21                 | 107.60          | 238,988.61             | 147,538.88             |
| M402A0117+43          | M402A0113+81            | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0001        | 0.0044         | 84                    | 0.001309                    | 90.01                  | 84              | 134.58           | 66              | 70.74                 | 111.52          | 481,440.81             | 297,216.01             |
| M402A0120+25          | M402A0117+43            | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0001        | 0.0044         | 84                    | 0.001349                    | 90.06                  | 84              | 136.61           | 66              | 71.81                 | 113.55          | 87,282.79              | 53,883.77              |
| M402B0123+40          | M402A0120+25            | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0001        | 0.0044         | 84                    | 0.001071                    | 90.17                  | 84              | 121.74           | 66              | 63.99                 | 100.96          | 213,357.94             | 131,715.87             |
| M402B0136+74          | M402B0123+40            | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0005        | 0.0055         | 66                    | 0.002647                    | 83.60                  | 66              | 100.57           | 48              | 43.02                 | 74.42           | 496,072.77             | 262,385.60             |

DESIGN CONDITION: OPTION NO. 0a  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50 2020 Eq. Pop. = 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33 2020 Sew. Ac. = 20,981.33  
 Constant Intel Flow = 10.00 Constant Intel Flow = 10.00  
 Avg. Estimated Per Foot Cost = \$1,043.31

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 LENGTH  
 Length of Pipe Segment in Feet  
 EXIST DIA  
 Existing Pipe Diameter in Inches  
 EXIST PIPE CAP  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 2000 MODEL FLOW  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 2020 MODEL FLOW  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 COEF. "A", COEF. "B"  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 MODEL PROP. DIA.  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 DESIGN H.G. SLOPE  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 PROP. REPL. PIPE  
 Proposed Replacement Pipe Capacity in MGD =  $(D^5/83) \times s^{1/2} / 1629.6 \times n / 1.54$   
 REPL. PIPE CAP.  
 Proposed Parallel Pipe Capacity in MGD =  $(D^5/83) \times s^{1/2} / 1629.6 \times n / 1.54$   
 PROP. PARL. PIPE  
 Proposed Parallel Pipe Capacity in MGD =  $(D^5/83) \times s^{1/2} / 1629.6 \times n / 1.54$   
 PARL. PIPE CAP.  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 ESTIM. REPL. PIPE COST  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (ft)  
 ESTIM. PARL. PIPE COST  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (ft)

OPTION 0a  
 Projected 2020 Conditions. Big Fossil C O F W Line  
 Serving Fort Worth, Haltom City (not including Little Fossil), BFX Area, Marine Creek, and with BFX Area, and estimated constant 10.0 MGD flow from the Inlet Facility Plant.  
 This is baseline 2020 Condition from the Fort Worth Sanitary Sewer Master Plan.

Estim. Cost Above R.H. Meter = \$6,586,472.24 \$4,022,275.07  
 Estim. Cost Below R.H. Meter = \$3,245,003.68 \$2,421,578.02  
 Percent R.H. Cost of Total Line = 33.01% 37.58%  
 Estim. Richland Hills Cost Share = \$4,867,505.52 \$3,632,367.03







FW 10 1 -  
BROADWAY  
# 8, 103, 460 \$ 5, 543, 782

| Project | Model Link | Main/UpStation | Main/DownStation | Existing | 2000 | 2020 | Parallel | Length | 2000 Cost | 2020 Cost   | Parallel Cost | Subbasin       | Group | Note |
|---------|------------|----------------|------------------|----------|------|------|----------|--------|-----------|-------------|---------------|----------------|-------|------|
| bf_cm_1 | BF000390.1 | M402A/0000+50  | M280A/0304+97    | 54       | 72   | 90   | 78       | 102    | \$46,713  | \$67,568    | \$51,645      | CDUAL          |       |      |
| bf_cm_1 | BF000400.1 | M402A/0020+17  | M402A/0000+50    | 54       | 72   | 90   | 78       | 1726   | \$790,456 | \$1,143,354 | \$873,908     | CDUAL          |       |      |
| bf_cm_1 | BF000404.1 | M402A/0020+90  | M468/0020+17     | 24       | 72   | 90   | 90       | 73     | \$33,432  | \$48,357    | \$48,357      | CDUAL          |       |      |
| bf_cm_1 | BF000406.1 | M402A/0022+40  | M402A/0020+90    | 24       | 72   | 90   | 90       | 150    | \$68,696  | \$99,365    | \$99,365      | CDUAL          |       |      |
| bf_cm_1 | BF000410.1 | M402A/0023+09  | M402A/0020+17    | 24       | 72   | 90   | 90       | 69     | \$31,600  | \$45,708    | \$45,708      | CDUAL          |       |      |
| bf_cm_1 | BF000430.1 | M402A/0032+40  | M402A/0023+09    | 54       | 72   | 90   | 78       | 870    | \$398,434 | \$576,314   | \$440,498     | CDUAL          |       |      |
| bf_cm_1 | BF000440.1 | M402A/0036+79  | M402A/0032+40    | 54       | 72   | 90   | 78       | 399    | \$182,730 | \$264,310   | \$202,022     | CDUAL          |       |      |
| bf_cm_1 | BF000450.1 | M402A/0040+28  | M402A/0036+79    | 54       | 72   | 84   | 66       | 433    | \$198,301 | \$245,411   | \$158,803     | CDUAL          |       |      |
| bf_cm_1 | BF000460.1 | M402A/0045+95  | M402A/0040+28    | 54       | 72   | 84   | 66       | 361    | \$165,327 | \$204,604   | \$132,397     | CDUAL          |       |      |
| bf_cm_1 | BF000470.1 | M402A/0049+00  | M402A/0045+95    | 54       | 72   | 84   | 66       | 559    | \$256,005 | \$316,824   | \$205,073     | CDUAL          |       |      |
| bf_cm_1 | BF000480.1 | M402A/0051+91  | M402A/0049+00    | 54       | 72   | 84   | 66       | 307    | \$140,597 | \$173,998   | \$112,592     | CDUAL          |       |      |
| bf_cm_1 | BF000490.1 | M402A/0054+21  | M402A/0051+91    | 54       | 72   | 84   | 66       | 252    | \$115,408 | \$142,826   | \$92,421      | CDUAL          |       |      |
| bf_cm_1 | BF000500.1 | M402A/0060+68  | M402A/0054+21    | 54       | 72   | 84   | 66       | 255    | \$116,782 | \$144,528   | \$93,521      | CDUAL          |       |      |
| bf_cm_1 | BF000510.1 | M402A/0061+67  | M402A/0060+68    | 54       | 72   | 84   | 66       | 645    | \$295,391 | \$365,567   | \$236,554     | CDUAL          |       |      |
| bf_cm_1 | BF000520.1 | M402A/0065+95  | M402A/0061+67    | 54       | 72   | 84   | 66       | 99     | \$45,339  | \$56,110    | \$36,308      | CDUAL          |       |      |
| bf_cm_1 | BF000530.1 | M402A/0072+77  | M402A/0065+95    | 54       | 72   | 84   | 66       | 510    | \$233,565 | \$289,053   | \$187,043     | CDUAL          |       |      |
| bf_cm_1 | BF000540.1 | M402A/0080+78  | M402A/0072+77    | 54       | 72   | 84   | 66       | 691    | \$316,457 | \$391,638   | \$253,424     | CDUAL          |       |      |
| bf_cm_1 | BF000550.1 | M402A/0085+50  | M402A/0080+78    | 54       | 72   | 84   | 66       | 808    | \$370,040 | \$457,950   | \$296,334     | CDUAL          |       |      |
| bf_cm_1 | BF000560.1 | M402A/0086+56  | M402A/0085+50    | 54       | 72   | 84   | 66       | 400    | \$183,188 | \$226,708   | \$146,700     | CDUAL          |       |      |
| bf_cm_1 | BF000570.1 | M402A/0088+51  | M402A/0086+56    | 54       | 72   | 84   | 66       | 151    | \$69,153  | \$86,582    | \$55,379      | CDUAL          |       |      |
| bf_cm_1 | BF000580.1 | M402A/0103+76  | M402A/0088+51    | 54       | 72   | 84   | 66       | 168    | \$76,939  | \$95,217    | \$61,614      | CDUAL          |       |      |
| bf_cm_1 | BF000590.1 | M402A/0105+11  | M402A/0103+76    | 54       | 72   | 84   | 66       | 820    | \$375,335 | \$464,751   | \$300,735     | CDUAL          |       |      |
| bf_cm_1 | BF000600.1 | M402A/0109+91  | M402A/0105+11    | 54       | 72   | 84   | 66       | 711    | \$325,617 | \$402,973   | \$260,759     | CDUAL          |       |      |
| bf_cm_1 | BF000610.1 | M402A/0113+81  | M402A/0109+91    | 54       | 72   | 84   | 66       | 135    | \$61,826  | \$76,514    | \$49,511      | CDUAL          |       |      |
| bf_cm_1 | BF000620.1 | M402A/0117+43  | M402A/0113+81    | 54       | 72   | 84   | 66       | 807    | \$369,582 | \$467,383   | \$295,967     | CDUAL          |       |      |
| bf_cm_1 | BF000630.1 | M402A/0120+25  | M402A/0117+43    | 54       | 72   | 84   | 66       | 345    | \$158,000 | \$195,636   | \$126,529     | CDUAL          |       |      |
| bf_cm_1 | BF000640.1 | M402B/0123+40  | M402A/0120+25    | 54       | 66   | 84   | 66       | 595    | \$254,891 | \$393,905   | \$254,891     | CDUAL          |       |      |
| bf_cm_1 | BF000650.1 | M402B/0136+74  | M402B/0123+40    | 54       | 66   | 84   | 66       | 126    | \$46,211  | \$71,413    | \$46,211      | CDUAL          |       |      |
| bf_cm_1 | BF000660.1 | M402B/0138+97  | M402B/0136+74    | 48       | 60   | 66   | 48       | 308    | \$112,959 | \$174,565   | \$112,959     | CDUAL          |       |      |
| bf_cm_1 | BF000670.1 | M402B/0145+84  | M402B/0138+97    | 48       | 60   | 66   | 48       | 1180   | \$377,151 | \$425,430   | \$266,614     | CDUAL          |       |      |
| bf_cm_1 | BF000680.1 | M402B/0151+18  | M402B/0145+84    | 48       | 60   | 66   | 48       | 214    | \$69,578  | \$78,485    | \$49,186      | CDUAL          |       |      |
| bf_cm_1 | BF000690.1 | M402B/0157+28  | M402B/0151+18    | 48       | 60   | 66   | 48       | 630    | \$204,832 | \$231,053   | \$144,799     | CDUAL          |       |      |
| bf_cm_1 | BF000700.1 | M402B/0162+84  | M402B/0157+28    | 48       | 60   | 66   | 48       | 1469   | \$477,616 | \$538,756   | \$337,635     | CDUAL          |       |      |
| bf_cm_1 | BF000710.1 | M402B/0167+42  | M402B/0162+84    | 48       | 60   | 66   | 48       | 725    | \$235,719 | \$265,894   | \$166,634     | CDUAL          |       |      |
| bf_cm_1 | BF000720.1 | M402B/0191+73  | M402B/0167+42    | 48       | 60   | 66   | 48       | 553    | \$179,797 | \$202,813   | \$127,102     | CDUAL          |       |      |
| bf_cm_1 | BF000730.1 | M402B/0193+88  | M402B/0191+73    | 48       | 60   | 66   | 48       | 2364   | \$768,607 | \$866,997   | \$543,342     | Hallom City -A |       |      |
| bf_cm_1 | BF000740.1 | M402B/0197+14  | M402B/0193+88    | 48       | 60   | 66   | 48       | 436    | \$141,757 | \$159,903   | \$100,210     | Hallom City -A |       |      |
| bf_cm_1 | BF000750.1 | M402B/0199+39  | M402B/0197+14    | 48       | 60   | 66   | 48       | 215    | \$69,903  | \$78,851    | \$49,415      | Hallom City -A |       |      |
| bf_cm_1 | BF000760.1 | M402B/0201+77  | M402B/0199+39    | 48       | 60   | 66   | 48       | 312    | \$101,441 | \$114,426   | \$71,710      | Hallom City -A |       |      |
| bf_cm_1 | BF000770.1 | M402B/0211+90  | M402B/0201+77    | 48       | 60   | 66   | 48       | 91     | \$29,567  | \$33,374    | \$20,915      | Hallom City -A |       |      |
| bf_cm_1 | BF000780.1 | M402B/0223+26  | M402B/0211+90    | 48       | 60   | 66   | 48       | 197    | \$64,051  | \$72,250    | \$45,278      | Hallom City -A |       |      |
| bf_cm_1 | BF000790.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 191    | \$62,100  | \$70,049    | \$43,899      | Hallom City -A |       |      |
| bf_cm_1 | BF000800.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 1018   | \$330,982 | \$373,352   | \$233,977     | Hallom City -A |       |      |
| bf_cm_1 | BF000810.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 877    | \$285,139 | \$321,640   | \$201,570     | Hallom City -A |       |      |
| bf_cm_1 | BF000820.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 242    | \$78,681  | \$88,754    | \$55,621      | Hallom City -A |       |      |
| bf_cm_1 | BF000830.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 417    | \$135,579 | \$152,935   | \$95,943      | Hallom City -A |       |      |

Parallel pipes were calculated based on equivalent area for 2020 pipe sizes. Minimum velocity and grade were not reviewed. Replacement or parallel pipe decisions and final pipe sizes must be determined during design.

| OPTION NO. | OPTION DESCRIPTION   | YEAR 2000 |           | YEAR 2005  |           | YEAR 2010  |           | YEAR 2015  |           | YEAR 2020  |           | YEAR 2050  |           | YEAR 2070  |           |
|------------|--|-----------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|
|            |  | EQ. POP.  | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  |
| 1          | All Cities Served By C.O.F.W. Big Fossil Outfall, including NRH, Haltom City, Richland Hills, Marine Creek Area, Year 2020 BFX Area, and 6.0 MGD Intel Flow, Plus Haltom City Little Fossil Area Extra | 93,900.75 | 17,885.92 | 100,339.88 | 19,366.02 | 106,779.00 | 20,554.00 | 116,778.00 | 23,826.69 | 126,777.00 | 25,540.00 | 161,728.99 | 29,865.17 | 180,801.77 | 32,329.98 |
| 2          | Same as Option 1 above, but less Marine Creek Area   | 90,518.25 | 15,473.77 | 96,946.88  | 16,882.20 | 103,375.50 | 17,998.52 | 112,980.75 | 20,730.07 | 122,586.00 | 21,884.42 | 156,708.49 | 24,835.40 | 175,228.27 | 26,431.99 |
| 3          | Same As Option 2, but also less Intel Facility Flow  | 90,518.25 | 15,473.77 | 96,946.88  | 16,882.20 | 103,375.50 | 17,998.52 | 112,980.75 | 20,730.07 | 122,586.00 | 21,884.42 | 156,708.49 | 24,835.40 | 175,228.27 | 26,431.99 |
| 4          | Same As Option 1, but less Haltom City Little Fossil Area  | 80,931.25 | 16,091.36 | 87,431.63  | 17,571.46 | 93,932.00  | 18,759.44 | 103,938.50 | 22,032.13 | 113,945.00 | 23,745.44 | 149,156.99 | 28,070.61 | 168,403.10 | 30,535.42 |
| 5          | All Cities Served by C.O.F.W. Big Fossil Outfall except Richland Hills Which will be served by the TCWSC Line. (includes L.F.)   |           |           |            |           |            |           |            |           |            |           |            |           |            |           |
| 5a         | Big Fossil Data (H.C. + NRH + F.W.)  | 85,990.79 | 16,728.36 | 91,937.31  | 18,136.37 | 97,883.84  | 19,299.64 | 107,643.23 | 22,572.33 | 117,402.63 | 24,285.65 | 150,439.81 | 28,610.82 | 169,512.59 | 31,075.63 |
| 5b         | TCWSC Data (Richland Hills Only)   | 7,909.96  | 1,157.56  | 8,402.56   | 1,229.65  | 8,895.16   | 1,254.35  | 9,134.77   | 1,254.35  | 9,374.37   | 1,254.35  | 11,289.18  | 1,254.35  | 11,289.18  | 1,254.35  |
| 6          | Only Fort Worth and Haltom City served by the Big Fossil Line, with Richland Hills and NRH served by the TCWSC Line  |           |           |            |           |            |           |            |           |            |           |            |           |            |           |
| 6a         | Big Fossil Data (H.C. + F.W.)  | 69,948.30 | 14,709.75 | 75,006.22  | 16,002.64 | 80,064.14  | 17,107.83 | 89,256.39  | 20,353.79 | 98,448.64  | 22,040.38 | 129,181.14 | 26,316.11 | 148,253.92 | 28,780.92 |
| 6b         | TCWSC Data (R.Hills + NRH)   | 23,952.45 | 3,176.17  | 25,333.66  | 3,363.38  | 26,714.86  | 3,446.17  | 27,521.61  | 3,472.90  | 28,328.36  | 3,499.63  | 32,547.85  | 3,549.06  | 32,547.85  | 3,549.06  |

**OPTION NUMBERING REVISIONS:**

**OPTION 1 = OPTION 1a**

**OPTION 2 = OPTION 1b**

**OPTION 3 = OPTION 1c**

**OPTION 4 = OPTION 1d**

**OPTION 5a = OPTION 2a**

**OPTION 5b = OPTION 2b**

**OPTION 6a = OPTION 3a**

**OPTION 6b = OPTION 3b**

***OPTION 1***

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0030+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 63.09                  | 84              | 69.57                 | 78              | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 64.37                  | 84              | 72.04                 | 78              | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 64.38                  | 84              | 72.06                 | 78              | 59.13                 | -11.44          | 50,568.60              | 43,602.52               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 64.39                  | 84              | 72.06                 | 78              | 59.13                 | 59.13           | 103,908.09             | 89,594.22               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.63                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 64.39                  | 84              | 72.08                 | 78              | 59.15                 | 133.46          | 47,797.72              | 41,213.34               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 64.84                  | 84              | 72.74                 | 78              | 159.69                | 84.73           | 519,646.47             | 412,133.34              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 64.98                  | 84              | 72.93                 | 78              | 159.69                | 95.52           | 276,395.52             | 238,320.62              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 65.12                  | 78              | 72.09                 | 66              | 46.17                 | 78.56           | 258,628.65             | 185,171.99              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 65.22                  | 78              | 72.19                 | 66              | 46.24                 | 75.27           | 215,823.42             | 154,381.27              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.92                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000551                   | 65.31                  | 78              | 72.28                 | 66              | 46.29                 | 80.11           | 333,887.79             | 239,055.76              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 65.36                  | 78              | 72.33                 | 66              | 46.33                 | 75.04           | 183,369.50             | 131,288.22              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 65.39                  | 78              | 72.38                 | 66              | 46.36                 | 78.08           | 150,518.29             | 107,767.53              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 65.47                  | 78              | 72.41                 | 66              | 46.38                 | 81.57           | 152,310.17             | 109,050.48              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 76.05                  | 84              | 88.35                 | 78              | 72.51                 | 102.23          | 446,804.78             | 385,255.15              |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 76.04                  | 84              | 88.37                 | 78              | 72.52                 | 104.40          | 68,579.34              | 59,132.19               |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 76.03                  | 84              | 88.46                 | 78              | 72.60                 | 104.99          | 353,287.50             | 304,620.35              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 76.07                  | 84              | 88.60                 | 78              | 72.71                 | 104.23          | 478,669.93             | 412,730.71              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 76.12                  | 84              | 88.80                 | 78              | 72.88                 | 105.11          | 559,718.24             | 482,614.20              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 76.15                  | 84              | 88.89                 | 78              | 72.95                 | 108.62          | 277,088.24             | 238,917.92              |
| M402A/0088+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 76.17                  | 84              | 88.94                 | 78              | 72.99                 | 102.25          | 104,600.81             | 90,191.51               |
| M402A/0088+51         | M402A/0088+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 76.22                  | 84              | 88.99                 | 78              | 73.03                 | 97.45           | 116,377.06             | 100,345.53              |
| M402A/0098+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 76.41                  | 84              | 89.19                 | 78              | 73.20                 | 104.92          | 568,030.89             | 489,781.73              |
| M402A/0103+76         | M402A/0098+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 76.55                  | 84              | 89.37                 | 78              | 73.34                 | 95.23           | 492,524.34             | 424,676.60              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 76.60                  | 84              | 89.42                 | 78              | 73.39                 | 126.86          | 93,517.28              | 80,634.80               |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 76.76                  | 84              | 89.67                 | 78              | 73.59                 | 98.67           | 559,025.52             | 482,016.90              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 76.86                  | 84              | 90.11                 | 78              | 73.66                 | 113.05          | 238,988.61             | 206,066.71              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 85.74                  | 84              | 90.11                 | 78              | 73.87                 | 114.65          | 481,440.81             | 415,119.89              |
| M402A/0120+25         | M402A/0117+43           | 128           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 85.76                  | 84              | 90.11                 | 78              | 73.91                 | 115.65          | 87,282.79              | 75,259.14               |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 85.80                  | 84              | 90.17                 | 78              | 74.00                 | 110.97          | 213,357.94             | 183,966.80              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 75.51                  | 66              | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50              |

DESIGN CONDITION: OPTION NO. 1  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 93,900.75  
 2000 Sew. Ac. = 17,885.92  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,277,334.79 \$7,792,254.93  
 + Engr., ROW, Financ., Conting. (1.5x) = \$13,916,002.18 \$11,688,382.40  
 Avg. Estimated Per Foot Cost = \$984.51 \$826.91

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq. n = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup> ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>5</sup>(8/3) x s<sup>1.49</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>5</sup>(8/3) x s<sup>1.49</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, Manne Creek Area, year 2020  
 BF X Area, and Constant 6.0 MGD Inlet Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line.  
 Estim. Cost Above R.H. Meter = \$6,455,452.62 \$5,428,469.60  
 Estim. Cost Below R.H. Meter = \$2,821,882.17 \$2,363,785.33  
 Percent R.H. Cost of Total Line = 30.42% 30.34%  
 Estim. Richland Hills Cost Share = \$4,232,823.25 \$3,545,678.00

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. P/F/L (%) | PARL. PIPE CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 69.13                  | 86                    | 74.07                 | 78              | 57.09                 | \$74,062.20            | \$60,924.07            |
| M402A/0020+10         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 70.63                  | 86                    | 76.70                 | 78              | 59.12                 | 1,253,248.58           | 1,030,930.82           |
| M402A/0020+17         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 70.64                  | 86                    | 76.72                 | 78              | 59.13                 | 53,005.30              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 70.64                  | 86                    | 76.72                 | 78              | 59.13                 | 108,915.00             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 70.65                  | 86                    | 76.75                 | 78              | 59.15                 | 50,100.90              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 71.16                  | 86                    | 77.45                 | 78              | 59.69                 | 631,706.99             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 71.32                  | 86                    | 77.65                 | 78              | 59.85                 | 289,713.90             | 238,320.62             |
| M402A/0036+79         | M402A/0032+40           | 433           | 307              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 71.47                  | 86                    | 93.53                 | 78              | 72.09                 | 314,401.30             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 71.58                  | 86                    | 93.66                 | 78              | 72.19                 | 262,122.10             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 71.74                  | 86                    | 93.85                 | 78              | 72.28                 | 405,889.89             | 333,887.79             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 71.85                  | 86                    | 93.90                 | 78              | 72.38                 | 222,912.70             | 183,369.50             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 71.77                  | 86                    | 93.85                 | 78              | 72.33                 | 185,155.50             | 152,310.17             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 71.85                  | 86                    | 94.07                 | 78              | 72.51                 | 468,334.49             | 385,255.15             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 82.34                  | 86                    | 94.09                 | 78              | 72.52                 | 370,310.99             | 304,620.35             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 82.33                  | 86                    | 94.19                 | 78              | 72.60                 | 59,132.19              | 51,332.19              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000565                   | 82.33                  | 86                    | 94.34                 | 78              | 72.71                 | 370,310.99             | 304,620.35             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000570                   | 82.44                  | 86                    | 94.55                 | 78              | 72.88                 | 501,735.09             | 412,730.71             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 82.48                  | 86                    | 94.65                 | 78              | 72.95                 | 586,688.79             | 482,614.20             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 82.50                  | 86                    | 94.70                 | 78              | 72.99                 | 290,440.00             | 238,917.92             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 82.55                  | 86                    | 94.75                 | 78              | 73.03                 | 109,641.10             | 90,191.51              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 82.75                  | 86                    | 94.97                 | 78              | 73.20                 | 121,984.80             | 100,345.53             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 82.75                  | 86                    | 95.16                 | 78              | 73.34                 | 516,257.09             | 424,676.60             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 82.91                  | 86                    | 95.21                 | 78              | 73.39                 | 98,023.50              | 80,634.80              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 83.14                  | 86                    | 95.48                 | 78              | 73.59                 | 585,962.69             | 482,016.90             |
| M402A/0109+81         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 83.25                  | 86                    | 95.57                 | 78              | 73.66                 | 250,504.50             | 208,066.71             |
| M402A/0113+81         | M402A/0109+81           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000586                   | 83.25                  | 86                    | 95.84                 | 78              | 73.87                 | 504,639.49             | 415,119.89             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 92.06                  | 86                    | 95.89                 | 78              | 73.97                 | 91,488.60              | 75,259.14              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 92.08                  | 86                    | 96.01                 | 78              | 74.00                 | 223,638.80             | 183,966.80             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.001829                   | 81.42                  | 66                    | 83.60                 | 68              | 64.84                 | 496,072.77             | 409,977.50             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 54               | 31.40                  | 33.78                 | 93.78                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 81.42                  | 66                    | 83.60                 | 68              | 64.84                 | \$9,917,220.12         | \$8,159,877.51         |

DESIGN CONDITION: OPTION NO. 1  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 100,339.88  
 2005 Sew. Ac. = 19,366.02  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,917,220.12  
 + Engr., ROW, Financ., Conting (1.5x) = \$14,875,830.18 \$12,239,816.26

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{1/2}] / 1629.6 \times n^{1/2}$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Manne Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line.

Estim. Cost Above R.H. Meter = \$6,879,943.87  
 Estim. Cost Below R.H. Meter = \$3,037,276.25 \$2,496,484.14  
 Percent R.H. Cost of Total Line = 30.63% 30.62%  
 Estim. Richland Hills Cost Share = \$4,555,914.38 \$3,747,726.21

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                   | 0.000350                   | 72.72                  | 86                    | 74.07                 | 78                    | 57.09                 | 279.20          | \$74,082.20            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 74.29                  | 86                    | 76.70                 | 78                    | 59.12                 | 93.15           | 1,253,248.58           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 74.30                  | 86                    | 76.72                 | 78                    | 59.13                 | -11.44          | 53,005.30              | 43,602.52              |
| M402A/0020+40         | M402A/0020+90           | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 74.30                  | 86                    | 76.72                 | 78                    | 59.13                 | 59.13           | 108,915.00             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 74.31                  | 86                    | 76.75                 | 78                    | 59.15                 | 133.46          | 50,100.90              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 74.85                  | 86                    | 77.45                 | 78                    | 59.89                 | 84.73           | 631,708.99             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                   | 0.000385                   | 75.01                  | 86                    | 77.65                 | 78                    | 59.85                 | 95.52           | 289,713.90             | 238,320.62             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 75.17                  | 86                    | 93.53                 | 78                    | 72.09                 | 104.48          | 314,401.30             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 75.29                  | 86                    | 93.66                 | 78                    | 72.19                 | 101.22          | 262,122.10             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 75.40                  | 86                    | 93.77                 | 78                    | 72.28                 | 106.10          | 405,889.89             | 333,887.79             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 75.46                  | 86                    | 93.85                 | 78                    | 72.33                 | 101.04          | 222,912.70             | 183,369.50             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 75.49                  | 86                    | 93.90                 | 78                    | 72.38                 | 104.10          | 182,977.20             | 150,518.29             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000563                   | 75.57                  | 86                    | 93.94                 | 78                    | 72.41                 | 107.60          | 185,155.50             | 152,310.17             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 86.91                  | 86                    | 94.07                 | 78                    | 72.51                 | 102.23          | 488,334.49             | 385,255.15             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000565                   | 86.91                  | 86                    | 94.09                 | 78                    | 72.52                 | 104.40          | 59,132.19              | 304,620.35             |
| M402A/0063+95         | M402A/0061+67           | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 86.90                  | 86                    | 94.19                 | 78                    | 72.58                 | 104.99          | 370,310.99             | 412,730.71             |
| M402A/0072+77         | M402A/0063+95           | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 86.95                  | 86                    | 94.34                 | 78                    | 72.60                 | 104.99          | 290,440.00             | 238,917.92             |
| M402A/0072+77         | M402A/0072+77           | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 87.02                  | 86                    | 94.55                 | 78                    | 72.88                 | 105.11          | 586,688.79             | 482,614.20             |
| M402A/0083+50         | M402A/0080+78           | 400           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 87.06                  | 86                    | 94.65                 | 78                    | 72.99                 | 102.25          | 109,641.10             | 90,191.51              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                   | 0.000573                   | 87.13                  | 86                    | 94.75                 | 78                    | 73.03                 | 97.45           | 121,984.80             | 100,345.53             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 87.35                  | 86                    | 94.97                 | 78                    | 73.20                 | 104.92          | 595,401.99             | 489,781.73             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000577                   | 87.52                  | 86                    | 95.16                 | 78                    | 73.34                 | 95.23           | 516,237.09             | 424,676.60             |
| M402A/0103+76         | M402A/0103+76           | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 87.58                  | 86                    | 95.21                 | 78                    | 73.39                 | 126.86          | 98,023.50              | 80,634.80              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 87.76                  | 86                    | 95.49                 | 78                    | 73.59                 | 95.23           | 516,237.09             | 424,676.60             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 87.88                  | 86                    | 95.57                 | 78                    | 73.66                 | 113.05          | 585,962.69             | 482,016.90             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 97.39                  | 86                    | 95.84                 | 78                    | 73.87                 | 114.65          | 504,639.49             | 415,119.89             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 97.47                  | 86                    | 96.01                 | 78                    | 74.00                 | 110.97          | 223,638.80             | 183,966.80             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                   | 0.000588                   | 97.47                  | 86                    | 96.01                 | 78                    | 74.00                 | 110.97          | 223,638.80             | 183,966.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001829                   | 86.02                  | 72                    | 105.43                | 66                    | 83.60                 | 115.00          | 590,367.59             | 496,072.77             |

DESIGN CONDITION: OPTION NO. 1  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 106,779.00  
 2010 Sew. Ac. = 20,564.00  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$10,011,514.95 \$8,245,972.78  
 + Engr., ROW, Financ., Conting. (1.5x) = \$15,017,272.42 \$12,368,959.17

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST PIPE DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line.

Estim. Cost Above R.H. Meter = \$6,974,238.69 \$5,747,488.64  
 Estim. Cost Below R.H. Meter = \$3,037,276.25 \$2,498,484.14  
 Percent R.H. Cost of Total Line = 30.34% 30.30%  
 Estim. Richland Hills Cost Share = \$4,555,914.38 \$3,747,726.21

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 90.26             | 96                    | 99.32                 | 90              | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A00020+17         | M402A0000+50            | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 92.68             | 96                    | 102.85                | 90              | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A00020+90         | M402A0020+17            | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 92.70             | 96                    | 102.88                | 90              | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A00022+40         | M402A0022+40            | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 92.70             | 96                    | 102.88                | 90              | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A00023+09         | M402A0023+09            | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 92.73             | 96                    | 102.91                | 90              | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A00028+40         | M402A0028+40            | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 93.45             | 96                    | 103.85                | 90              | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A00036+79         | M402A0036+79            | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 93.67             | 96                    | 104.12                | 90              | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A00040+28         | M402A0040+28            | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 93.87             | 90                    | 105.58                | 84              | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A00045+95         | M402A0045+95            | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 94.00             | 90                    | 105.73                | 84              | 87.96                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A00049+00         | M402A0049+00            | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 94.13             | 90                    | 105.86                | 84              | 88.07                 | 119.91          | 444,525.17             | 387,230.81              |
| M402A00051+91         | M402A0051+91            | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 94.20             | 90                    | 105.94                | 84              | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A00054+21         | M402A0054+21            | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 94.24             | 90                    | 106.00                | 84              | 88.19                 | 119.91          | 200,394.17             | 174,565.59              |
| M402A00060+68         | M402A0060+68            | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 94.32             | 90                    | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A00061+67         | M402A0061+67            | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 102.36            | 90                    | 106.20                | 84              | 88.35                 | 118.07          | 512,913.65             | 446,804.78              |
| M402A00065+95         | M402A0065+95            | 99            | 54              | 31.86                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 102.37            | 90                    | 106.22                | 84              | 88.37                 | 120.25          | 78,726.28              | 68,579.34               |
| M402A00072+77         | M402A0072+77            | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 102.40            | 90                    | 106.33                | 84              | 88.46                 | 120.85          | 405,559.63             | 353,287.50              |
| M402A00080+78         | M402A0080+78            | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 102.50            | 90                    | 106.50                | 84              | 88.60                 | 120.12          | 549,493.54             | 478,689.93              |
| M402A00085+50         | M402A0085+50            | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 102.64            | 90                    | 106.74                | 84              | 88.80                 | 121.03          | 642,533.69             | 559,718.24              |
| M402A00086+56         | M402A0086+56            | 151           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 102.70            | 90                    | 106.85                | 84              | 88.89                 | 124.56          | 318,085.99             | 277,088.24              |
| M402A00088+51         | M402A0088+51            | 168           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 102.75            | 90                    | 106.91                | 84              | 88.94                 | 118.20          | 120,077.46             | 104,600.81              |
| M402A00096+65         | M402A0096+65            | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 102.80            | 90                    | 106.97                | 84              | 88.99                 | 113.41          | 133,596.11             | 116,377.06              |
| M402A0103+76          | M402A0103+76            | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 103.24            | 90                    | 107.21                | 84              | 89.19                 | 120.91          | 652,076.27             | 568,030.89              |
| M402A0105+11          | M402A0105+11            | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 103.31            | 90                    | 107.42                | 84              | 89.37                 | 111.26          | 565,387.84             | 492,524.34              |
| M402A0109+91          | M402A0109+91            | 807           | 54              | 25.06                  | 31.70                 | 89.87                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 103.55            | 90                    | 107.78                | 84              | 89.42                 | 142.89          | 93,517.28              | 81,738.48               |
| M402A0113+81          | M402A0113+81            | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 103.67            | 90                    | 107.89                | 84              | 89.67                 | 114.75          | 641,738.48             | 559,025.52              |
| M402A0117+43          | M402A0117+43            | 695           | 54              | 40.76                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 110.48            | 90                    | 108.19                | 84              | 89.76                 | 129.15          | 274,349.16             | 238,988.61              |
| M402A0120+25          | M402A0120+25            | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 110.53            | 90                    | 108.25                | 84              | 90.01                 | 130.79          | 552,674.40             | 481,440.81              |
| M402B0123+40          | M402B0123+40            | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 110.61            | 90                    | 108.38                | 84              | 90.06                 | 131.60          | 100,197.09             | 87,282.79               |
| M402B0138+74          | M402B0138+74            | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 99.61             | 72                    | 105.43                | 66              | 83.60                 | 115.00          | 244,926.21             | 213,357.94              |
|                       |                         |               |                 |                        |                       |                       |                |                |                       |                            |                   |                       |                       |                 |                       |                 | 590,367.59             | 496,072.77              |

DESIGN YEAR: 2015  
 DESIGN NO. 1  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 116,778.00  
 2015 Sew. Ac. = 23,826.69  
 TOTAL ESTIM. CONST. COST = \$11,279,590.65 \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5x) = \$16,919,385.98 \$14,747,213.88  
 Constant Intel Flow = 6.00

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup>(8/3)]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line.

Estim. Cost Above R.H. Meter = \$7,581,897.60 \$6,586,472.24  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 32.78% 33.01%  
 Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PAR. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------------|-----------------------|----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.82                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 94.74             | 96                          | 99.32                 | 90                   | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17         | M432A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 97.20             | 96                          | 102.85                | 90                   | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 97.21             | 96                          | 102.88                | 90                   | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0022+40         | M402A/0022+40           | 150           | 24               | 0.00                   | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 97.21             | 96                          | 102.88                | 90                   | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A/0023+09         | M402A/0023+09           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 97.24             | 96                          | 102.91                | 90                   | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 97.24             | 96                          | 103.85                | 90                   | 87.43                 | 112.47          | 78,156.79              | 69,187.02               |
| M402A/0036+78         | M402A/0032+40           | 433           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 97.99             | 96                          | 104.12                | 90                   | 87.43                 | 123.33          | 361,006.39             | 277,290.77              |
| M402A/0040+28         | M402A/0036+78           | 361           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 98.22             | 96                          | 105.58                | 84                   | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 98.43             | 90                          | 105.73                | 84                   | 87.96                 | 116.85          | 444,525.17             | 387,230.81              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 98.71             | 90                          | 105.86                | 84                   | 88.07                 | 121.89          | 244,131.00             | 212,665.22              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 98.79             | 90                          | 105.94                | 84                   | 88.14                 | 116.85          | 209,394.17             | 174,565.59              |
| M402A/0060+68         | M402A/0051+91           | 645           | 54               | 35.19                  | 19.06                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 98.83             | 90                          | 106.05                | 84                   | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0065+95         | M402A/0060+68           | 255           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 98.92             | 90                          | 106.14                | 84                   | 88.35                 | 118.07          | 583,581.76             | 446,804.78              |
| M402A/0067+78         | M402A/0065+95           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 108.71            | 96                          | 126.14                | 84                   | 88.37                 | 120.25          | 89,573.01              | 68,579.34               |
| M402A/0072+77         | M402A/0067+78           | 691           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 108.73            | 96                          | 126.30                | 84                   | 88.46                 | 120.85          | 461,436.74             | 353,287.50              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 108.83            | 96                          | 126.50                | 84                   | 88.60                 | 120.12          | 625,201.54             | 478,669.93              |
| M402A/0086+56         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 108.96            | 96                          | 126.78                | 84                   | 88.80                 | 121.03          | 731,060.56             | 559,718.24              |
| M402A/0088+51         | M402A/0086+56           | 151           | 54               | 29.26                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 109.03            | 96                          | 126.98                | 84                   | 88.89                 | 124.56          | 361,911.17             | 277,088.24              |
| M402A/0096+65         | M402A/0088+51           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 109.07            | 96                          | 127.05                | 84                   | 88.99                 | 118.20          | 136,621.47             | 104,600.81              |
| M402A/0103+76         | M402A/0096+65           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 109.13            | 96                          | 127.34                | 84                   | 88.99                 | 113.41          | 152,002.69             | 116,377.06              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 109.40            | 96                          | 127.54                | 84                   | 89.19                 | 120.91          | 741,917.89             | 568,030.89              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 109.61            | 96                          | 127.67                | 84                   | 89.37                 | 111.26          | 643,297.10             | 492,524.34              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 109.68            | 96                          | 128.02                | 84                   | 89.67                 | 142.89          | 122,145.02             | 93,517.28               |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 109.93            | 96                          | 128.15                | 84                   | 89.76                 | 114.75          | 730,155.78             | 559,025.52              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 110.06            | 96                          | 128.51                | 84                   | 90.01                 | 130.79          | 312,148.38             | 238,988.61              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 118.37            | 96                          | 128.58                | 84                   | 90.06                 | 131.80          | 628,820.65             | 481,440.81              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 66                    | 0.000588                   | 118.46            | 78                          | 128.74                | 84                   | 90.17                 | 127.14          | 114,002.02             | 87,282.72               |
|                       |                         |               |                  | 31.40                  | 33.78                 | 93.60                 | -0.0001        | 0.0045         |                       | 0.001829                   | 106.15            | 78                          | 130.52                |                      | 105.43                | 136.83          | 692,861.97             | 590,367.59              |

DESIGN CONDITION: OPTION NO. 1  
DESIGN YEAR: 2020

F.W. Model Eq. Pop. = 57,207.50 93,287.50  
F.W. Model Sew. Ac. = 9,004.81 20,981.33

2020 Eq. Pop. = 126,777.00  
2020 Sew. Ac. = 25,540.00  
Constant Inlet Flow = 6.00

TOTAL ESTIM. CONST. COST = \$12,184,932.56  
+ Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$14,888,656.12

UPSTREAM MAIN/STATION: Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
DOWNSTREAM MAIN/STATION: Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
LENGTH: Length of Pipe Segment in Feet  
EXIST DIA: Existing Pipe Diameter in Inches  
EXIST PIPE CAP: Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
2000 MODEL FLOW: Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
2020 MODEL FLOW: Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
COEF. "A", COEF. "B": Calibration Coefficients used to Compute Design Flows based on Model Flows  
MODEL PROP DIA: Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
MODEL H.G. SLOPE: Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Exp.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{5.49} / (D^{3.02} \times n)]^{0.145}$   
DESIGN FLOW: Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
PROP. REPL. PIPE: Proposed Replacement Pipe in Inches  
REPL. PIPE CAP.: Proposed Replacement Pipe Capacity in MGD =  $[D^{5.49} / (D^{3.02} \times n^{1.54})] / 1.54$   
PARL. PIPE: Proposed Parallel Pipe in Inches  
PARL. PIPE CAP.: Proposed Parallel Pipe Capacity in MGD =  $[D^{5.49} / (D^{3.02} \times n^{1.54})] / 1.54$   
BOTH CAP.: Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
ESTIM. REPL. PIPE COST: Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
ESTIM. PARL. PIPE COST: Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 1**  
All Cities Served by City of Fort Worth  
Big Fossil Outfall, Including NRH, Haltom City, Richland Hills, Marine Creek Area, Year 2020 BFX Area, and Constant 6.0 MGD Inlet Facility Flow. This Option also includes diversion of Little Fossil Creek Area in Haltom City to this line.

Estim. Cost Above R.H. Meier = \$8,497,239.51  
Estim. Cost Below R.H. Meier = \$3,697,693.06  
Percent R.H. Cost of Total Line = 30.32%  
Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | REPL. P. I.P.E. (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 96.46                  | 96                    | 99.32                 | 90                   | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 98.15                  | 96                    | 102.85                | 90                   | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0022+40         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 98.16                  | 96                    | 102.88                | 90                   | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 0.00                   | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 98.18                  | 96                    | 102.91                | 90                   | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 98.86                  | 96                    | 103.85                | 90                   | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 39.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 99.07                  | 96                    | 104.12                | 90                   | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 29.03                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 99.29                  | 90                    | 105.58                | 90                   | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0045+95         | M402A/0040+28           | 361           | 54               | 33.82                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 99.46                  | 90                    | 105.73                | 84                   | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A/0049+00         | M402A/0045+95           | 559           | 54               | 28.71                  | 18.97                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 99.62                  | 90                    | 105.86                | 84                   | 87.96                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0054+21         | M402A/0049+00           | 307           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 99.71                  | 90                    | 105.94                | 84                   | 88.07                 | 121.89          | 444,525.17             | 387,230.81              |
| M402A/0060+88         | M402A/0054+21           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 99.74                  | 90                    | 106.00                | 84                   | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0065+67         | M402A/0060+88           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0091         | 84                    | 0.000564                   | 99.89                  | 90                    | 106.05                | 84                   | 88.23                 | 123.42          | 202,779.82             | 174,565.59              |
| M402A/0065+95         | M402A/0065+67           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 121.16                 | 96                    | 126.14                | 90                   | 106.20                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 121.08                 | 96                    | 126.17                | 90                   | 106.20                | 138.10          | 461,436.74             | 405,559.63              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 121.12                 | 96                    | 126.30                | 90                   | 106.33                | 138.72          | 625,201.54             | 549,493.54              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.69                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 121.17                 | 96                    | 126.50                | 90                   | 106.50                | 138.02          | 731,060.56             | 642,533.69              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 121.20                 | 96                    | 126.78                | 90                   | 106.85                | 142.52          | 361,911.17             | 318,085.09              |
| M402A/0098+65         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 121.24                 | 96                    | 127.05                | 90                   | 106.91                | 136.17          | 136,621.47             | 120,077.46              |
| M402A/0103+76         | M402A/0098+65           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 121.33                 | 96                    | 127.34                | 90                   | 106.97                | 131.39          | 152,002.69             | 133,596.11              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 121.63                 | 96                    | 127.60                | 90                   | 107.21                | 138.93          | 741,917.89             | 652,076.27              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 121.87                 | 96                    | 127.67                | 90                   | 107.42                | 129.31          | 643,297.10             | 565,397.84              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 122.20                 | 96                    | 128.02                | 90                   | 107.48                | 160.95          | 122,145.02             | 107,354.02              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 122.38                 | 96                    | 128.15                | 90                   | 107.78                | 132.86          | 730,155.78             | 641,738.48              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 140.17                 | 96                    | 128.51                | 90                   | 107.89                | 147.28          | 312,148.38             | 274,349.16              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 140.25                 | 96                    | 128.58                | 90                   | 108.19                | 148.97          | 628,820.65             | 552,674.40              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 121.45                 | 78                    | 130.52                | 90                   | 108.38                | 145.35          | 114,002.02             | 100,197.09              |

DESIGN CONDITION: OPTION NO. 1  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 161,728.99  
 2050 Sew. Ac. = 29,865.17  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76

UPSTREAM MAIN/STATION LENGTH EXIST DIA. EXISTING GRAVITY FLOW CAPACITY IN INCHES  
 UPSTREAM MAIN/STATION LENGTH EXIST DIA. EXISTING GRAVITY FLOW CAPACITY IN INCHES  
 2000 MODEL FLOW YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 COEF. "A", COEF. "B" CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODFLOW CALCULATIONS  
 MODEL PROP DIA. COMPUTED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 MODEL H.G. SLOPE CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 P/OP. REPL. PIPE PROPOSED REPLACEMENT PIPE IN INCHES  
 REPL. PIPE CAP. PROPOSED REPLACEMENT PIPE CAPACITY IN MGD =  $[D^*(8/3) \times s^*(1/2) / 1629.6 \times n] / 1.54$   
 PARL. PIPE CAP. PROPOSED PARALLEL PIPE IN INCHES  
 BOTH CAP. COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIM. REPL. PIPE COST ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.)  $\times$  \$0.125/SQ. IN.  $\times$  LENGTH (FT.)  
 ESTIM. PARL. PIPE COST ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.)  $\times$  \$0.125/SQ. IN.  $\times$  LENGTH (FT.)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Hallom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BF X Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Hallom City  
 to this line.

Estim. Cost Above R.H. Meter = \$8,497,239.51 \$7,441,172.82  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 30.32% 30.37%  
 Est. n. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

| UPSTREAM MAINSTATION | DOWNSTREAM MAINSTATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PRO. PAR. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|----------------------|------------------------|---------------|------------------|------------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|---------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50        | M280A/0304+97          | 102           | 54               | 222.11                 | 18.94                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 98.27                  | 96                    | 99.32                 | 90                  | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17        | M402A/0000+50          | 1726          | 54               | 34.03                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.60                  | 96                    | 102.85                | 90                  | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90        | M402A/0020+17          | 73            | 24               | -70.57                 | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.61                  | 96                    | 102.88                | 90                  | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0022+40        | M402A/0020+90          | 150           | 24               | 0.00                   | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.61                  | 96                    | 102.88                | 90                  | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A/0023+09        | M402A/0022+40          | 69            | 24               | 74.31                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 99.63                  | 96                    | 102.91                | 90                  | 86.64                 | 86.64           | 62,429.68              | 54,869.83               |
| M402A/0028+40        | M402A/0023+09          | 870           | 54               | 25.04                  | 18.78                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 100.27                 | 96                    | 103.85                | 90                  | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A/0032+40        | M402A/0028+40          | 399           | 54               | 35.67                  | 18.81                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 100.48                 | 96                    | 104.12                | 90                  | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0036+79        | M402A/0032+40          | 433           | 54               | 32.39                  | 18.87                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 100.72                 | 90                    | 105.18                | 94                  | 87.84                 | 344,328.08      | 299,948.02             |                         |
| M402A/0040+28        | M402A/0036+79          | 361           | 54               | 29.03                  | 18.92                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 101.07                 | 90                    | 105.86                | 84                  | 88.07                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0045+95        | M402A/0040+28          | 559           | 54               | 33.82                  | 18.97                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 101.19                 | 90                    | 106.00                | 94                  | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0049+00        | M402A/0045+95          | 307           | 54               | 28.71                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 101.19                 | 90                    | 106.00                | 94                  | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0051+91        | M402A/0049+00          | 252           | 54               | 31.72                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 101.37                 | 90                    | 106.05                | 94                  | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0054+21        | M402A/0051+91          | 255           | 54               | 35.19                  | 19.06                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 101.37                 | 90                    | 106.05                | 94                  | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0060+68        | M402A/0054+21          | 645           | 54               | 29.72                  | 31.63                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 128.57                 | 96                    | 126.14                | 90                  | 106.21                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0061+67        | M402A/0060+68          | 99            | 54               | 31.88                  | 31.61                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 128.57                 | 96                    | 126.14                | 90                  | 106.21                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0065+95        | M402A/0061+67          | 510           | 54               | 32.39                  | 31.54                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 128.44                 | 96                    | 126.30                | 90                  | 106.33                | 138.10          | 86,573.01              | 78,726.28               |
| M402A/0072+77        | M402A/0065+95          | 891           | 54               | 31.52                  | 31.50                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 128.44                 | 96                    | 126.30                | 90                  | 106.33                | 138.10          | 86,573.01              | 78,726.28               |
| M402A/0080+78        | M402A/0072+77          | 400           | 54               | 35.67                  | 31.45                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 128.46                 | 96                    | 126.78                | 90                  | 106.74                | 138.97          | 361,911.17             | 318,085.99              |
| M402A/0085+50        | M402A/0080+78          | 151           | 54               | 29.26                  | 31.43                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 128.50                 | 96                    | 126.50                | 90                  | 106.50                | 138.02          | 625,201.54             | 549,493.54              |
| M402A/0088+56        | M402A/0085+50          | 168           | 54               | 24.42                  | 31.45                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 128.47                 | 96                    | 126.98                | 90                  | 106.85                | 142.52          | 731,060.56             | 642,533.69              |
| M402A/0088+51        | M402A/0088+56          | 820           | 54               | 31.72                  | 31.56                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 128.93                 | 96                    | 127.34                | 90                  | 107.21                | 138.93          | 741,917.89             | 652,076.27              |
| M402A/0103+76        | M402A/0088+51          | 711           | 54               | 21.89                  | 31.63                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 129.19                 | 96                    | 127.67                | 90                  | 107.42                | 129.31          | 643,297.10             | 565,397.84              |
| M402A/0105+11        | M402A/0103+76          | 135           | 54               | 53.47                  | 31.66                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 129.29                 | 96                    | 127.67                | 90                  | 107.42                | 129.31          | 643,297.10             | 565,397.84              |
| M402A/0117+43        | M402A/0105+11          | 807           | 54               | 25.08                  | 31.70                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 129.53                 | 96                    | 128.02                | 90                  | 107.78                | 132.86          | 730,155.78             | 641,738.48              |
| M402A/0113+81        | M402A/0117+43          | 345           | 54               | 39.39                  | 31.77                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 129.74                 | 96                    | 128.15                | 90                  | 107.89                | 147.28          | 312,148.38             | 274,349.16              |
| M402A/0120+25        | M402A/0113+81          | 695           | 54               | 40.78                  | 42.22                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 152.44                 | 96                    | 128.51                | 90                  | 108.19                | 148.97          | 628,820.65             | 552,674.40              |
| M402B/0123+40        | M402A/0120+25          | 126           | 54               | 41.74                  | 42.22                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 152.47                 | 96                    | 128.58                | 90                  | 108.25                | 149.99          | 114,002.02             | 100,197.09              |
| M402B/0136+74        | M402B/0123+40          | 1160          | 54               | 36.97                  | 42.20                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 152.50                 | 96                    | 128.74                | 90                  | 108.38                | 145.35          | 278,671.60             | 244,926.21              |
|                      |                        | 14135         | 48               | 31.40                  | 33.78                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 130.29                 | 78                    | 130.52                | 72                  | 105.43                | 136.83          | 692,861.97             | 590,367.59              |

DESIGN CONDITION: 2070  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 180,801.77  
 2070 Sew. Ac. = 32,329.98  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76  
 Avg. Estimated Per Foot Cost = \$1,294.12 \$1,134.01

NOTES:  
 UPSTREAM MAINSTATION  
 UPSTREAM MAINSTATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PARL. PIPE CAP  
 BOTH CAP  
 ESTIM. REPL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Hallom City,  
 Richland Hills, Marne Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Inlet Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Hallom City  
 to this line.

Estim. Cost Above R.H. Meter = \$8,497,239.51 \$7,441,172.82  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 30.32% 30.37%  
 Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

**OPTION 2**

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                   | 0.000350                   | 46.23                  | 72                    | 48.12                 | 60              | 28.36                 | 250.47          | \$51,911.63            | \$36,049.75            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 46.52                  | 72                    | 47.76                 | 60              | 29.37                 | 63.40           | 878,426.26             | 610,018.24             |
| M402A/0020+90         | M402A/0020+17           | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 46.52                  | 72                    | 47.77                 | 60              | 29.38                 | -41.19          | 37,152.44              | 25,800.31              |
| M402A/0022+09         | M402A/0020+90           | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 46.52                  | 72                    | 47.77                 | 60              | 29.38                 | 29.38           | 76,340.64              | 53,014.33              |
| M402A/0023+09         | M402A/0022+09           | 69            | 24              | 74.31                  | 18.71                 | 87.43                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 46.53                  | 72                    | 47.79                 | 60              | 29.38                 | 103.70          | 35,116.69              | 24,386.59              |
| M402A/0032+40         | M402A/0023+09           | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 46.77                  | 72                    | 48.22                 | 60              | 29.65                 | 54.69           | 442,775.69             | 307,483.12             |
| M402A/0036+79         | M402A/0032+40           | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                   | 0.000385                   | 46.85                  | 72                    | 48.35                 | 60              | 29.73                 | 65.40           | 203,066.09             | 141,018.12             |
| M402A/0040+28         | M402A/0036+79           | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 46.96                  | 72                    | 58.23                 | 60              | 35.81                 | 68.20           | 220,369.97             | 153,034.70             |
| M402A/0045+95         | M402A/0040+28           | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 47.05                  | 72                    | 58.31                 | 60              | 35.86                 | 64.89           | 183,726.47             | 127,587.82             |
| M402A/0049+00         | M402A/0045+95           | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 47.14                  | 72                    | 58.39                 | 60              | 35.90                 | 69.72           | 284,496.11             | 197,566.74             |
| M402A/0051+91         | M402A/0049+00           | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 47.18                  | 72                    | 58.43                 | 60              | 35.93                 | 64.64           | 156,243.84             | 108,502.66             |
| M402A/0054+21         | M402A/0051+91           | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 47.18                  | 72                    | 58.46                 | 60              | 35.95                 | 67.67           | 128,252.27             | 89,064.08              |
| M402A/0061+67         | M402A/0054+21           | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 47.28                  | 72                    | 58.49                 | 60              | 35.97                 | 71.16           | 129,779.08             | 90,124.36              |
| M402A/0065+95         | M402A/0061+67           | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 63.20                  | 78                    | 72.51                 | 66              | 46.44                 | 76.16           | 385,255.15             | 275,833.57             |
| M402A/0068+68         | M402A/0065+95           | 99            | 54              | 31.88                  | 31.63                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 63.20                  | 78                    | 72.51                 | 66              | 46.44                 | 76.16           | 391,132.19             | 281,337.24             |
| M402A/0081+67         | M402A/0068+68           | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 63.18                  | 78                    | 72.52                 | 66              | 46.45                 | 78.33           | 304,620.35             | 218,100.96             |
| M402A/0086+56         | M402A/0081+67           | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 63.11                  | 78                    | 72.60                 | 66              | 46.50                 | 78.89           | 412,730.71             | 295,505.42             |
| M402A/0092+77         | M402A/0086+56           | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 63.06                  | 78                    | 72.88                 | 66              | 46.57                 | 78.09           | 482,614.20             | 345,540.34             |
| M402A/0085+50         | M402A/0092+77           | 400           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000572                   | 63.06                  | 78                    | 72.95                 | 66              | 46.78                 | 82.40           | 238,917.92             | 171,654.98             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 63.07                  | 78                    | 72.99                 | 66              | 46.75                 | 76.01           | 90,191.51              | 64,574.98              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 63.10                  | 78                    | 73.03                 | 66              | 46.78                 | 71.20           | 100,345.53             | 71,845.02              |
| M402A/0103+76         | M402A/0088+51           | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                   | 0.000573                   | 63.10                  | 78                    | 73.03                 | 66              | 46.78                 | 78.60           | 489,781.73             | 350,672.13             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 63.28                  | 78                    | 73.20                 | 66              | 46.88                 | 78.60           | 424,676.60             | 304,058.40             |
| M402A/0109+91         | M402A/0105+11           | 711           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 63.45                  | 78                    | 73.39                 | 66              | 46.98                 | 88.87           | 424,676.60             | 304,058.40             |
| M402A/0113+81         | M402A/0109+91           | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 63.55                  | 78                    | 73.59                 | 66              | 47.00                 | 100.47          | 482,016.90             | 345,112.69             |
| M402A/0117+43         | M402A/0113+81           | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 63.66                  | 78                    | 73.66                 | 66              | 47.14                 | 72.22           | 206,066.71             | 147,538.88             |
| M402A/0120+25         | M402A/0117+43           | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 76.92                  | 78                    | 73.87                 | 66              | 47.18                 | 86.57           | 415,119.89             | 297,216.01             |
| M402B/0123+40         | M402A/0120+25           | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 76.93                  | 78                    | 73.91                 | 66              | 47.34                 | 89.09           | 75,259.14              | 53,883.77              |
| M402B/0136+74         | M402B/0123+40           | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                   | 0.000588                   | 76.93                  | 78                    | 74.00                 | 66              | 47.40                 | 84.37           | 183,966.80             | 131,715.87             |
|                       |                         | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001829                   | 65.00                  | 78                    | 130.52                | 66              | 83.60                 | 115.00          | 692,861.97             | 496,072.77             |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 90,518.25  
 2000 Sew. Ac. = 15,473.77  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$7,951,849.27 \$5,632,451.08  
 + Engr., ROW, Financ., Conting. (1.5x) = \$1,927,773.91 \$8,448,676.61

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE PIPE  
 PROP. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^2$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^4(8/3) \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BFx Area, and Constant  
 6.0 MGD Intel Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marne Creek Area is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$5,822,963.38 \$4,154,058.09  
 Estim. Cost Below R.H. Meter = \$2,128,885.90 \$1,478,392.98  
 Percent R.H. Cost of Total Line = 26.77% 26.25%  
 Estim. Richland Hills Cost Share = \$3,193,328.85 \$2,217,569.48

01/13/2000, 3:20 P.M.  
 CFWW Option 2.xls  
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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 51.68                  | 78                    | 57.09                 | 66                    | 36.57                 | 258.68          | \$60,924.07            | \$43,620.19             |
| M402A/0000+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.15                  | 78                    | 59.12                 | 66                    | 37.87                 | 71.90           | 1,030,930.82           | 738,122.07              |
| M402A/0020+17         | M402A/0020+17           | 73            | 24               | 70.57                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.16                  | 78                    | 59.13                 | 66                    | 37.88                 | 32.69           | 43,602.52              | 31,218.37               |
| M402A/0022+40         | M402A/0022+40           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.16                  | 78                    | 59.13                 | 66                    | 37.88                 | 37.88           | 89,594.22              | 64,147.34               |
| M402A/0023+09         | M402A/0023+09           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 52.17                  | 78                    | 59.15                 | 66                    | 37.89                 | 112.20          | 41,213.34              | 29,507.78               |
| M402A/0028+40         | M402A/0028+40           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 52.46                  | 78                    | 59.69                 | 66                    | 38.24                 | 63.28           | 519,946.47             | 372,054.58              |
| M402A/0032+40         | M402A/0032+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 52.56                  | 78                    | 59.85                 | 66                    | 38.34                 | 74.01           | 238,320.62             | 170,631.93              |
| M402A/0036+79         | M402A/0036+79           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 52.68                  | 78                    | 72.09                 | 66                    | 46.17                 | 78.56           | 258,628.65             | 185,171.99              |
| M402A/0045+95         | M402A/0045+95           | 559           | 54               | 33.82                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 52.77                  | 78                    | 72.19                 | 66                    | 46.24                 | 75.27           | 215,623.42             | 154,381.27              |
| M402A/0049+00         | M402A/0049+00           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 52.87                  | 78                    | 72.28                 | 66                    | 46.29                 | 80.11           | 333,887.79             | 239,055.76              |
| M402A/0051+91         | M402A/0051+91           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 52.91                  | 78                    | 72.33                 | 66                    | 46.33                 | 75.04           | 183,369.50             | 131,288.22              |
| M402A/0054+21         | M402A/0054+21           | 645           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 53.02                  | 78                    | 72.38                 | 66                    | 46.36                 | 78.08           | 150,518.29             | 107,767.53              |
| M402A/0060+68         | M402A/0060+68           | 99            | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 69.07                  | 78                    | 72.51                 | 66                    | 46.44                 | 76.16           | 385,255.15             | 275,833.57              |
| M402A/0065+95         | M402A/0065+95           | 510           | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 69.07                  | 78                    | 72.51                 | 66                    | 46.44                 | 76.16           | 385,255.15             | 275,833.57              |
| M402A/0072+77         | M402A/0072+77           | 681           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 69.05                  | 78                    | 72.52                 | 66                    | 46.45                 | 78.33           | 59,132.19              | 42,337.24               |
| M402A/0080+78         | M402A/0080+78           | 808           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 68.99                  | 78                    | 72.60                 | 66                    | 46.50                 | 78.89           | 304,620.35             | 218,100.96              |
| M402A/0085+50         | M402A/0085+50           | 151           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000568                   | 68.97                  | 78                    | 72.71                 | 66                    | 46.57                 | 78.09           | 412,730.71             | 295,505.42              |
| M402A/0088+56         | M402A/0088+56           | 168           | 54               | 29.26                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 68.96                  | 78                    | 72.88                 | 66                    | 46.68                 | 78.91           | 482,614.20             | 345,540.34              |
| M402A/0096+65         | M402A/0096+65           | 820           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 68.97                  | 78                    | 72.99                 | 66                    | 46.73                 | 82.40           | 238,917.92             | 171,059.58              |
| M402A/0103+76         | M402A/0103+76           | 711           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 69.01                  | 78                    | 73.03                 | 66                    | 46.75                 | 76.01           | 90,191.51              | 64,574.99               |
| M402A/0105+11         | M402A/0105+11           | 135           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 69.01                  | 78                    | 73.03                 | 66                    | 46.78                 | 71.20           | 100,345.53             | 71,845.02               |
| M402A/0109+91         | M402A/0109+91           | 807           | 54               | 53.47                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 69.20                  | 78                    | 73.20                 | 66                    | 46.88                 | 78.60           | 489,781.73             | 350,672.13              |
| M402A/0113+81         | M402A/0113+81           | 345           | 54               | 25.08                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 69.34                  | 78                    | 73.34                 | 66                    | 46.98                 | 88.87           | 424,676.60             | 304,058.40              |
| M402A/0117+43         | M402A/0117+43           | 695           | 54               | 39.39                  | 31.77                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 69.39                  | 78                    | 73.39                 | 66                    | 47.00                 | 100.47          | 80,634.80              | 57,732.61               |
| M402A/0120+25         | M402A/0120+25           | 126           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000582                   | 69.50                  | 78                    | 73.59                 | 66                    | 47.14                 | 72.22           | 482,016.90             | 345,112.69              |
| M402B/0123+40         | M402B/0123+40           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 83.00                  | 78                    | 73.87                 | 66                    | 47.31                 | 88.09           | 208,066.71             | 147,538.88              |
| M402B/0136+74         | M402B/0136+74           | 1160          | 48               | 31.40                  | 33.78                 | 93.60                 | -0.0001        | 0.0045         | 66                    | 0.000588                   | 83.01                  | 78                    | 73.91                 | 66                    | 47.34                 | 89.08           | 415,119.89             | 297,216.01              |
|                       |                         |               |                  |                        |                       |                       |                |                |                       |                            | 70.52                  | 78                    | 74.00                 | 66                    | 47.40                 | 84.37           | 183,966.80             | 131,715.87              |
|                       |                         |               |                  |                        |                       |                       |                |                |                       |                            | 130.52                 | 78                    | 130.52                | 66                    | 83.60                 | 115.00          | 692,861.97             | 496,072.77              |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 96,946.88  
 2005 Sew. Ac. = 16,882.20  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$8,442,761.98 \$6,044,817.75  
 + Engr., ROW, Financ., Conting. (1.5x) = \$12,664,142.97 \$9,067,226.62

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{5.49} / (8/3)]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Parallel Pipe Capacity in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{5.49} / (8/3) \times s^{1.54} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{5.49} / (8/3) \times s^{1.54} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, year 2020 BFX Area, and Constant  
 6.0 MGD Intel Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$5,944,277.84 \$4,255,962.24  
 Estim. Cost Below R.H. Meter = \$2,498,484.14 \$1,788,855.51  
 Percent R.H. Cost of Total Line = 29.59% 29.59%  
 Estim. Richland Hills Cost Share = \$3,747,726.21 \$2,683,283.27



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/ft) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|-----------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|--------------------------|------------------------|-----------------------|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                 | 54.68                  | 78                    | 57.09                       | 36.57                 | 258.68                | 36.57                 | 258.68          | \$60,924.07            | \$43,620.19            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                 | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 55.19                  | 78                    | 59.12                       | 37.87                 | 71.90                 | 37.87                 | 71.90           | 1,030,930.82           | 738,122.07             |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 55.19                  | 78                    | 59.13                       | 37.88                 | -32.69                | 37.88                 | -32.69          | 43,602.52              | 31,218.37              |
| M402A/0022+40         | M402A/0022+40           | 150           | 24               | 0.00                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 55.19                  | 78                    | 59.13                       | 37.88                 | 37.88                 | 37.88                 | 37.88           | 89,594.22              | 64,147.34              |
| M402A/0023+09         | M402A/0023+09           | 69            | 24               | 74.31                 | 18.71                 | 86.64                 | -0.0011        | 0.0090         | 90                    | 0.000376                 | 55.20                  | 78                    | 59.15                       | 37.89                 | 112.20                | 37.89                 | 112.20          | 41,213.34              | 29,507.78              |
| M402A/0028+40         | M402A/0028+40           | 870           | 54               | 25.04                 | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                 | 55.51                  | 78                    | 59.69                       | 38.24                 | 63.28                 | 38.24                 | 63.28           | 519,646.47             | 372,054.58             |
| M402A/0036+79         | M402A/0036+79           | 399           | 54               | 35.67                 | 18.81                 | 87.66                 | -0.0011        | 0.0091         | 90                    | 0.000385                 | 55.61                  | 78                    | 59.85                       | 38.34                 | 74.01                 | 38.34                 | 74.01           | 238,320.62             | 170,631.93             |
| M402A/0040+28         | M402A/0040+28           | 361           | 54               | 32.39                 | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000388                 | 55.75                  | 78                    | 72.09                       | 46.17                 | 78.56                 | 46.17                 | 78.56           | 258,628.65             | 185,171.99             |
| M402A/0045+95         | M402A/0045+95           | 559           | 54               | 29.03                 | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                 | 55.85                  | 78                    | 72.19                       | 46.24                 | 75.27                 | 46.24                 | 75.27           | 215,623.42             | 154,381.27             |
| M402A/0049+00         | M402A/0049+00           | 307           | 54               | 33.82                 | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000562                 | 55.99                  | 78                    | 72.28                       | 46.29                 | 80.11                 | 46.29                 | 80.11           | 333,887.79             | 239,055.76             |
| M402A/0051+91         | M402A/0051+91           | 252           | 54               | 28.71                 | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                 | 56.00                  | 78                    | 72.33                       | 46.33                 | 75.04                 | 46.33                 | 75.04           | 183,369.50             | 131,288.22             |
| M402A/0054+21         | M402A/0054+21           | 645           | 54               | 31.72                 | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                 | 56.00                  | 78                    | 72.38                       | 46.36                 | 81.57                 | 46.36                 | 81.57           | 152,310.17             | 109,050.48             |
| M402A/0060+68         | M402A/0060+68           | 255           | 54               | 35.19                 | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                 | 56.11                  | 78                    | 72.41                       | 46.38                 | 78.08                 | 46.38                 | 78.08           | 446,804.76             | 385,255.15             |
| M402A/0061+67         | M402A/0061+67           | 99            | 54               | 29.72                 | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                 | 73.24                  | 84                    | 88.35                       | 72.52                 | 102.23                | 72.52                 | 102.23          | 152,310.17             | 109,050.48             |
| M402A/0065+95         | M402A/0065+95           | 510           | 54               | 31.88                 | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                 | 73.15                  | 84                    | 88.46                       | 72.60                 | 104.99                | 72.60                 | 104.99          | 353,287.50             | 304,620.35             |
| M402A/0072+77         | M402A/0072+77           | 891           | 54               | 32.39                 | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                 | 73.15                  | 84                    | 88.46                       | 72.60                 | 104.99                | 72.60                 | 104.99          | 478,669.93             | 482,614.20             |
| M402A/0080+78         | M402A/0080+78           | 808           | 54               | 31.52                 | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000570                 | 73.12                  | 84                    | 88.80                       | 72.88                 | 105.11                | 72.88                 | 105.11          | 559,718.24             | 482,614.20             |
| M402A/0085+50         | M402A/0085+50           | 151           | 54               | 35.67                 | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                 | 73.11                  | 84                    | 88.89                       | 72.95                 | 108.62                | 72.95                 | 108.62          | 277,088.24             | 238,917.92             |
| M402A/0088+51         | M402A/0088+51           | 168           | 54               | 29.26                 | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000571                 | 73.13                  | 84                    | 88.89                       | 72.95                 | 108.62                | 72.95                 | 108.62          | 104,600.81             | 90,191.51              |
| M402A/0096+65         | M402A/0096+65           | 820           | 54               | 24.42                 | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                 | 73.17                  | 84                    | 88.99                       | 73.03                 | 97.45                 | 73.03                 | 97.45           | 116,377.06             | 100,345.53             |
| M402A/0103+76         | M402A/0103+76           | 711           | 54               | 31.72                 | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                 | 73.17                  | 84                    | 89.19                       | 73.20                 | 104.92                | 73.20                 | 104.92          | 568,030.89             | 489,781.73             |
| M402A/0105+11         | M402A/0105+11           | 135           | 54               | 21.89                 | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                 | 73.52                  | 84                    | 89.37                       | 73.34                 | 95.23                 | 73.34                 | 95.23           | 492,524.34             | 424,676.60             |
| M402A/0109+91         | M402A/0109+91           | 807           | 54               | 53.47                 | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000577                 | 73.52                  | 84                    | 89.37                       | 73.34                 | 95.23                 | 73.34                 | 95.23           | 93,517.28              | 80,634.80              |
| M402A/0113+81         | M402A/0113+81           | 345           | 54               | 25.08                 | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                 | 73.57                  | 84                    | 89.42                       | 73.39                 | 126.86                | 73.39                 | 126.86          | 539,025.52             | 482,016.90             |
| M402A/0117+43         | M402A/0117+43           | 695           | 54               | 39.39                 | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                 | 73.82                  | 84                    | 89.67                       | 73.59                 | 113.05                | 73.59                 | 113.05          | 258,988.61             | 206,066.71             |
| M402A/0120+25         | M402A/0120+25           | 126           | 54               | 40.78                 | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                 | 88.09                  | 84                    | 90.01                       | 73.66                 | 114.65                | 73.66                 | 114.65          | 481,440.81             | 415,119.89             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 41.74                 | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                 | 88.11                  | 84                    | 90.06                       | 73.87                 | 115.65                | 73.87                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 36.97                 | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                 | 88.11                  | 84                    | 90.17                       | 74.00                 | 110.97                | 74.00                 | 110.97          | 213,357.94             | 183,968.80             |
|                       |                         |               |                  | 31.40                 | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                 | 74.86                  | 64                    | 77.01                       | 130.52                | 161.92                | 130.52                | 161.92          | 466,463.28             | 692,861.97             |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 103,375.50  
 2010 Sew. Ac. = 17,998.52  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$8,924,327.28  
 + Engr., ROW, Finance, Conting. (1.5x) = \$13,386,490.92 \$11,250,314.37

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.: s = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup>(8/3) ]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BEF, Area, and Constant  
 6.0 MGD Intel Facility Flow This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$6,425,843.14 \$5,711,354.07  
 Estim. Cost Below R.H. Meter = \$2,498,484.14 \$1,788,855.51  
 Percent R.H. Cost of Total Line = 28.00% 23.85%  
 Estim. Richland Hills Cost Share = \$3,747,726.21 \$2,683,283.27

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/ft) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. P/ARL PIPE (n) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|--------------------------|------------------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                 | 68.08                  | 84                    | 69.57                 | 84                   | 69.57                 | 291.68          | \$70,657.50            | \$70,657.50             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 69.19                  | 84                    | 72.04                 | 84                   | 72.04                 | 106.07          | 1,195,635.75           | 1,195,635.75            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 69.20                  | 84                    | 72.06                 | 84                   | 72.06                 | 1.49            | 50,568.60              | 50,568.60               |
| M402A/0022+40         | M402A/0022+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 69.20                  | 84                    | 72.06                 | 84                   | 72.06                 | 146.39          | 103,908.09             | 103,908.09              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                 | 69.21                  | 84                    | 72.08                 | 84                   | 72.08                 | 47,797.72       | 47,797.72              | 47,797.72               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                 | 69.67                  | 84                    | 72.74                 | 84                   | 72.74                 | 59,696.47       | 59,696.47              | 59,696.47               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.65                 | -0.0011        | 0.0090         | 90                    | 0.000385                 | 69.81                  | 84                    | 72.93                 | 84                   | 72.93                 | 276,395.52      | 276,395.52             | 276,395.52              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000358                 | 69.81                  | 84                    | 72.84                 | 84                   | 72.84                 | 95.52           | 299,948.02             | 299,948.02              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000358                 | 69.97                  | 84                    | 72.84                 | 84                   | 72.84                 | 104.48          | 299,948.02             | 299,948.02              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000359                 | 70.08                  | 84                    | 87.96                 | 84                   | 87.96                 | 101.22          | 250,072.13             | 250,072.13              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000361                 | 70.20                  | 84                    | 88.07                 | 84                   | 88.07                 | 106.10          | 387,230.81             | 387,230.81              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000362                 | 70.25                  | 84                    | 88.07                 | 84                   | 88.07                 | 104.10          | 212,665.22             | 212,665.22              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000362                 | 70.28                  | 84                    | 88.19                 | 84                   | 88.19                 | 107.60          | 174,565.59             | 174,565.59              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000364                 | 70.38                  | 84                    | 88.23                 | 84                   | 88.23                 | 102.23          | 152,310.17             | 152,310.17              |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000364                 | 85.67                  | 84                    | 88.37                 | 84                   | 88.37                 | 104.40          | 446,804.78             | 446,804.78              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000366                 | 85.66                  | 84                    | 88.46                 | 84                   | 88.46                 | 104.99          | 68,579.34              | 68,579.34               |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000368                 | 85.61                  | 84                    | 88.46                 | 84                   | 88.46                 | 104.99          | 352,287.50             | 352,287.50              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000368                 | 85.63                  | 84                    | 88.60                 | 84                   | 88.60                 | 104.23          | 478,669.93             | 478,669.93              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000370                 | 85.66                  | 84                    | 88.80                 | 84                   | 88.80                 | 105.11          | 559,718.24             | 559,718.24              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000371                 | 85.68                  | 84                    | 88.89                 | 84                   | 88.89                 | 108.62          | 277,088.24             | 277,088.24              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000372                 | 85.70                  | 84                    | 88.94                 | 84                   | 88.94                 | 102.25          | 104,600.81             | 104,600.81              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000373                 | 85.75                  | 84                    | 88.99                 | 84                   | 88.99                 | 97.45           | 116,377.06             | 116,377.06              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000375                 | 85.98                  | 84                    | 89.19                 | 84                   | 89.19                 | 104.92          | 568,030.89             | 568,030.89              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000377                 | 86.15                  | 84                    | 89.19                 | 84                   | 89.19                 | 95.23           | 492,524.34             | 492,524.34              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000378                 | 86.21                  | 84                    | 89.37                 | 84                   | 89.37                 | 126.86          | 93,517.28              | 93,517.28               |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000381                 | 86.37                  | 84                    | 89.67                 | 84                   | 89.67                 | 98.67           | 559,025.52             | 559,025.52              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000382                 | 86.50                  | 84                    | 89.76                 | 84                   | 89.76                 | 113.05          | 238,988.61             | 238,988.61              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000386                 | 99.28                  | 84                    | 90.01                 | 84                   | 90.01                 | 114.65          | 481,440.81             | 481,440.81              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000386                 | 99.33                  | 84                    | 90.06                 | 84                   | 90.06                 | 115.65          | 87,282.79              | 87,282.79               |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                 | 86.05                  | 84                    | 159.04                | 84                   | 159.04                | 161.92          | 803,555.89             | 803,555.89              |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 112,980.75  
 2015 Sew. Ac. = 20,730.07  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,791,605.61 \$8,645,064.67  
 + Engr. ROW, financ., Conting. (1.5x) = \$14,687,408.42 \$12,967,597.00

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROF. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

Estim. Cost Above R.H. Meter = \$6,893,955.36 \$5,944,277.84  
 Estim. Cost Below R.H. Meter = \$2,897,650.25 \$2,700,786.83  
 Percent R.H. Cost of Total Line = 29.50% 31.24%  
 Estim. Richland Hills Cost Share = \$4,346,475.37 \$4,051,180.25

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BF X Area, and Constant  
 6.0 MGD Intel Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model.

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 COFW Option 2.xls  
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OPTION 2 - YEAR 2020

BIG FOSSIL SEWER STUDY

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 68.26                  | 84                    | 69.57                 | 78                    | 57.09                 | 279.20          | \$70,657.50            | \$80,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 69.15                  | 84                    | 72.04                 | 78                    | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 69.15                  | 84                    | 72.06                 | 78                    | 59.13                 | -11.44          | 50,568.60              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 69.15                  | 84                    | 72.06                 | 78                    | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 69.15                  | 84                    | 72.04                 | 78                    | 59.13                 | 133.46          | 47,977.72              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 69.59                  | 84                    | 72.74                 | 78                    | 59.89                 | 84.73           | 602,666.92             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 69.73                  | 84                    | 72.93                 | 78                    | 59.85                 | 95.52           | 276,395.52             | 238,320.62             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 69.89                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 298,948.02             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 70.02                  | 84                    | 87.96                 | 78                    | 72.19                 | 101.22          | 250,072.13             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 70.14                  | 84                    | 88.07                 | 78                    | 72.28                 | 106.10          | 387,230.81             | 333,887.79             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 70.19                  | 84                    | 88.14                 | 78                    | 72.33                 | 101.04          | 212,665.22             | 183,369.50             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 70.22                  | 84                    | 88.19                 | 78                    | 72.38                 | 104.10          | 174,565.59             | 150,518.29             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 70.33                  | 84                    | 88.23                 | 78                    | 72.41                 | 107.60          | 176,643.75             | 152,310.17             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 88.89                  | 90                    | 106.20                | 84                    | 88.35                 | 120.25          | 512,913.65             | 446,604.78             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 88.87                  | 90                    | 106.22                | 84                    | 88.35                 | 120.25          | 405,559.63             | 353,287.50             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 88.81                  | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 549,493.54             | 478,669.93             |
| M402A/0072+77         | M402A/0065+95           | 808           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000570                   | 88.81                  | 90                    | 106.74                | 84                    | 88.60                 | 120.12          | 642,533.69             | 559,718.24             |
| M402A/0080+78         | M402A/0072+77           | 400           | 54               | 32.23                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 88.82                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.99             | 277,088.24             |
| M402A/0085+50         | M402A/0080+78           | 151           | 54               | 29.26                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 88.84                  | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81             |
| M402A/0086+56         | M402A/0085+50           | 168           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 88.84                  | 90                    | 106.97                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06             |
| M402A/0088+51         | M402A/0086+56           | 820           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 88.89                  | 90                    | 107.21                | 84                    | 88.99                 | 120.91          | 652,076.27             | 568,030.89             |
| M402A/0086+65         | M402A/0088+51           | 711           | 54               | 21.89                  | 31.72                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 89.14                  | 90                    | 107.42                | 84                    | 89.37                 | 111.26          | 565,397.84             | 492,524.34             |
| M402A/0103+76         | M402A/0086+65           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 89.31                  | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28              |
| M402A/0105+11         | M402A/0103+76           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 89.54                  | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52             |
| M402A/0109+91         | M402A/0105+11           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 89.68                  | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61             |
| M402A/0113+81         | M402A/0109+91           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 105.17                 | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 552,674.40             | 481,440.81             |
| M402A/0117+43         | M402A/0113+81           | 126           | 54               | 41.74                  | 42.20                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 105.19                 | 90                    | 108.25                | 84                    | 90.06                 | 131.80          | 100,197.09             | 87,282.79              |
| M402A/0120+25         | M402A/0117+43           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 105.21                 | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 213,357.94             |
| M402B/0123+40         | M402A/0120+25           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 90.11                  | 90                    | 191.16                | 64                    | 159.04                | 190.44          | 922,449.36             | 803,555.89             |
| M402B/0136+74         | M402B/0123+40           |               |                  |                        |                       |                       |                |                |                       |                            |                        |                       |                       |                       |                       |                 |                        |                        |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2020 Eq. Pop. = 122,586.00  
 2020 Sew. Ac. = 21,884.42  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$10,670,904.84 \$9,261,419.89  
 + Engr., ROW, F.H.I., Conting. (1.5x) = \$16,006,357.26 \$13,892,129.83

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

NOTES:  
 Stations confirmed by Field Survey  
 Stations confirmed by Field Survey  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(8/3)]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [D<sup>4.75</sup>(8/3) x s<sup>1.54</sup> / 1629.6 x n]<sup>1/2</sup> / 1.54  
 Proposed Parallel Pipe Capacity in MGD = [D<sup>4.75</sup>(8/3) x s<sup>1.54</sup> / 1629.6 x n]<sup>1/2</sup> / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BFV Area, and Constant  
 6.0 MGD Intel Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$7,773,254.59 \$6,762,935.74  
 Estim. Cost Below R.H. Meter = \$2,897,650.25 \$2,498,484.14  
 Percent R.H. Cost of Total Line = 27.15% 26.98%  
 Estim. Richland Hills Cost Share = \$4,346,475.37 \$3,747,726.21

COFW Option 2.xls  
 Page 1 of 1

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. P/R.L. P/E (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 59.29                  | 84                    | 69.57                 | 84                    | 69.57                 | 291.68          | \$70,657.50            | \$70,657.50             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 58.75                  | 84                    | 72.04                 | 84                    | 72.04                 | 106.07          | 1,195,635.75           | 1,195,635.75            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 58.75                  | 84                    | 72.06                 | 84                    | 72.06                 | 1.49            | 50,568.60              | 50,568.60               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 58.75                  | 84                    | 72.06                 | 84                    | 72.06                 | 72.06           | 103,908.09             | 103,908.09              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 58.75                  | 84                    | 72.08                 | 84                    | 72.08                 | 146.39          | 47,797.72              | 47,797.72               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 58.96                  | 84                    | 72.74                 | 84                    | 72.74                 | 97.78           | 602,666.92             | 602,666.92              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.65                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 59.05                  | 84                    | 72.93                 | 84                    | 72.93                 | 108.60          | 276,395.52             | 276,395.52              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 59.22                  | 84                    | 87.84                 | 84                    | 87.84                 | 120.23          | 299,948.02             | 299,948.02              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 59.36                  | 84                    | 87.96                 | 84                    | 87.96                 | 116.99          | 250,072.13             | 250,072.13              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.92                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 59.49                  | 84                    | 88.07                 | 84                    | 88.07                 | 121.89          | 387,230.81             | 387,230.81              |
| M402A/0051+91         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 59.55                  | 84                    | 88.14                 | 84                    | 88.14                 | 116.85          | 212,665.22             | 212,665.22              |
| M402A/0054+21         | M402A/0051+91           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 59.55                  | 84                    | 88.19                 | 84                    | 88.19                 | 119.91          | 174,565.59             | 174,565.59              |
| M402A/0060+68         | M402A/0054+21           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 59.74                  | 84                    | 88.23                 | 84                    | 88.23                 | 123.42          | 176,643.75             | 176,643.75              |
| M402A/0061+67         | M402A/0060+68           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 93.63                  | 90                    | 106.20                | 84                    | 88.35                 | 118.07          | 512,913.65             | 446,804.78              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.61                 | 88.37                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 93.39                  | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,559.63             | 353,287.50              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 93.28                  | 90                    | 106.50                | 84                    | 88.60                 | 120.12          | 549,493.54             | 478,669.93              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 93.15                  | 90                    | 106.74                | 84                    | 88.80                 | 121.03          | 642,533.69             | 559,718.24              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 93.10                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.99             | 277,088.24              |
| M402A/0088+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 93.10                  | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81              |
| M402A/0096+65         | M402A/0088+56           | 168           | 54               | 24.42                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 93.16                  | 90                    | 107.21                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 93.66                  | 90                    | 107.42                | 84                    | 89.42                 | 142.89          | 565,397.84             | 492,524.34              |
| M402A/0109+91         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 93.74                  | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28               |
| M402A/0113+81         | M402A/0109+91           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 93.85                  | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52              |
| M402A/0120+25         | M402A/0113+81           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 94.04                  | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61              |
| M402A/0120+25         | M402A/0120+25           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 122.22                 | 90                    | 108.19                | 84                    | 90.06                 | 130.79          | 552,674.40             | 481,440.81              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 122.17                 | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 87,282.79               |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 86                    | 0.001829                   | 99.30                  | 90                    | 191.16                | 84                    | 159.04                | 190.44          | 922,449.36             | 803,555.89              |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 156,708.49  
 2050 Sew. Ac. = 24,835.40  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$10,670,904.84 \$9,791,605.61  
 + Engr., ROW, -manc., Conting. (1.5x) = \$16,006,357.26 \$14,687,408.42

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 EXIST DIA.  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FL. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 COEF. "A", COEF. "B"  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 MODEL PROP DIA.  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 DESIGN FLOW  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGDS BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGDS  
 PROPOSED PARALLEL PIPE CAPACITY IN MGDS =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 PARL. PIPE CAP.  
 Proposed Parallel Pipe Capacity in MGDS =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 BOTH CAP.  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 ESTIM. REPL. PIPE COST  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 ESTIM. PARL. PIPE COST  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BFV Area, and Constant  
 6.0 MGD Inlet Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model

Estim. Cost Above R.H. Meter = \$7,773,254.59 \$6,893,955.36  
 Estim. Cost Below R.H. Meter = \$2,897,650.25 \$2,897,650.25  
 Percent R.H. Cost of Total Line = 27.15% 29.59%  
 Estim. Richland Hills Cost Share = \$4,346,475.37 \$4,346,475.37

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A0000+50          | M280A00304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 54.38                  | 90                    | 83.62                 | 84                    | 69.57                 | 291.68          | \$81,111.93            | \$70,657.50             |
| M402A0020+17          | M402A0000+50            | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 53.07                  | 90                    | 86.59                 | 84                    | 72.04                 | 106.07          | 1,372,541.04           | 1,195,635.75            |
| M402A0020+90          | M402A0020+17            | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 53.06                  | 90                    | 86.61                 | 84                    | 72.06                 | 1.49            | 58,050.89              | 50,568.60               |
| M402A0022+40          | M402A0020+90            | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 53.06                  | 90                    | 86.61                 | 84                    | 72.06                 | 146.39          | 119,289.23             | 103,908.09              |
| M402A0023+09          | M402A0022+40            | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 53.06                  | 90                    | 86.64                 | 84                    | 72.08                 | 97.78           | 54,866.83              | 47,797.72               |
| M402A0028+40          | M402A0023+09            | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 53.15                  | 90                    | 87.43                 | 84                    | 72.74                 | 108.60          | 691,637.02             | 602,666.92              |
| M402A0032+40          | M402A0028+40            | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 53.21                  | 90                    | 87.66                 | 84                    | 72.93                 | 317,290.77      | 276,395.52             |                         |
| M402A0036+79          | M402A0032+40            | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 53.38                  | 90                    | 105.58                | 84                    | 87.84                 | 344,328.08      | 299,948.02             |                         |
| M402A0040+28          | M402A0036+79            | 381           | 54               | 29.03                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 53.52                  | 90                    | 105.73                | 84                    | 87.96                 | 287,072.60      | 250,072.13             |                         |
| M402A0045+95          | M402A0040+28            | 559           | 54               | 33.82                  | 18.97                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 53.67                  | 90                    | 105.86                | 84                    | 88.07                 | 444,525.17      | 387,230.81             |                         |
| M402A0049+00          | M402A0045+95            | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 53.73                  | 90                    | 105.94                | 84                    | 88.14                 | 200,394.17      | 174,565.59             |                         |
| M402A0051+91          | M402A0049+00            | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 53.72                  | 90                    | 106.00                | 84                    | 88.19                 | 202,779.82      | 176,643.78             |                         |
| M402A0054+21          | M402A0051+91            | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 53.94                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.78              |
| M402A0058+68          | M402A0054+21            | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 96.17                  | 90                    | 106.22                | 84                    | 88.35                 | 118.07          | 512,913.65             | 446,804.78              |
| M402A0061+67          | M402A0058+68            | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 96.10                  | 90                    | 106.22                | 84                    | 88.37                 | 120.25          | 68,578.34              | 59,718.24               |
| M402A0065+95          | M402A0061+67            | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 95.85                  | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,559.63             | 353,287.50              |
| M402A0072+77          | M402A0065+95            | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 95.48                  | 90                    | 106.74                | 84                    | 88.60                 | 120.12          | 549,493.54             | 478,669.93              |
| M402A0080+78          | M402A0072+77            | 808           | 54               | 32.23                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 95.40                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 642,533.69             | 559,718.24              |
| M402A0085+50          | M402A0080+78            | 400           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 95.39                  | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81              |
| M402A0086+56          | M402A0085+50            | 151           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 95.45                  | 90                    | 106.97                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06              |
| M402A0096+65          | M402A0086+56            | 168           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 95.78                  | 90                    | 107.21                | 84                    | 89.19                 | 120.91          | 652,076.27             | 568,030.89              |
| M402A0103+76          | M402A0096+65            | 711           | 54               | 24.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 95.98                  | 90                    | 107.42                | 84                    | 89.37                 | 111.26          | 565,397.84             | 492,524.34              |
| M402A0105+11          | M402A0103+76            | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 96.07                  | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28               |
| M402A0109+91          | M402A0105+11            | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 96.16                  | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52              |
| M402A0113+81          | M402A0109+91            | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 96.38                  | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61              |
| M402A0117+43          | M402A0113+81            | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 131.46                 | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 552,674.40             | 481,440.81              |
| M402A0120+25          | M402A0117+43            | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 131.46                 | 90                    | 108.25                | 84                    | 90.17                 | 131.80          | 100,197.09             | 87,282.79               |
| M402B0123+40          | M402A0120+25            | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 131.36                 | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 213,357.84              |
| M402B0136+74          | M402B0123+40            | 1180          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 104.26                 | 90                    | 191.16                | 84                    | 159.04                | 190.44          | 922,449.36             | 803,555.89              |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 175,228.27  
 2070 Sew. Ac. = 26,431.99  
 + Engr., ROW, Fin. Inc., Conting. (1.5x) = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,240,363.58 \$9,791,605.61  
 \$16,860,545.37 \$14,687,408.42

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows. Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan Using Manning's Eq. s = [ 1629.6 x n x MGD<sup>0.33</sup> ] / 2. n = 0.0145  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq. s = [ 1629.6 x n x MGD<sup>0.33</sup> ] / 2. n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>5</sup>(873) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>5</sup>(873) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Hallom City,  
 Richland Hills, year 2020 BFX Area, and Constant  
 6.0 MGD Inlet Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Hallom City  
 to this line. The Marine Creek Area is not included in  
 this model  
 Estim. Cost Above R.H. Meter = \$7,913,979.37 \$6,893,955.36  
 Estim. Cost Below R.H. Meter = \$3,326,384.21 \$2,897,650.25  
 Percent R.H. Cost of Total Line = 29.59% 29.59%  
 Estim. Richland Hills Cost Share = \$4,989,576.32 \$4,346,475.37

**OPTION 3**

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+10         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 40.23                  | 72                    | 46.12                 | 54                    | 21.41                 | 243.52          | \$51,911.63            | \$29,200.29            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 40.52                  | 72                    | 47.76                 | 54                    | 22.18                 | 56.21           | 878,426.26             | 494,114.77             |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 40.52                  | 72                    | 47.77                 | 54                    | 22.18                 | -48.39          | 37,152.44              | 20,898.25              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 40.52                  | 72                    | 47.77                 | 54                    | 22.18                 | 22.18           | 76,340.64              | 42,941.61              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 40.53                  | 72                    | 47.79                 | 54                    | 22.19                 | 96.50           | 35,116.69              | 19,753.14              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 40.77                  | 72                    | 48.22                 | 54                    | 22.39                 | 47.43           | 442,775.69             | 249,061.33             |
| M402A/0032+40         | M402A/0028+40           | 389           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 40.85                  | 72                    | 48.25                 | 54                    | 22.45                 | 58.12           | 203,066.09             | 114,224.68             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 29.03                  | 18.87                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 40.96                  | 66                    | 46.17                 | 54                    | 27.04                 | 59.43           | 185,171.99             | 123,958.11             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 41.14                  | 66                    | 46.24                 | 54                    | 27.08                 | 56.11           | 154,381.27             | 103,346.14             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 41.18                  | 66                    | 46.33                 | 54                    | 27.11                 | 55.84           | 131,288.22             | 87,887.16              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 31.72                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 41.18                  | 66                    | 46.33                 | 54                    | 27.11                 | 55.84           | 131,288.22             | 87,887.16              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 57.18                  | 72                    | 58.57                 | 54                    | 27.20                 | 56.92           | 328,264.74             | 184,648.92             |
| M402A/0061+67         | M402A/0054+21           | 645           | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 57.11                  | 72                    | 58.64                 | 54                    | 27.23                 | 59.62           | 259,558.17             | 146,001.47             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 57.09                  | 72                    | 58.71                 | 54                    | 27.33                 | 59.56           | 351,675.87             | 197,817.68             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000570                   | 57.06                  | 72                    | 58.87                 | 54                    | 27.36                 | 63.03           | 203,575.03             | 114,510.96             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.43                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 57.06                  | 72                    | 58.93                 | 54                    | 27.36                 | 63.03           | 203,575.03             | 114,510.96             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 57.07                  | 72                    | 59.06                 | 54                    | 27.36                 | 63.03           | 203,575.03             | 114,510.96             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 57.11                  | 72                    | 59.13                 | 54                    | 27.36                 | 63.03           | 203,575.03             | 114,510.96             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 57.28                  | 72                    | 59.28                 | 54                    | 27.36                 | 63.03           | 203,575.03             | 114,510.96             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 57.45                  | 72                    | 59.28                 | 54                    | 27.36                 | 63.03           | 203,575.03             | 114,510.96             |
| M402A/0103+76         | M402A/0096+65           | 135           | 54               | 25.08                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 57.45                  | 72                    | 59.28                 | 54                    | 27.36                 | 63.03           | 203,575.03             | 114,510.96             |
| M402A/0105+11         | M402A/0103+76           | 807           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 57.66                  | 72                    | 59.51                 | 54                    | 27.36                 | 63.03           | 203,575.03             | 114,510.96             |
| M402A/0109+91         | M402A/0105+11           | 345           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 70.92                  | 78                    | 73.87                 | 60                    | 36.70                 | 77.48           | 145,589.89             | 245,633.07             |
| M402A/0113+81         | M402A/0109+91           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 70.92                  | 78                    | 73.87                 | 60                    | 36.70                 | 77.48           | 145,589.89             | 245,633.07             |
| M402A/0117+43         | M402A/0113+81           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 70.93                  | 78                    | 73.91                 | 60                    | 36.72                 | 78.46           | 75,259.14              | 44,532.04              |
| M402A/0120+25         | M402A/0117+43           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 70.93                  | 78                    | 74.00                 | 60                    | 36.76                 | 73.73           | 183,966.90             | 108,858.09             |
| M402B/0123+40         | M402A/0120+25           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 59.00                  | 78                    | 130.52                | 60                    | 64.84                 | 96.24           | 692,861.97             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 90,518.25  
 2000 Sew. Ac. = 15,473.77  
 Constant Intel Flow = 0.00  
 TOTAL ESTIM. CONST. COST = \$7,219,929.88  
 + Engr., RO V, Financ., Conting. (1.5%) = \$10,929,894.82 \$8,616,342.28

NOTES:  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n]^{1/2}$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n]^{1/2}$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BF X Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Haltom City. The Marine Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model

Estim. Cost Above R.H. Meter = \$4,916,531.41 \$3,053,367.48  
 Estim. Cost Below R.H. Meter = \$2,251,486.84 \$1,328,327.08  
 Percent R.H. Cost of Total Line = 20.79% 20.08%  
 Estim. Richland Hills Cost Share = \$0.00 \$0.00

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE DIA. (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 45.68                  | 72                    | 46.12                 | 28.36                | 250.47                | \$51,911.63     | \$36,049.75            |                         |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 46.15                  | 72                    | 47.76                 | 29.37                | 63.40                 | 878,426.26      | 610,018.24             |                         |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 46.16                  | 72                    | 47.77                 | 29.38                | -41.19                | 37,152.44       | 25,800.31              |                         |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.62                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 46.16                  | 72                    | 47.77                 | 29.38                | 29.38                 | 76,340.64       | 53,014.33              |                         |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 46.17                  | 72                    | 47.79                 | 29.39                | 103.70                | 35,116.69       | 24,386.59              |                         |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 46.46                  | 72                    | 48.22                 | 29.65                | 54.69                 | 442,775.69      | 307,483.12             |                         |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 46.46                  | 72                    | 48.35                 | 29.65                | 58.12                 | 203,066.09      | 114,224.68             |                         |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 46.68                  | 72                    | 58.23                 | 27.04                | 59.43                 | 220,369.97      | 123,958.11             |                         |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 46.77                  | 72                    | 58.31                 | 27.08                | 56.11                 | 183,726.47      | 103,346.14             |                         |
| M402A/0045+95         | M402A/0040+28           | 359           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 46.87                  | 72                    | 58.39                 | 27.11                | 60.93                 | 284,496.11      | 160,029.06             |                         |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 46.91                  | 72                    | 58.43                 | 27.13                | 55.84                 | 156,243.84      | 87,887.16              |                         |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 46.92                  | 72                    | 58.46                 | 27.15                | 58.87                 | 128,252.27      | 72,141.90              |                         |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 47.02                  | 72                    | 58.49                 | 27.16                | 62.35                 | 129,779.08      | 73,000.73              |                         |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 63.07                  | 78                    | 72.51                 | 66                   | 46.44                 | 385,255.15      | 275,833.57             |                         |
| M402A/0060+68         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 63.05                  | 78                    | 72.52                 | 66                   | 46.45                 | 59,132.19       | 42,337.24              |                         |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 62.99                  | 78                    | 72.60                 | 66                   | 46.50                 | 304,620.35      | 218,100.96             |                         |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 62.97                  | 78                    | 72.71                 | 66                   | 46.57                 | 78.09           | 295,505.42             |                         |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 62.96                  | 78                    | 72.88                 | 66                   | 46.68                 | 412,730.71      | 295,505.42             |                         |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 62.96                  | 78                    | 72.95                 | 66                   | 46.73                 | 238,917.92      | 171,059.58             |                         |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 62.97                  | 78                    | 72.99                 | 66                   | 46.75                 | 90,191.51       | 64,574.99              |                         |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 63.01                  | 78                    | 73.03                 | 66                   | 46.78                 | 100,345.53      | 71,845.02              |                         |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 63.20                  | 78                    | 73.20                 | 66                   | 46.88                 | 489,781.73      | 350,672.13             |                         |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 63.34                  | 78                    | 73.34                 | 66                   | 46.98                 | 424,676.60      | 304,058.40             |                         |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 63.39                  | 78                    | 73.39                 | 66                   | 47.00                 | 100.47          | 80,634.80              |                         |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 63.50                  | 78                    | 73.59                 | 66                   | 47.14                 | 72.22           | 482,016.90             |                         |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 63.62                  | 78                    | 73.66                 | 66                   | 47.18                 | 86.57           | 206,066.71             |                         |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 77.00                  | 78                    | 73.87                 | 66                   | 47.31                 | 88.09           | 415,119.89             |                         |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 77.02                  | 78                    | 73.91                 | 66                   | 47.34                 | 89.08           | 75,259.14              |                         |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 77.01                  | 78                    | 74.00                 | 66                   | 47.40                 | 84.37           | 183,966.80             |                         |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.0001829                  | 64.59                  | 78                    | 130.52                | 66                   | 83.60                 | 692,861.97      | 496,072.77             |                         |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50 2005 Eq. Pop. = 96,946.88  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33 2005 Sew. Ac. = 16,882.20  
 TOTAL ESTIM. CONST. COST = \$7,951,849.27  
 + Engr., ROW, Financ., Conting. (1.5x) = \$11,927,773.91  
 \$8,190,213.54

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MDEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP REPL PIPE  
 REPL PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter, Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient, Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, year 2020 BF-X Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Haltom City. The Marine Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$5,822,963.38 \$4,061,859.10  
 Estim. Cost Below R.H. Meter = \$2,128,885.90 \$1,398,281.26  
 Percent R.H. Cost of Total Line = 26.77% 25.61%  
 Estim. Richland Hills Cost Share = \$3,193,328.85 \$2,097,421.89



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PRC (P. PAR. L. (ft.) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 48.68                  | 76                    | 57.09                 | 60                    | 28.36                 | 250.47          | \$60,924.07            | \$36,049.75             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 49.19                  | 78                    | 59.12                 | 60                    | 29.37                 | 63.40           | 1,030,930.82           | 610,018.24              |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 49.19                  | 78                    | 59.13                 | 60                    | 29.38                 | -41.19          | 43,602.52              | 25,800.31               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 49.19                  | 78                    | 59.13                 | 60                    | 29.38                 | 29.38           | 89,594.22              | 53,014.33               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 49.51                  | 78                    | 59.15                 | 60                    | 29.39                 | 103.70          | 41,213.34              | 24,386.59               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 49.51                  | 78                    | 59.69                 | 60                    | 29.85                 | 54.69           | 519,646.47             | 307,483.12              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 49.75                  | 78                    | 59.85                 | 60                    | 29.85                 | 65.40           | 238,320.62             | 141,018.12              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 49.75                  | 72                    | 58.23                 | 60                    | 35.81                 | 68.20           | 220,369.97             | 153,034.70              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 49.85                  | 72                    | 58.31                 | 60                    | 35.86                 | 64.89           | 183,726.47             | 127,587.82              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 49.94                  | 72                    | 58.39                 | 60                    | 35.90                 | 69.72           | 284,486.11             | 187,566.74              |
| M402A/0051+91         | M402A/0045+95           | 307           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 50.00                  | 72                    | 58.43                 | 60                    | 35.93                 | 64.64           | 156,243.84             | 108,502.66              |
| M402A/0055+21         | M402A/0051+91           | 252           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 50.11                  | 72                    | 58.46                 | 60                    | 35.95                 | 67.67           | 128,252.27             | 89,084.08               |
| M402A/0060+68         | M402A/0055+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 67.24                  | 78                    | 72.51                 | 66                    | 46.44                 | 71.16           | 129,779.08             | 90,124.36               |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 67.22                  | 78                    | 72.52                 | 66                    | 46.45                 | 78.33           | 385,255.15             | 275,833.57              |
| M402A/0063+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 67.15                  | 78                    | 72.60                 | 66                    | 46.50                 | 78.89           | 59,132.19              | 42,337.24               |
| M402A/0072+77         | M402A/0063+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 67.13                  | 78                    | 72.71                 | 66                    | 46.57                 | 78.09           | 304,620.35             | 218,100.96              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 67.12                  | 78                    | 72.88                 | 66                    | 46.68                 | 78.91           | 412,730.71             | 295,505.42              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 67.11                  | 78                    | 72.95                 | 66                    | 46.73                 | 82.40           | 482,614.20             | 345,540.34              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 67.13                  | 78                    | 72.99                 | 66                    | 46.75                 | 76.01           | 238,917.92             | 171,059.58              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 67.17                  | 78                    | 73.03                 | 66                    | 46.78                 | 71.20           | 90,191.51              | 64,574.99               |
| M402A/0096+85         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 67.37                  | 78                    | 73.20                 | 66                    | 46.88                 | 78.60           | 100,345.53             | 71,845.02               |
| M402A/0103+76         | M402A/0096+85           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 67.52                  | 78                    | 73.34                 | 66                    | 46.88                 | 81.14           | 424,676.60             | 350,672.13              |
| M402A/0109+91         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 67.57                  | 78                    | 73.39                 | 66                    | 46.88                 | 78.60           | 489,781.73             | 361,854.62              |
| M402A/0113+81         | M402A/0109+91           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 67.70                  | 78                    | 73.59                 | 66                    | 46.88                 | 81.14           | 424,676.60             | 361,854.62              |
| M402A/0117+43         | M402A/0113+81           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 67.82                  | 78                    | 73.66                 | 66                    | 46.88                 | 81.14           | 424,676.60             | 361,854.62              |
| M402A/0120+25         | M402A/0117+43           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 82.09                  | 84                    | 90.01                 | 72                    | 59.51                 | 98.90           | 482,016.90             | 410,712.63              |
| M402B/0123+40         | M402A/0120+25           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 82.11                  | 84                    | 90.06                 | 72                    | 59.67                 | 100.45          | 206,066.71             | 175,563.47              |
| M402B/0136+74         | M402B/0123+40           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 82.11                  | 84                    | 90.17                 | 72                    | 59.70                 | 101.44          | 87,282.79              | 64,126.14               |
|                       |                         | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 68.86                  | 72                    | 105.43                | 66                    | 83.60                 | 115.00          | 213,357.94             | 156,752.77              |
|                       |                         |               |                  |                        |                       |                       |                |                |                       |                            |                        |                       |                       |                       |                       |                 | 590,367.59             | 495,072.77              |

F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33

2010 Eq. Pop. = 103,375.50  
 2010 Sew. Ac. = 17,998.52  
 Constant Intel Flow = 0.00

TOTAL ESTIM. CONST. COST = \$8,256,533.24  
 + Engr., ROW, Financ., Conting. (1.5x) = \$12,384,799.86  
 \$8,829,960.98

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2010

UPSTREAM MAIN/STATION  
 DOWNSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 LENGTH  
 LENGTH of Pipe Segment in Feet  
 EXIST DIA.  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQN.: S = [ 1629.6 x n x MGD^1.54 / D^5(8/3) ]^2, n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN INCHES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGD = [ D\*(8/3) x S^(1/2) / 1629.6 x n ] / 1.54  
 PROPOSED PARALLEL PIPE IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [ D\*(8/3) x S^(1/2) / 1629.6 x n ] / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

NOTES:  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City, Richland Hills, year 2020 BFx Area. This option also includes diversion of Little Fossil Creek Area in Haltom City. The Marine Creek Area is included, but the 6.0 MGD Intel Facility flow is not included in this model.

Estim. Cost Above R.H. Meter = \$5,828,204.73  
 Estim. Cost Below R.H. Meter = \$2,428,328.51  
 Percent R.H. Cost of Total Line = 29.41%  
 Estim. Richland Hills Cost Share = \$3,642,492.77  
 \$2,217,569.48

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 62.08                  | 84                    | 69.57                 | 78                    | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 63.19                  | 84                    | 72.04                 | 78                    | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 63.20                  | 84                    | 72.06                 | 78                    | 59.13                 | -11.44          | 50,568.60              | 43,602.52              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 0.00                   | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 63.21                  | 84                    | 72.06                 | 78                    | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A/0023+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 63.67                  | 84                    | 72.74                 | 72                    | 47.79                 | 122.10          | 47,797.72              | 35,116.69              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 63.81                  | 84                    | 72.74                 | 72                    | 48.22                 | 73.26           | 60,266.92              | 44,275.69              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | -0.0011        | 0.0091         | 84                    | 0.000385                   | 63.81                  | 84                    | 72.93                 | 72                    | 48.35                 | 84.02           | 276,395.52             | 203,066.09             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 18.92                  | 18.92                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 64.08                  | 78                    | 72.09                 | 72                    | 58.23                 | 90.62           | 298,628.65             | 220,369.97             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 64.20                  | 78                    | 72.28                 | 72                    | 58.31                 | 87.34           | 215,623.42             | 183,726.47             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 64.25                  | 78                    | 72.33                 | 72                    | 58.39                 | 92.21           | 333,887.79             | 284,496.11             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 64.25                  | 78                    | 72.33                 | 72                    | 58.46                 | 87.14           | 183,369.50             | 156,243.84             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 64.28                  | 78                    | 72.38                 | 72                    | 58.46                 | 90.18           | 150,518.29             | 128,252.27             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | -0.0004        | 0.0058         | 84                    | 0.000563                   | 64.38                  | 84                    | 72.41                 | 72                    | 58.49                 | 93.68           | 152,310.17             | 129,779.08             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 79.67                  | 84                    | 88.35                 | 72                    | 58.57                 | 88.29           | 446,804.78             | 328,264.74             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 79.66                  | 84                    | 88.37                 | 72                    | 58.58                 | 90.46           | 468,579.34             | 351,675.87             |
| M402A/0065+95         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 79.61                  | 84                    | 88.46                 | 72                    | 58.58                 | 91.03           | 353,287.50             | 259,558.17             |
| M402A/0072+77         | M402A/0065+95           | 808           | 54               | 32.23                  | 31.45                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 79.66                  | 84                    | 88.80                 | 72                    | 58.74                 | 90.26           | 478,669.93             | 351,675.87             |
| M402A/0080+78         | M402A/0072+77           | 400           | 54               | 35.67                  | 31.43                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 79.75                  | 84                    | 88.89                 | 72                    | 58.93                 | 94.60           | 559,718.24             | 411,221.56             |
| M402A/0085+50         | M402A/0080+78           | 151           | 54               | 24.42                  | 31.45                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 79.70                  | 84                    | 88.94                 | 72                    | 58.96                 | 88.22           | 104,600.81             | 76,849.57              |
| M402A/0086+56         | M402A/0085+50           | 168           | 54               | 21.89                  | 31.56                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 79.75                  | 84                    | 88.99                 | 72                    | 59.00                 | 83.42           | 116,377.06             | 85,501.51              |
| M402A/0091+11         | M402A/0086+56           | 820           | 54               | 29.26                  | 31.43                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 79.98                  | 84                    | 89.19                 | 78                    | 59.13                 | 90.85           | 568,030.89             | 417,328.82             |
| M402A/0105+11         | M402A/0091+11           | 711           | 54               | 31.72                  | 31.56                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 80.15                  | 84                    | 89.37                 | 78                    | 73.34                 | 95.23           | 492,524.34             | 424,676.60             |
| M402A/0108+51         | M402A/0105+11           | 135           | 54               | 53.47                  | 31.63                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 80.21                  | 84                    | 89.42                 | 78                    | 73.39                 | 92.86           | 93,517.28              | 80,634.80              |
| M402A/0113+81         | M402A/0108+51           | 807           | 54               | 25.08                  | 31.70                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 80.37                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0117+43         | M402A/0113+81           | 345           | 54               | 39.39                  | 31.77                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 80.50                  | 84                    | 89.76                 | 78                    | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0120+25         | M402A/0117+43           | 695           | 54               | 40.78                  | 42.22                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 93.28                  | 84                    | 90.01                 | 78                    | 73.87                 | 114.65          | 481,440.81             | 415,119.89             |
| M402B/0123+40         | M402A/0120+25           | 126           | 54               | 41.74                  | 42.22                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 93.31                  | 84                    | 90.06                 | 78                    | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0136+74         | M402B/0123+40           | 308           | 54               | 36.97                  | 42.20                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 93.33                  | 84                    | 90.17                 | 78                    | 74.00                 | 110.97          | 213,357.94             | 183,966.80             |
|                       |                         | 1160          | 48               | 31.40                  | 33.78                 | -0.0001        | 0.0045         | 66                    | 0.001929                   | 80.05                  | 84                    | 159.04                | 78                    | 130.32                | 161.92          | 803,552.89             | 692,861.97             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 112,980.75  
 2015 Sew. Ac. = 20,730.07  
 Constant Intel Flow = 0.00  
 TOTAL ESTIM CONST. COST = \$9,584,817.91 \$7,753,840.75  
 + Engr., ROW, Financ., Conting. (1.5x) = \$14,377,226.86 \$11,630,761.12

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(8/3) ]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.12</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.12</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Hallom City,  
 Richland Hills, year 2020 BFX Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Hallom City. The Marine Creek Area is included, but  
 the 6 MGD Intel Facility flow is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$6,762,935.74 \$5,443,734.19  
 Estim. Cost Below R.H. Meter = \$2,821,882.17 \$2,310,106.55  
 Percent R.H. Cost of Total Line = 29.44%  
 Estirn., Richland Hills Cost Share = \$4,232,823.25 \$3,465,159.83

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 COFW Option 3.xls  
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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROF. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 62.26                  | 84                    | 69.57                 | 72                    | 46.12                 | 268.23          | \$70,657.50            | \$51,911.63            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 63.15                  | 84                    | 72.04                 | 72                    | 47.76                 | 81.79           | 1,195,635.75           | 878,426.26             |
| M402A/0020+90         | M402A/0020+17           | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 63.15                  | 84                    | 72.06                 | 72                    | 47.77                 | -22.80          | 50,968.60              | 37,152.44              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 63.15                  | 84                    | 72.06                 | 72                    | 47.77                 | 47.77           | 103,908.09             | 76,340.64              |
| M402A/0023+09         | M402A/0022+40           | 68            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 63.17                  | 84                    | 72.08                 | 72                    | 47.79                 | 122.10          | 47,797.72              | 35,116.69              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 63.59                  | 84                    | 72.74                 | 72                    | 48.22                 | 73.26           | 602,666.92             | 442,775.69             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0091         | 90                    | 0.000385                   | 63.73                  | 84                    | 72.93                 | 72                    | 48.35                 | 84.02           | 276,395.52             | 203,066.09             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 63.89                  | 84                    | 87.94                 | 72                    | 58.23                 | 90.62           | 299,948.02             | 220,369.97             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 64.02                  | 84                    | 87.96                 | 72                    | 58.31                 | 87.34           | 250,072.13             | 183,726.47             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 64.14                  | 84                    | 88.07                 | 72                    | 58.39                 | 92.21           | 387,230.81             | 284,496.11             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 64.19                  | 84                    | 88.14                 | 72                    | 58.43                 | 87.14           | 212,665.22             | 156,243.84             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 64.22                  | 84                    | 88.19                 | 72                    | 58.46                 | 90.18           | 174,565.59             | 128,252.27             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 64.33                  | 84                    | 88.23                 | 72                    | 58.49                 | 93.68           | 176,643.75             | 129,779.08             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 82.89                  | 84                    | 88.35                 | 72                    | 58.57                 | 88.29           | 446,804.78             | 328,264.74             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 82.87                  | 84                    | 88.37                 | 72                    | 58.58                 | 90.46           | 68,579.34              | 50,384.82              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 82.81                  | 84                    | 88.46                 | 72                    | 58.64                 | 91.03           | 353,287.50             | 259,558.17             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 82.80                  | 84                    | 88.60                 | 72                    | 58.74                 | 90.26           | 478,669.93             | 351,675.87             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 82.81                  | 84                    | 88.80                 | 72                    | 58.87                 | 91.10           | 559,718.24             | 411,221.56             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 82.82                  | 84                    | 88.89                 | 72                    | 58.93                 | 94.60           | 277,088.24             | 203,575.03             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 82.84                  | 84                    | 88.94                 | 72                    | 58.96                 | 88.22           | 104,600.81             | 76,849.57              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 82.89                  | 84                    | 88.99                 | 72                    | 58.99                 | 113.41          | 116,377.06             | 86,377.06              |
| M402A/0103+76         | M402A/0088+51           | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 83.14                  | 84                    | 89.19                 | 72                    | 59.19                 | 120.91          | 568,030.89             | 568,030.89             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 83.31                  | 84                    | 89.37                 | 72                    | 59.37                 | 111.26          | 492,524.34             | 492,524.34             |
| M402A/0113+81         | M402A/0105+11           | 807           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 83.38                  | 84                    | 89.42                 | 72                    | 59.42                 | 142.89          | 93,517.28              | 93,517.28              |
| M402A/0109+91         | M402A/0113+81           | 345           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 83.54                  | 84                    | 89.67                 | 72                    | 59.67                 | 114.75          | 559,025.52             | 559,025.52             |
| M402A/0117+43         | M402A/0109+91           | 695           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 83.68                  | 84                    | 89.76                 | 72                    | 59.76                 | 129.15          | 238,988.61             | 238,988.61             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 99.19                  | 84                    | 90.01                 | 72                    | 60.01                 | 130.79          | 87,282.79              | 87,282.79              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 99.19                  | 84                    | 90.17                 | 72                    | 60.17                 | 127.14          | 213,357.94             | 213,357.94             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 89.21                  | 84                    | 159.04                | 78                    | 130.52                | 161.92          | 803,555.89             | 692,861.97             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2020 Eq. Pop. = 122,586.00  
 2020 Sew. Ac. = 21,884.42  
 Constant Intel Flow = 0.00  
 TOTAL ESTIM. CONST. COST = \$9,791,605.61 \$8,052,584.17  
 + Engr., ROW, Financ., Conting. (1.5x) = \$14,687,408.42 \$12,078,891.26

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^2$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Year 2020 BFX Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Haltom City. The Marine Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$6,893,955.36 \$5,923,708.28  
 Estim. Cost Below R.H. Meter = \$2,897,650.25 \$2,128,885.90  
 Percent R.H. Cost of Total Line = 29.59% 26.44%  
 Estim. Richland Hills Cost Share = \$4,346,475.37 \$3,193,328.85

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. PIPE CAP. (MGD) | PROF. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 53.29                  | 90                    | 83.62                 | 78                    | 57.09                 | 279.20          | \$81,111.93            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.75                  | 90                    | 86.59                 | 78                    | 59.12                 | 93.15           | 1,372,541.04           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | 70.57                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.75                  | 90                    | 86.61                 | 78                    | 59.13                 | -11.44          | 58,050.69              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.75                  | 90                    | 86.61                 | 78                    | 59.13                 | 59.13           | 119,282.25             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 52.75                  | 90                    | 86.61                 | 78                    | 59.15                 | 133.46          | 54,869.83              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 52.96                  | 90                    | 87.43                 | 72                    | 48.35                 | 73.26           | 602,666.92             | 442,775.69             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 53.05                  | 90                    | 87.66                 | 72                    | 48.35                 | 84.02           | 276,395.52             | 203,066.09             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.82                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 53.22                  | 84                    | 87.84                 | 72                    | 58.23                 | 90.62           | 299,948.02             | 220,369.97             |
| M402A/0040+28         | M402A/0036+79           | 559           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 53.36                  | 84                    | 87.96                 | 72                    | 58.31                 | 87.34           | 250,072.13             | 183,726.47             |
| M402A/0045+95         | M402A/0040+28           | 307           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 53.49                  | 84                    | 88.07                 | 72                    | 58.39                 | 92.21           | 387,230.81             | 284,496.11             |
| M402A/0049+00         | M402A/0045+95           | 252           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 53.55                  | 84                    | 88.14                 | 72                    | 58.43                 | 87.14           | 212,665.22             | 156,243.84             |
| M402A/0051+91         | M402A/0049+00           | 307           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 53.55                  | 84                    | 88.19                 | 72                    | 58.46                 | 90.18           | 174,565.59             | 128,252.27             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 53.74                  | 84                    | 88.23                 | 72                    | 58.49                 | 93.68           | 176,643.75             | 129,779.08             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 87.63                  | 84                    | 88.35                 | 72                    | 58.57                 | 88.29           | 446,804.78             | 328,264.74             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 87.75                  | 84                    | 88.37                 | 72                    | 58.58                 | 90.46           | 68,579.34              | 50,384.82              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 87.39                  | 84                    | 88.46                 | 72                    | 58.64                 | 91.03           | 353,287.50             | 259,558.17             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 87.28                  | 84                    | 88.60                 | 72                    | 58.74                 | 90.26           | 478,669.93             | 351,675.87             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 87.15                  | 84                    | 88.80                 | 72                    | 58.87                 | 91.10           | 559,718.24             | 411,221.56             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 87.10                  | 84                    | 88.89                 | 72                    | 58.93                 | 94.60           | 277,088.24             | 203,575.03             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 87.16                  | 84                    | 88.94                 | 72                    | 58.96                 | 88.22           | 104,600.81             | 76,849.57              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 87.46                  | 84                    | 89.19                 | 72                    | 58.99                 | 113.41          | 116,377.06             | 86,377.06              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 87.66                  | 84                    | 89.19                 | 72                    | 58.96                 | 120.91          | 568,030.89             | 568,030.89             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 87.66                  | 84                    | 89.37                 | 72                    | 58.96                 | 111.26          | 492,524.34             | 492,524.34             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 87.74                  | 84                    | 89.42                 | 72                    | 58.96                 | 112.69          | 93,517.28              | 55,517.28              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 87.85                  | 84                    | 89.67                 | 72                    | 58.96                 | 114.75          | 559,025.52             | 559,025.52             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 88.04                  | 84                    | 89.67                 | 72                    | 58.96                 | 129.15          | 238,988.61             | 238,988.61             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 116.22                 | 84                    | 90.01                 | 72                    | 58.96                 | 130.79          | 481,440.81             | 481,440.81             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 116.22                 | 84                    | 90.06                 | 72                    | 58.96                 | 131.80          | 87,282.79              | 87,282.79              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0001        | 0.0034         | 84                    | 0.000588                   | 116.17                 | 84                    | 90.17                 | 72                    | 58.96                 | 127.14          | 213,357.94             | 213,357.94             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 93.30                  | 84                    | 159.04                | 78                    | 130.52                | 161.92          | 803,555.89             | 692,861.97             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 156,708.49  
 2050 Sew. Ac. = 24,835.40  
 Constant Inlet Flow = 0.00  
 TOTAL ESTIM. CONST. COST = \$10,008,893.68  
 + Engr., ROW, Financ., Conting. (1.5x) = \$15,013,340.52  
 \$12,359,867.22

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn. s = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup> ]<sup>0.2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe Capacity in Inches  
 Proposed Parallel Pipe Capacity in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup> / (83) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup> / (83) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BF-A Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Haltom City. The Marime Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model.

Estim. Cost Above R H Meter = \$6,893,955.36  
 Estim. Cost Below R H Meter = \$3,114,938.32  
 Percent R.H. Cost of Total Line = 31.12%  
 Estim. Richland Hills Cost Share = \$4,672,407.48  
 \$5,923,708.28  
 \$2,316,203.20  
 28.11%  
 \$3,474,304.80

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL DIA. (in) | MODEL SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PAR. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------|-----------------------|------------------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90              | 0.000350              | 48.38                  | 90                    | 83.62                 | 78                   | 57.09                 | 279.20          | \$81,111.93            | \$60,924.07            |
| M402A/0000+17         | M402A/0000+17           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90              | 0.000375              | 47.07                  | 90                    | 86.59                 | 78                   | 58.12                 | 93.15           | 1,372,541.04           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+10           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90              | 0.000375              | 47.06                  | 90                    | 86.61                 | 78                   | 59.13                 | -11.44          | 58,050.69              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90              | 0.000375              | 47.06                  | 90                    | 86.61                 | 78                   | 59.13                 | 119,282.25      | 89,594.22              | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90              | 0.000376              | 47.06                  | 90                    | 86.64                 | 78                   | 59.15                 | 133.46          | 54,869.83              | 41,213.34              |
| M402A/0028+40         | M402A/0028+40           | 399           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90              | 0.000383              | 47.15                  | 90                    | 87.43                 | 78                   | 59.69                 | 84.73           | 691,837.02             | 519,646.47             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90              | 0.000385              | 47.21                  | 90                    | 87.66                 | 78                   | 59.85                 | 95.52           | 317,290.77             | 238,320.62             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 90              | 0.000558              | 47.38                  | 90                    | 105.58                | 78                   | 72.09                 | 104.48          | 344,328.08             | 258,628.65             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 90              | 0.000561              | 47.67                  | 90                    | 105.73                | 78                   | 72.19                 | 101.22          | 287,072.60             | 215,623.42             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 90              | 0.000562              | 47.73                  | 90                    | 105.86                | 78                   | 72.28                 | 106.10          | 444,525.17             | 333,887.79             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 90              | 0.000562              | 47.73                  | 90                    | 105.86                | 78                   | 72.33                 | 101.04          | 212,665.22             | 183,369.50             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 90              | 0.000563              | 47.94                  | 90                    | 105.73                | 78                   | 72.38                 | 104.10          | 174,565.59             | 150,518.29             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84              | 0.000564              | 90.17                  | 84                    | 88.35                 | 78                   | 72.41                 | 107.60          | 152,310.17             | 127,300.52             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84              | 0.000565              | 90.10                  | 84                    | 88.37                 | 78                   | 72.52                 | 104.40          | 176,643.75             | 136,555.15             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84              | 0.000566              | 89.85                  | 84                    | 88.46                 | 78                   | 72.50                 | 104.89          | 68,579.34              | 59,132.19              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84              | 0.000568              | 89.69                  | 84                    | 88.60                 | 78                   | 72.71                 | 104.23          | 353,287.50             | 304,620.35             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84              | 0.000570              | 89.48                  | 84                    | 88.80                 | 78                   | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84              | 0.000571              | 89.48                  | 84                    | 88.89                 | 78                   | 72.95                 | 105.11          | 559,718.24             | 482,614.20             |
| M402A/0088+51         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84              | 0.000572              | 89.39                  | 84                    | 88.94                 | 78                   | 72.99                 | 102.25          | 277,088.24             | 238,917.92             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84              | 0.000573              | 89.45                  | 84                    | 88.99                 | 78                   | 72.99                 | 102.25          | 104,600.81             | 90,191.51              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84              | 0.000578              | 89.98                  | 84                    | 89.19                 | 78                   | 72.99                 | 113.41          | 116,377.06             | 116,377.06             |
| M402A/0109+91         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84              | 0.000577              | 89.98                  | 84                    | 89.37                 | 78                   | 72.99                 | 120.91          | 568,030.89             | 568,030.89             |
| M402A/0113+81         | M402A/0109+91           | 807           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84              | 0.000577              | 89.98                  | 84                    | 89.37                 | 78                   | 72.99                 | 111.26          | 482,524.34             | 482,524.34             |
| M402A/0117+43         | M402A/0113+81           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84              | 0.000581              | 90.07                  | 84                    | 89.42                 | 78                   | 72.99                 | 142.89          | 93,517.28              | 93,517.28              |
| M402A/0120+25         | M402A/0117+43           | 695           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84              | 0.000581              | 90.16                  | 84                    | 89.67                 | 78                   | 72.99                 | 142.89          | 559,025.52             | 559,025.52             |
| M402B/0123+40         | M402A/0120+25           | 126           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84              | 0.000586              | 125.46                 | 84                    | 90.01                 | 78                   | 72.99                 | 129.15          | 238,988.61             | 238,988.61             |
|                       |                         | 308           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84              | 0.000586              | 125.45                 | 84                    | 90.06                 | 78                   | 72.99                 | 130.79          | 481,440.81             | 481,440.81             |
|                       |                         | 1160          | 48               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84              | 0.000588              | 125.36                 | 84                    | 90.17                 | 78                   | 72.99                 | 127.14          | 213,357.94             | 87,282.79              |
|                       |                         |               |                  | 33.78                  | 83.60                 | 83.60                 | -0.0001        | 0.0045         | 66              | 0.001828              | 98.26                  | 84                    | 159.04                | 78                   | 130.52                | 161.92          | 603,555.89             | 213,357.94             |
|                       |                         |               |                  |                        |                       |                       |                |                |                 |                       |                        |                       |                       |                      |                       |                 |                        | 692,861.97             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 175,228.27  
 2070 Sew. Ac. = 26,431.99  
 Constant Intel Flow = 0.00  
 TOTAL ESTIM. CONST. COST = \$10,277,633.93 \$8,835,439.13  
 + Engr. ROW, Financ. Conting. (1.5%) = \$15,416,450.90 \$13,253,158.70

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 EXIST GRAVITY FLOW CAPACITY IN MG  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING GRAVITY FLOW CAPACITY IN MG  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON HYDROWORKS CALCULATIONS  
 PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EXP.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MG  
 PROPOSED PARALLEL PIPE IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Hallom City,  
 Richland Hills, Year 2020 BF Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Hallom City. The Marine Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$6,951,249.72 \$6,336,954.99  
 Estim. Cost Below R.H. Meter = \$3,326,384.21 \$2,498,484.14  
 Percent R.H. Cost of Total Line = 32.37% 28.28%  
 Estim. Richland Hills Cost Share = \$4,989,576.32 \$3,747,726.21

***OPTION 4***

BIG FOSSIL SEWER STUDY

OPTION 4 - YEAR 2000

TABLE F-1

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 60.87                  | 84                    | 69.57                 | 78                    | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A0020+17          | M402A0000+50            | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.32                  | 84                    | 72.04                 | 78                    | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A0020+90          | M402A0020+17            | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.33                  | 84                    | 72.06                 | 78                    | 59.13                 | -11.44          | 50,568.60              | 43,602.52              |
| M402A0022+40          | M402A0022+40            | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 62.33                  | 84                    | 72.06                 | 78                    | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A0023+09          | M402A0023+09            | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 62.81                  | 84                    | 72.08                 | 72                    | 47.79                 | 122.10          | 47,797.72              | 35,116.69              |
| M402A0028+40          | M402A0028+40            | 870           | 54              | 25.07                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 62.81                  | 84                    | 72.74                 | 72                    | 48.27                 | 73.26           | 602,666.92             | 442,775.69             |
| M402A0036+79          | M402A0032+40            | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 84                    | 0.000558                   | 62.95                  | 84                    | 72.93                 | 72                    | 48.35                 | 84.02           | 276,395.52             | 203,066.09             |
| M402A0045+95          | M402A0036+79            | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 63.17                  | 84                    | 72.19                 | 72                    | 48.35                 | 84.02           | 258,628.65             | 185,171.99             |
| M402A0049+00          | M402A0040+28            | 361           | 54              | 29.03                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 63.25                  | 84                    | 72.28                 | 72                    | 48.35                 | 84.02           | 215,623.42             | 154,381.27             |
| M402A0051+81          | M402A0049+00            | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 63.30                  | 84                    | 72.33                 | 72                    | 48.35                 | 84.02           | 333,887.79             | 239,055.76             |
| M402A0054+21          | M402A0051+81            | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 63.30                  | 84                    | 72.33                 | 72                    | 48.35                 | 84.02           | 183,369.50             | 131,288.22             |
| M402A0060+68          | M402A0054+21            | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 63.33                  | 84                    | 72.38                 | 72                    | 48.35                 | 84.02           | 150,518.29             | 107,875.53             |
| M402A0066+68          | M402A0060+68            | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 63.33                  | 84                    | 72.41                 | 72                    | 48.35                 | 84.02           | 152,310.17             | 109,050.48             |
| M402A0061+67          | M402A0066+68            | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 70.32                  | 78                    | 72.51                 | 66                    | 46.44                 | 76.16           | 385,255.15             | 275,833.57             |
| M402A0065+95          | M402A0061+67            | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 70.32                  | 78                    | 72.51                 | 66                    | 46.44                 | 76.16           | 59,132.19              | 42,337.24              |
| M402A0072+77          | M402A0065+95            | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 70.33                  | 78                    | 72.52                 | 66                    | 46.50                 | 78.89           | 304,620.35             | 218,100.96             |
| M402A0080+78          | M402A0072+77            | 808           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 70.38                  | 78                    | 72.71                 | 66                    | 46.57                 | 78.09           | 412,730.71             | 295,505.42             |
| M402A0085+50          | M402A0080+78            | 400           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 70.46                  | 78                    | 72.88                 | 66                    | 46.73                 | 82.40           | 482,614.20             | 345,540.34             |
| M402A0086+56          | M402A0085+50            | 151           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 70.50                  | 78                    | 72.99                 | 66                    | 46.75                 | 82.40           | 238,917.92             | 171,059.58             |
| M402A0088+51          | M402A0086+56            | 168           | 54              | 29.26                  | 31.43                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 70.53                  | 78                    | 72.99                 | 66                    | 46.75                 | 82.40           | 90,191.51              | 64,574.99              |
| M402A0096+65          | M402A0088+51            | 820           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 70.56                  | 78                    | 73.03                 | 66                    | 46.78                 | 71.20           | 100,345.53             | 71,845.02              |
| M402A0103+76          | M402A0096+65            | 711           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 70.73                  | 78                    | 73.20                 | 66                    | 46.88                 | 78.60           | 489,781.73             | 350,672.13             |
| M402A0105+11          | M402A0103+76            | 135           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 70.86                  | 78                    | 73.34                 | 66                    | 46.98                 | 88.87           | 424,676.60             | 304,058.40             |
| M402A0109+91          | M402A0105+11            | 807           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 70.91                  | 78                    | 73.39                 | 66                    | 47.14                 | 100.47          | 80,634.80              | 57,732.61              |
| M402A0113+81          | M402A0109+91            | 345           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 71.06                  | 78                    | 73.59                 | 66                    | 47.14                 | 100.47          | 482,018.90             | 345,112.69             |
| M402A0117+43          | M402A0113+81            | 695           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 71.15                  | 78                    | 73.66                 | 66                    | 47.18                 | 86.57           | 206,066.71             | 147,538.88             |
| M402A0120+25          | M402A0117+43            | 126           | 54              | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 76.99                  | 78                    | 73.87                 | 66                    | 47.31                 | 88.09           | 415,119.89             | 297,216.01             |
| M402B0123+40          | M402A0120+25            | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 77.02                  | 78                    | 73.87                 | 66                    | 47.34                 | 89.08           | 75,259.14              | 53,883.77              |
| M402B0136+74          | M402B0123+40            | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 68.97                  | 66                    | 83.60                 | 66                    | 83.60                 | 115.00          | 496,072.77             | 496,072.77             |

F.W. Model Eq. Pop. = 57,207.50 93,267.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 80,931.25  
 2000 Sew. Ac. = 16,091.36  
 Constant Inlet Flow = 6.00

TOTAL ESTIM. CONST. COST = \$8,569,370.81 \$9,501,525.61  
 + Engr., ROW, Financ., Conting. (1.5x) = \$12,854,056.21 \$9,752,288.42

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2000

UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP.  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq. n = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>0.154</sup> ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>5</sup>(8/3) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>5</sup>(8/3) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City, Richland Hills, Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Intel Facility Flow. This Option does NOT include diversion of Little Creek Area in Haltom City to this line -- this area is omitted.

Estim. Cost Above R.H. Meter = \$5,747,488.64 \$4,255,962.24  
 Estim. Cost Below R.H. Meter = \$2,821,882.17 \$2,245,563.37  
 Percent R.H. Cost of Total Line = 32.93% 34.54%  
 Estim. Richland Hills Cost Share = \$4,232,823.25 \$3,368,345.06

TABLE F-2

OPTION 4 - YEAR 2005

BIG FOSSIL SEWER STUDY

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350              | 66.85                  | 84                    | 69.57                 | 78                    | 57.09                 | 279.20                | \$70,657.50     | \$60,924.07            |                         |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375              | 68.52                  | 84                    | 72.04                 | 78                    | 59.12                 | 93.15                 | 1,195,635.75    | 1,030,930.82           |                         |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375              | 68.53                  | 84                    | 72.06                 | 78                    | 59.13                 | -11.44                | 50,568.60       | 43,602.52              |                         |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375              | 68.53                  | 84                    | 72.06                 | 78                    | 59.13                 | 59.13                 | 103,908.09      | 89,594.22              |                         |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376              | 68.55                  | 84                    | 72.08                 | 78                    | 59.15                 | 133.46                | 47,797.72       | 41,213.34              |                         |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383              | 69.06                  | 84                    | 72.74                 | 78                    | 58.69                 | 95.52                 | 602,666.92      | 519,646.47             |                         |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385              | 69.22                  | 84                    | 72.93                 | 78                    | 59.85                 | 95.52                 | 276,395.52      | 238,320.62             |                         |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558              | 69.36                  | 78                    | 72.09                 | 66                    | 46.17                 | 78.56                 | 258,628.65      | 185,171.99             |                         |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559              | 69.46                  | 78                    | 72.19                 | 66                    | 46.24                 | 75.27                 | 215,623.42      | 154,381.27             |                         |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561              | 69.55                  | 78                    | 72.28                 | 66                    | 46.29                 | 80.11                 | 333,887.79      | 239,055.76             |                         |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562              | 69.61                  | 78                    | 72.33                 | 66                    | 46.33                 | 75.04                 | 183,369.50      | 131,288.22             |                         |
| M402A/0054+21         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562              | 69.64                  | 78                    | 72.38                 | 66                    | 46.36                 | 78.08                 | 150,518.29      | 107,767.53             |                         |
| M402A/0060+68         | M402A/0054+21           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563              | 69.70                  | 78                    | 72.41                 | 66                    | 46.38                 | 81.57                 | 152,310.17      | 109,050.48             |                         |
| M402A/0065+95         | M402A/0060+68           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564              | 76.58                  | 84                    | 88.35                 | 78                    | 72.51                 | 102.23                | 446,804.78      | 385,255.15             |                         |
| M402A/0072+77         | M402A/0065+95           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565              | 76.58                  | 84                    | 88.37                 | 78                    | 72.51                 | 104.40                | 468,579.34      | 59,132.19              |                         |
| M402A/0080+78         | M402A/0072+77           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566              | 76.60                  | 84                    | 88.46                 | 78                    | 72.60                 | 104.99                | 353,287.50      | 304,620.35             |                         |
| M402A/0085+95         | M402A/0080+78           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568              | 76.66                  | 84                    | 88.60                 | 78                    | 72.71                 | 104.23                | 478,669.93      | 412,730.71             |                         |
| M402A/0088+51         | M402A/0085+95           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570              | 76.76                  | 84                    | 88.80                 | 78                    | 72.88                 | 105.11                | 559,718.24      | 482,614.20             |                         |
| M402A/0098+65         | M402A/0088+51           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571              | 76.80                  | 84                    | 88.89                 | 78                    | 72.95                 | 108.62                | 277,088.24      | 238,917.92             |                         |
| M402A/0103+76         | M402A/0098+65           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572              | 76.83                  | 84                    | 88.94                 | 78                    | 73.03                 | 102.25                | 446,804.78      | 385,255.15             |                         |
| M402A/0105+11         | M402A/0103+76           | 188           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573              | 76.87                  | 84                    | 88.99                 | 78                    | 73.09                 | 102.25                | 446,804.78      | 385,255.15             |                         |
| M402A/0109+91         | M402A/0105+11           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575              | 77.05                  | 84                    | 89.19                 | 78                    | 73.20                 | 104.92                | 353,287.50      | 304,620.35             |                         |
| M402A/0113+81         | M402A/0109+91           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577              | 77.20                  | 84                    | 89.37                 | 78                    | 73.34                 | 104.23                | 478,669.93      | 412,730.71             |                         |
| M402A/0117+43         | M402A/0113+81           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578              | 77.25                  | 84                    | 89.42                 | 78                    | 73.39                 | 126.86                | 568,030.89      | 489,781.73             |                         |
| M402A/0120+25         | M402A/0117+43           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581              | 77.42                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67                 | 559,025.52      | 482,016.90             |                         |
| M402B/0123+40         | M402A/0120+25           | 695           | 54               | 39.39                  | 31.77                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586              | 77.51                  | 84                    | 90.01                 | 78                    | 73.66                 | 113.05                | 238,988.61      | 206,066.71             |                         |
|                       |                         | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586              | 83.36                  | 84                    | 90.06                 | 78                    | 73.91                 | 115.65                | 87,282.79       | 75,259.14              |                         |
|                       |                         | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588              | 83.41                  | 84                    | 90.17                 | 78                    | 74.00                 | 110.97                | 213,357.94      | 183,966.80             |                         |
|                       |                         | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829              | 74.88                  | 78                    | 130.52                | 72                    | 105.43                | 136.83                | 692,861.97      | 590,367.59             |                         |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 87,431.63  
 2005 Sew. Ac. = 17,571.46  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,474,123.99  
 + Engr. ROW, Finance, Conting. (1.5x) = \$14,211,185.98  
 \$7,972,645.03  
 \$11,958,967.54

NOTES:

- UPSTREAM MAIN/STATION
- DOWNSTREAM MAIN/STATION
- LENGTH
- EXIST DIA.
- EXIST PIPE CAP
- 2000 MODEL FLOW
- 2020 MODEL FLOW
- 2000 FLOW RATE IN FL. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS
- 2020 FLOW RATE IN FL. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS
- COEF. "A", COEF. "B"
- MODEL PROP DIA.
- MODEL H.G. SLOPE
- DESIGN FLOW
- PROP. REPL. PIPE
- REPL. PIPE CAP.
- PROP. PARL. PIPE
- PARL. PIPE CAP.
- BOTH CAP.
- ESTIM. REPL. PIPE COST
- ESTIM. PARL. PIPE COST

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, Year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option does NOT include diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line -- this area is omitted.

Estim. Cost Above R.H. Meter = \$6,652,241.82  
 Estim. Cost Below R.H. Meter = \$2,821,882.17  
 Percent R.H. Cost of Total Line = 29.79%  
 Estim. Richland Hills Cost Share = \$4,232,823.25  
 \$5,608,859.70  
 \$2,363,785.33  
 29.65%  
 \$3,545,678.00



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PAHL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0034         | 90                   | 0.000350                   | 70.38                  | 90                    | 83.62                 | 84                    | 69.57                 | 291.68          | \$81,111.93            | \$70,657.50            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 72.11                  | 90                    | 86.59                 | 84                    | 72.04                 | 106.07          | 1,372,541.04           | 1,195,635.75           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 72.12                  | 90                    | 86.61                 | 84                    | 72.06                 | 106.07          | 58,050.69              | 50,568.60              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 72.12                  | 90                    | 86.61                 | 84                    | 72.06                 | 106.07          | 119,282.25             | 103,908.09             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 72.14                  | 90                    | 86.64                 | 84                    | 72.08                 | 146.39          | 54,869.83              | 47,797.72              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 72.68                  | 90                    | 87.43                 | 84                    | 72.74                 | 97.78           | 691,837.02             | 602,666.92             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                   | 0.000385                   | 72.85                  | 90                    | 87.66                 | 84                    | 72.93                 | 108.60          | 317,290.77             | 276,335.52             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 73.00                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 299,948.02             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 73.10                  | 84                    | 87.96                 | 78                    | 72.19                 | 101.22          | 250,072.13             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 73.20                  | 84                    | 88.07                 | 78                    | 72.28                 | 106.10          | 387,230.81             | 333,887.79             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 73.26                  | 84                    | 88.14                 | 78                    | 72.33                 | 101.04          | 212,665.22             | 183,369.50             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 73.29                  | 84                    | 88.19                 | 78                    | 72.38                 | 104.10          | 174,565.59             | 150,518.29             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000563                   | 73.36                  | 84                    | 88.23                 | 78                    | 72.41                 | 107.60          | 176,643.75             | 152,310.17             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 81.14                  | 84                    | 88.35                 | 78                    | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000565                   | 81.14                  | 84                    | 88.37                 | 78                    | 72.52                 | 104.40          | 66,579.34              | 59,132.19              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 81.15                  | 84                    | 88.46                 | 78                    | 72.60                 | 104.99          | 353,287.50             | 304,620.35             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 81.22                  | 84                    | 88.60                 | 78                    | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 81.31                  | 84                    | 88.80                 | 78                    | 72.88                 | 105.11          | 559,716.24             | 482,614.20             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 81.36                  | 84                    | 88.89                 | 78                    | 72.95                 | 108.62          | 277,088.24             | 238,917.92             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                   | 0.000572                   | 81.39                  | 84                    | 88.94                 | 78                    | 72.99                 | 102.25          | 104,600.81             | 90,191.51              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                   | 0.000573                   | 81.43                  | 84                    | 88.99                 | 78                    | 73.03                 | 97.45           | 116,377.06             | 100,345.53             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 81.63                  | 84                    | 89.19                 | 78                    | 73.20                 | 104.92          | 568,030.89             | 489,781.73             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000577                   | 81.78                  | 84                    | 89.37                 | 78                    | 73.34                 | 95.23           | 492,524.34             | 424,676.60             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 81.83                  | 84                    | 89.42                 | 78                    | 73.39                 | 128.86          | 93,517.28              | 80,634.80              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 82.02                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 82.12                  | 84                    | 89.76                 | 78                    | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 88.68                  | 84                    | 90.01                 | 78                    | 73.87                 | 114.65          | 481,440.81             | 415,119.89             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 88.71                  | 84                    | 90.06                 | 78                    | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                   | 0.000588                   | 88.77                  | 84                    | 90.17                 | 78                    | 74.00                 | 110.97          | 213,357.94             | 183,966.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001829                   | 79.46                  | 66                    | 83.60                 | 60                    | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 93,932.00  
 2010 Sew. Ac. = 18,759.44  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5%) = \$14,747,213.88  
 \$12,724,913.30

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn: s = [ 1629.6 x n x MGD^1.54 / D^4.873 ] ^2, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D^4.873 / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D^4.873 / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe Capacity in MGD = [ D^4.873 / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 of Little Fossil Creek Area in Haltom City  
 to this line -- this area is omitted

Estim. Cost Above R.H. Meter = \$5,586,472.24  
 Estim. Cost Below R.H. Meter = \$3,245,003.68  
 Percent R.H. Cost of Total Line = 33.01%  
 Estim. Richland Hills Cost Share = \$4,867,505.52  
 \$4,232,823.25

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 COWF-Option 4.xls  
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TABLE F-4

OPTION 4 - YEAR 2015

BIG FOSSIL SEWER STUDY

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/ft) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|--------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                 | 87.91                  | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 90.50                  | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 90.52                  | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 86,048.79              | 58,050.89              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 90.52                  | 96                    | 102.88                | 90                    | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000376                 | 90.55                  | 96                    | 102.91                | 90                    | 86.61                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                 | 91.28                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                 | 91.50                  | 96                    | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000358                 | 91.68                  | 90                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000359                 | 91.81                  | 90                    | 105.86                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000362                 | 91.99                  | 90                    | 105.94                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000363                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 444,525.17             | 387,230.81             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000363                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 29.72                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 31.88                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 29.72                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0066+55         | M402A/0065+95           | 691           | 54               | 31.52                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0072+77         | M402A/0066+55           | 808           | 54               | 32.23                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0080+78         | M402A/0072+77           | 400           | 54               | 35.67                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0085+50         | M402A/0080+78           | 151           | 54               | 29.26                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0086+56         | M402A/0085+50           | 168           | 54               | 24.42                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0088+51         | M402A/0086+56           | 820           | 54               | 31.72                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0086+65         | M402A/0088+51           | 711           | 54               | 21.89                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0103+76         | M402A/0086+65           | 135           | 54               | 53.47                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0105+11         | M402A/0103+76           | 807           | 54               | 31.72                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0109+91         | M402A/0105+11           | 345           | 54               | 39.39                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0113+81         | M402A/0109+91           | 695           | 54               | 40.78                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0117+43         | M402A/0113+81           | 126           | 54               | 41.74                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0120+25         | M402A/0117+43           | 308           | 54               | 36.97                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402B/0123+40         | M402A/0120+25           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 68                    | 0.001829                 | 93.06                  | 78                    | 130.52                | 72                    | 105.43                | 136.83          | 682,861.97             | 590,367.59             |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50 2015 Eq. Pop. = 103,938.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33 2015 Sew. Ac. = 22,032.13  
 Constant Intel Flow = 6.00  
 TOT-AL ESTIM. CONST. COST = \$11,382,085.03 \$9,925,770.75  
 + Engr., ROW, I manc., Conting. (1.5x) = \$17,073,127.54 \$14,888,656.12

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup> ]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup> x s<sup>1/2</sup> / (1629.6 x n) ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, Maric Creek Area, year 2020  
 BFx Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option does not include diversion  
 of Little Fossil Creek Area in Haltom City  
 (to this line --- this area is omitted)

Estim. Cost Above R.H. Meter = \$7,684,391.97 \$6,680,767.06  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 32.49% 32.69%  
 Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

BIG FOSSIL SEWER STUDY

OPTION 4 - YEAR 2020

TABLE F-5

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | 2020 PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000-50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                   | 0.000350                   | 92.38                  | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 95.00                  | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 95.02                  | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 95.02                  | 96                    | 102.88                | 90                    | 86.61                 | 160.95          | 135,716.69             | 119,282.25              |
| M402A/0023+09         | M402A/0022+40           | 89            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 95.05                  | 96                    | 102.91                | 90                    | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0028+40         | M402A/0023+09           | 870           | 24               | 25.04                  | 18.71                 | 87.43                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 95.81                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 78,156.79              | 69,183.07               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                   | 0.000385                   | 96.04                  | 96                    | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 96.24                  | 90                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 96.37                  | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 96.50                  | 90                    | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 96.57                  | 90                    | 105.94                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.59              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 96.62                  | 90                    | 106.00                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.29              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000563                   | 96.69                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 102.92                 | 90                    | 106.20                | 84                    | 88.35                 | 118.07          | 512,913.65             | 446,804.78              |
| M402A/0065+95         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000565                   | 102.93                 | 90                    | 106.22                | 84                    | 88.37                 | 120.25          | 78,726.28              | 68,579.34               |
| M402A/0072+77         | M402A/0065+95           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 102.98                 | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,599.63             | 353,287.50              |
| M402A/0080+78         | M402A/0072+77           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 103.09                 | 90                    | 106.50                | 84                    | 88.60                 | 120.12          | 549,493.54             | 476,669.93              |
| M402A/0085+50         | M402A/0080+78           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 103.25                 | 90                    | 106.74                | 84                    | 88.80                 | 121.03          | 642,533.69             | 559,718.24              |
| M402A/0086+56         | M402A/0085+50           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 103.33                 | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.99             | 277,088.24              |
| M402A/0096+65         | M402A/0086+56           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                   | 0.000572                   | 103.37                 | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81              |
| M402A/0103+76         | M402A/0096+65           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                   | 0.000573                   | 103.43                 | 90                    | 106.97                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06              |
| M402A/0105+11         | M402A/0103+76           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 103.67                 | 90                    | 107.21                | 84                    | 89.19                 | 120.91          | 652,076.27             | 568,030.89              |
| M402A/0109+91         | M402A/0105+11           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000577                   | 103.87                 | 90                    | 107.42                | 84                    | 89.37                 | 111.26          | 565,397.84             | 492,524.34              |
| M402A/0113+81         | M402A/0109+91           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 103.93                 | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28               |
| M402A/0117+43         | M402A/0113+81           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 104.18                 | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52              |
| M402A/0120+25         | M402A/0117+43           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 104.29                 | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61              |
| M402B/0123+40         | M402A/0120+25           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 109.62                 | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 552,674.40             | 481,440.81              |
| M402B/0136+74         | M402B/0123+40           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 109.66                 | 90                    | 108.25                | 84                    | 90.06                 | 131.80          | 100,197.09             | 87,282.79               |
|                       |                         | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                   | 0.000588                   | 109.76                 | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 213,357.94              |
|                       |                         | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001829                   | 99.59                  | 78                    | 130.52                | 72                    | 105.43                | 136.83          | 692,861.97             | 590,367.59              |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,267.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2020 Eq. Pop. = 113,945.00  
 2020 Sew. Ac. = 23,745.44  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,382,085.03 \$9,925,770.75  
 + Engr., ROW, Fin. inc., Conting. (1.5x) = \$17,073,127.54 \$14,888,656.12

NOTES:  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn.:  $s = 1/1629.6 \times n \times \text{MGD}^{0.54} / D^{4.75} \times L^{0.2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BFx Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option does not include diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line -- this area is omitted

Estim. Cost Above R.H. Meter = \$7,684,391.97 \$6,680,767.06  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 32.49% 32.69%  
 Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

COFW Option 4.xls  
 Page 1 of 1

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000-50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 93.84             | 96                    | 99.32                 | 83.62           | 305.73                | \$92,287.35     | \$81,111.93            |                         |
| M402A/0002-17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 95.68             | 96                    | 102.85                | 86.59           | 120.62                | 1,561,646.69    | 1,372,541.04           |                         |
| M402A/0020+10         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 95.68             | 96                    | 102.88                | 86.61           | 16.04                 | 66,048.79       | 58,050.69              |                         |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 95.68             | 96                    | 102.88                | 86.61           | 16.04                 | 66,048.79       | 58,050.69              |                         |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 95.72             | 96                    | 102.91                | 86.64           | 160.95                | 135,716.69      | 119,282.25             |                         |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 96.39             | 96                    | 103.85                | 87.43           | 112.47                | 787,156.79      | 691,837.07             |                         |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.86                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 96.39             | 96                    | 103.85                | 87.43           | 112.47                | 787,156.79      | 691,837.07             |                         |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 96.82             | 90                    | 105.58                | 87.84           | 120.23                | 344,328.08      | 299,948.02             |                         |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 96.88             | 90                    | 105.73                | 87.96           | 116.99                | 287,072.60      | 250,072.13             |                         |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 97.13             | 90                    | 105.86                | 88.07           | 121.89                | 444,525.17      | 387,230.81             |                         |
| M402A/0049+00         | M402A/0045+95           | 54            | 54               | 28.71                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 97.24             | 90                    | 105.94                | 88.19           | 116.85                | 244,131.00      | 212,665.22             |                         |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 97.24             | 90                    | 105.94                | 88.19           | 116.85                | 244,131.00      | 212,665.22             |                         |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 97.37             | 90                    | 106.05                | 88.23           | 123.42                | 202,779.82      | 176,643.75             |                         |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 115.28            | 96                    | 126.14                | 88.35           | 135.92                | 583,581.76      | 512,913.65             |                         |
| M402A/0061+67         | M402A/0060+68           | 98            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 115.27            | 96                    | 126.17                | 88.37           | 136.10                | 89,573.01       | 78,726.28              |                         |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 115.28            | 96                    | 126.14                | 88.46           | 135.92                | 583,581.76      | 512,913.65             |                         |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.50                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 115.36            | 96                    | 126.50                | 88.50           | 138.72                | 461,436.74      | 405,559.63             |                         |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 115.39            | 96                    | 126.78                | 88.80           | 138.02                | 625,201.54      | 549,493.54             |                         |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 115.39            | 96                    | 126.78                | 88.89           | 138.97                | 731,060.56      | 642,533.69             |                         |
| M402A/0088+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 115.40            | 96                    | 126.98                | 88.94           | 142.52                | 361,911.17      | 318,085.99             |                         |
| M402A/0096+65         | M402A/0088+56           | 820           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 115.50            | 96                    | 127.05                | 88.99           | 136.17                | 136,621.47      | 120,077.46             |                         |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 115.80            | 96                    | 127.34                | 89.19           | 131.39                | 152,002.69      | 133,596.11             |                         |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 116.03            | 96                    | 127.67                | 89.37           | 138.93                | 741,917.89      | 652,076.27             |                         |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 116.11            | 96                    | 127.67                | 89.42           | 129.31                | 643,297.10      | 565,397.84             |                         |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 116.35            | 96                    | 128.02                | 89.67           | 160.95                | 122,145.02      | 107,354.02             |                         |
| M402A/0117+43         | M402A/0113+81           | 126           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 116.51            | 96                    | 128.15                | 89.76           | 132.86                | 730,155.78      | 641,738.48             |                         |
| M402A/0120+25         | M402A/0117+43           | 308           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 131.51            | 96                    | 128.51                | 90.06           | 148.97                | 312,148.38      | 274,349.16             |                         |
| M402B/0123+40         | M402A/0120+25           | 1160          | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 131.60            | 96                    | 128.58                | 90.17           | 149.99                | 628,820.65      | 552,674.40             |                         |
| M402B/0136+74         | M402B/0123+40           | 48            | 48               | 31.40                  | 33.78                 | 83.80                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 114.87            | 78                    | 130.52                | 48              | 105.43                | 278,671.60      | 244,926.21             |                         |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 149,156.99  
 2050 Sew. Ac. = 28,070.61  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76  
 Constant Intel Flow = 6.00

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST  
 Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup> ]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D\*(8/3) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D\*(8/3) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BFx Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option does not include diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line -- this area is omitted

Estim. Cost Above R.H. Meter = \$8,497,239.51  
 Estim. Cost Below R.H. Meter = \$3,697,693.06  
 Percent R.H. Cost of Total Line = 30.32%  
 Estim. Richland Hills Cost Share = \$5,546,539.58  
 \$7,441,172.82  
 \$3,245,003.68  
 30.37%  
 \$4,867,505.52

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 95.48                  | 96                          | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1728          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.95                  | 96                          | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.96                  | 96                          | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.69              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.96                  | 96                          | 102.88                | 90                    | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 96.98                  | 96                          | 102.91                | 90                    | 86.64                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 97.62                  | 96                          | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 97.82                  | 96                          | 104.12                | 90                    | 87.66                 | 123.33          | 381,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 98.05                  | 90                          | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 98.22                  | 90                          | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 98.39                  | 90                          | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 98.47                  | 90                          | 105.94                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 98.50                  | 90                          | 106.00                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.59             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 98.66                  | 90                          | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 122.63                 | 96                          | 126.14                | 90                    | 106.20                | 135.92          | 583,581.76             | 512,913.65             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 122.60                 | 96                          | 126.17                | 90                    | 106.22                | 138.10          | 89,573.01              | 78,726.28              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 122.53                 | 96                          | 126.30                | 90                    | 106.33                | 138.72          | 461,436.74             | 405,959.63             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 122.54                 | 96                          | 126.50                | 90                    | 106.50                | 138.02          | 625,201.54             | 549,483.54             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 122.57                 | 96                          | 126.78                | 90                    | 106.74                | 138.97          | 731,060.56             | 642,533.69             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 122.59                 | 96                          | 126.91                | 90                    | 106.85                | 142.52          | 361,911.17             | 318,085.99             |
| M402A/0088+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 122.63                 | 96                          | 126.98                | 90                    | 106.91                | 136.17          | 136,621.47             | 120,077.46             |
| M402A/0096+65         | M402A/0088+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 122.70                 | 96                          | 127.05                | 90                    | 106.97                | 131.39          | 152,002.69             | 133,596.11             |
| M402A/0103+76         | M402A/0096+65           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 123.03                 | 96                          | 127.34                | 90                    | 107.21                | 138.93          | 741,917.89             | 652,076.27             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 123.28                 | 96                          | 127.60                | 90                    | 107.42                | 129.31          | 643,297.10             | 565,397.84             |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 123.37                 | 96                          | 127.67                | 90                    | 107.48                | 160.95          | 122,145.02             | 107,354.02             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 123.61                 | 96                          | 128.02                | 90                    | 107.78                | 132.86          | 730,155.78             | 641,738.48             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 143.82                 | 96                          | 128.51                | 90                    | 108.19                | 148.97          | 628,820.65             | 552,674.40             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 143.85                 | 96                          | 128.58                | 90                    | 108.25                | 149.99          | 114,002.02             | 100,197.09             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 143.88                 | 96                          | 128.74                | 90                    | 108.38                | 145.35          | 278,671.60             | 244,926.21             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 123.68                 | 78                          | 130.52                | 72                    | 105.43                | 136.83          | 692,861.97             | 590,367.59             |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 168,403.10  
 2070 Sew. Ac. = 30,535.42  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING PIPE DIAMETER IN INCHES  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNING'S EQN.: S = [1629.6 x n x MGD^1.54 / D^5(8/3)]^2, n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGD = [D^5(8/3) x S^1/2] / 1629.6 x n / 1.54  
 PROPOSED PARALLEL PIPE IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [D^5(8/3) x S^1/2] / 1629.6 x n / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, Year 2020  
 BFx Area, and Constant 6.0 MGD Inlet Facility  
 Flow. This Option does not include diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line -- this area is omitted.

Estim. Cost Above R.H. Meter = \$8,497,239.51 \$7,441,172.82  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 30.32% 30.37%  
 Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

***OPTION 5a***

OPTION 5A YEAR 2000

BIG FOL SEWER STUDY

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0004+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 61.21                  | 84                          | 69.57                 | 78              | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.56                  | 84                          | 72.04                 | 78              | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.57                  | 84                          | 72.06                 | 84              | 72.06                 | 1.49            | 50,568.60              | 50,568.60              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.57                  | 84                          | 72.06                 | 84              | 72.06                 | 72.06           | 103,908.09             | 103,908.09             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000383                   | 63.03                  | 84                          | 72.08                 | 84              | 72.08                 | 146.39          | 47,797.72              | 47,797.72              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 63.03                  | 84                          | 72.74                 | 78              | 59.69                 | 84.73           | 602,669.92             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 63.03                  | 84                          | 72.93                 | 78              | 59.85                 | 95.52           | 276,395.52             | 238,320.62             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.86                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 63.30                  | 78                          | 72.09                 | 66              | 46.17                 | 78.56           | 258,628.65             | 185,171.99             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 63.30                  | 78                          | 72.19                 | 66              | 46.24                 | 75.27           | 333,887.79             | 154,381.27             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 63.48                  | 78                          | 72.28                 | 66              | 46.29                 | 80.11           | 333,887.79             | 239,055.76             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 63.53                  | 78                          | 72.33                 | 66              | 46.33                 | 75.04           | 183,369.50             | 131,288.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 63.56                  | 78                          | 72.38                 | 66              | 46.36                 | 78.08           | 150,518.29             | 107,675.53             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 63.63                  | 78                          | 72.41                 | 66              | 46.38                 | 81.57           | 152,310.17             | 109,050.48             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 72.19                  | 84                          | 88.35                 | 78              | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 72.19                  | 84                          | 88.37                 | 78              | 72.52                 | 104.40          | 68,579.34              | 59,132.19              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 72.18                  | 84                          | 88.46                 | 78              | 72.60                 | 104.99          | 353,287.50             | 304,620.35             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 72.23                  | 84                          | 88.60                 | 78              | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 72.29                  | 84                          | 88.80                 | 78              | 72.88                 | 105.11          | 559,718.24             | 482,614.20             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 72.35                  | 84                          | 88.94                 | 78              | 72.99                 | 102.25          | 277,088.24             | 238,917.92             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 72.39                  | 84                          | 88.99                 | 78              | 73.03                 | 97.45           | 116,377.06             | 90,191.51              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 72.57                  | 84                          | 89.19                 | 78              | 73.20                 | 104.92          | 568,030.89             | 489,781.73             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 72.71                  | 84                          | 89.37                 | 78              | 73.34                 | 95.23           | 492,524.34             | 424,676.60             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 72.75                  | 84                          | 89.42                 | 78              | 73.39                 | 126.86          | 93,517.28              | 80,634.80              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 72.90                  | 84                          | 89.67                 | 78              | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 73.00                  | 84                          | 89.76                 | 78              | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 80.19                  | 84                          | 90.01                 | 78              | 73.87                 | 114.65          | 481,440.81             | 415,119.89             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 80.22                  | 84                          | 90.06                 | 78              | 74.00                 | 115.65          | 87,282.79              | 75,259.14              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 80.26                  | 84                          | 90.17                 | 78              | 74.00                 | 110.97          | 213,357.94             | 183,966.80             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 71.23                  | 66                          | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |
| M402B/0136+74         | M402B/0123+40           | 1,160         | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 71.23                  | 66                          | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 85,990.79  
 2000 Sew. Ac. = 16,728.36  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,277,334.79 \$7,820,119.26  
 + Engr., ROW, Finance, Conting. (1.5x) = \$13,916,002.18 \$11,730,178.89

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Existing Pipe Diameter in Inches  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn.: s = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup>(ft<sup>3</sup>) ]<sup>0.2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>2.63</sup>(ft) x s<sup>0.154</sup>(1/2) / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>2.63</sup>(ft) x s<sup>0.154</sup>(1/2) / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (ft.)  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (ft.)

OPTION 5a  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marne Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

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COFW Option 5a.xls

12/31/1999, 10:40 AM

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 67.13                  | 84              | 69.57                 | 78              | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 68.71                  | 84              | 72.04                 | 78              | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 68.72                  | 84              | 72.06                 | 84              | 72.06                 | 1.49            | 50,568.60              | 50,568.60              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 68.72                  | 84              | 72.06                 | 84              | 72.06                 | 72.06           | 103,908.09             | 103,908.09             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 68.73                  | 84              | 72.08                 | 84              | 72.08                 | 146.39          | 47,797.72              | 47,797.72              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 69.24                  | 84              | 72.74                 | 78              | 59.69                 | 84.73           | 519,646.47             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 69.39                  | 84              | 72.74                 | 78              | 59.69                 | 84.73           | 276,395.52             | 238,320.62             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 69.54                  | 78              | 72.09                 | 66              | 46.17                 | 78.56           | 258,628.65             | 185,171.99             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 69.64                  | 78              | 72.19                 | 66              | 46.24                 | 75.27           | 215,623.42             | 154,381.27             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 69.74                  | 78              | 72.28                 | 66              | 46.29                 | 80.11           | 333,887.79             | 239,055.76             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 69.82                  | 78              | 72.33                 | 66              | 46.33                 | 75.04           | 183,369.50             | 131,288.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 69.89                  | 78              | 72.38                 | 66              | 46.36                 | 78.08           | 150,518.29             | 107,767.53             |
| M402A/0054+21         | M402A/0051+91           | 645           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 69.79                  | 78              | 72.41                 | 66              | 46.38                 | 81.57           | 152,310.17             | 109,050.48             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 78.23                  | 84              | 88.35                 | 78              | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0061+87         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 78.23                  | 84              | 88.37                 | 78              | 72.52                 | 104.40          | 68,579.34              | 59,132.19              |
| M402A/0065+95         | M402A/0061+87           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 78.24                  | 84              | 88.46                 | 78              | 72.60                 | 104.99          | 353,287.50             | 304,620.35             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 78.29                  | 84              | 88.60                 | 78              | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 78.38                  | 84              | 88.80                 | 78              | 72.88                 | 105.11          | 559,718.24             | 482,614.20             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 78.41                  | 84              | 88.89                 | 78              | 72.95                 | 108.62          | 277,088.24             | 238,917.92             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 78.49                  | 84              | 88.94                 | 78              | 72.99                 | 102.25          | 104,600.81             | 90,191.51              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 78.49                  | 84              | 88.99                 | 78              | 73.03                 | 97.45           | 116,377.06             | 100,345.53             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 78.87                  | 84              | 89.19                 | 78              | 73.20                 | 104.92          | 568,030.89             | 489,781.73             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 78.83                  | 84              | 89.37                 | 78              | 73.34                 | 95.23           | 492,524.34             | 424,876.60             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 78.87                  | 84              | 89.42                 | 78              | 73.39                 | 126.86          | 93,517.28              | 80,634.80              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 79.05                  | 84              | 89.67                 | 78              | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 79.14                  | 84              | 89.76                 | 78              | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 86.17                  | 84              | 90.01                 | 78              | 73.87                 | 114.65          | 481,440.81             | 415,119.89             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 86.20                  | 84              | 90.06                 | 78              | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 86.25                  | 84              | 90.17                 | 78              | 74.00                 | 110.97          | 213,357.94             | 183,966.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 76.88                  | 66              | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: 2005  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 91,937.31  
 2005 Sew. Ac. = 18,136.37  
 CONSTANT INTEL FLOW = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,277,334.79 \$7,820,119.26  
 + Engr., ROW, Financ., Conting. (1.5x) = \$13,916,002.18 \$11,730,178.89

NOTES:

- UPSTREAM MAIN/STATION
  - LENGTH
  - EXIST DIA.
  - EXIST PIPE CAP
  - 2000 MODEL FLOW
  - 2020 MODEL FLOW
  - COEF. "A", COEF. "B"
  - MODEL PROP DIA.
  - MODEL H.G. SLOPE
  - DESIGN FLOW
  - PROP. REPL. PIPE
  - PROP. PIPE CAP
  - PROP. PARL. PIPE
  - PARL. PIPE CAP.
  - BOTH CAP.
  - ESTIM. REPL. PIPE COST
  - ESTIM. PARL. PIPE COST
- Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn.: s = [ (1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>) ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>2.63</sup> x s<sup>0.5</sup> / (1629.6 x n) ] / 1.54  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>2.63</sup> x s<sup>0.5</sup> / (1629.6 x n) ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 5a**  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 71.00                  | 90                    | 83.62                 | 84                    | 69.57                 | 291.68          | \$81,111.93            | \$70,657.50             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 72.67                  | 90                    | 86.59                 | 84                    | 72.04                 | 106.07          | 1,372,541.04           | 1,195,635.75            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 72.69                  | 90                    | 86.61                 | 90                    | 86.61                 | 16.04           | 58,050.69              | 58,050.69               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 72.71                  | 90                    | 86.61                 | 90                    | 86.61                 | 16.04           | 58,050.69              | 58,050.69               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 72.71                  | 90                    | 86.61                 | 90                    | 86.61                 | 16.04           | 58,050.69              | 58,050.69               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 73.24                  | 90                    | 87.43                 | 84                    | 72.74                 | 97.78           | 54,869.83              | 54,869.83               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | -0.0011        | 0.0091         | 90                    | 0.000558                   | 73.41                  | 90                    | 87.66                 | 84                    | 72.93                 | 104.60          | 691,837.02             | 602,666.92              |
| M402A/0038+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 73.56                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 317,290.77             | 276,395.52              |
| M402A/0040+28         | M402A/0038+79           | 361           | 54               | 29.03                  | 18.92                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 73.67                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 299,948.02             | 258,628.65              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 73.77                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 250,072.13             | 215,623.42              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 73.83                  | 84                    | 88.07                 | 78                    | 72.28                 | 106.10          | 387,230.81             | 333,887.79              |
| M402A/0054+21         | M402A/0051+91           | 252           | 54               | 31.72                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 73.86                  | 84                    | 88.14                 | 78                    | 72.33                 | 106.10          | 212,665.22             | 183,369.50              |
| M402A/0060+68         | M402A/0054+21           | 255           | 54               | 35.19                  | 19.06                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 73.93                  | 84                    | 88.19                 | 78                    | 72.38                 | 104.10          | 174,585.59             | 150,518.29              |
| M402A/0061+67         | M402A/0060+68           | 645           | 54               | 29.72                  | 31.63                 | -0.0004        | 0.0088         | 84                    | 0.000564                   | 82.85                  | 84                    | 88.23                 | 78                    | 72.41                 | 107.60          | 176,643.75             | 152,310.17              |
| M402A/0065+95         | M402A/0061+67           | 99            | 54               | 31.88                  | 31.61                 | -0.0004        | 0.0088         | 84                    | 0.000566                   | 82.85                  | 84                    | 88.35                 | 78                    | 72.51                 | 102.23          | 446,804.78             | 385,255.15              |
| M402A/0072+77         | M402A/0065+95           | 510           | 54               | 32.39                  | 31.54                 | -0.0004        | 0.0088         | 84                    | 0.000566                   | 82.85                  | 84                    | 88.37                 | 78                    | 72.52                 | 102.23          | 446,804.78             | 385,255.15              |
| M402A/0080+78         | M402A/0072+77           | 691           | 54               | 31.52                  | 31.50                 | -0.0004        | 0.0088         | 84                    | 0.000568                   | 82.91                  | 84                    | 88.46                 | 78                    | 72.60                 | 104.99          | 353,287.50             | 304,620.35              |
| M402A/0085+50         | M402A/0080+78           | 808           | 54               | 32.23                  | 31.45                 | -0.0004        | 0.0088         | 84                    | 0.000570                   | 83.00                  | 84                    | 88.60                 | 78                    | 72.71                 | 104.23          | 478,669.93             | 412,730.71              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 35.67                  | 31.43                 | -0.0004        | 0.0088         | 84                    | 0.000571                   | 83.04                  | 84                    | 88.80                 | 78                    | 72.88                 | 105.11          | 559,718.24             | 482,614.20              |
| M402A/0096+85         | M402A/0086+56           | 168           | 54               | 29.26                  | 31.43                 | -0.0004        | 0.0088         | 84                    | 0.000572                   | 83.07                  | 84                    | 88.89                 | 78                    | 72.99                 | 108.62          | 277,088.24             | 238,917.92              |
| M402A/0103+76         | M402A/0096+85           | 820           | 54               | 24.42                  | 31.45                 | -0.0004        | 0.0088         | 84                    | 0.000575                   | 83.12                  | 84                    | 88.99                 | 78                    | 73.03                 | 102.25          | 104,600.81             | 90,191.51               |
| M402A/0109+91         | M402A/0103+76           | 711           | 54               | 21.89                  | 31.63                 | -0.0004        | 0.0088         | 84                    | 0.000577                   | 83.32                  | 84                    | 89.19                 | 78                    | 73.20                 | 104.92          | 568,030.89             | 489,781.73              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | -0.0004        | 0.0088         | 84                    | 0.000578                   | 83.53                  | 84                    | 89.37                 | 78                    | 73.34                 | 95.23           | 492,524.34             | 424,676.60              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 39.39                  | 31.77                 | -0.0004        | 0.0088         | 84                    | 0.000581                   | 83.71                  | 84                    | 89.42                 | 78                    | 73.39                 | 126.86          | 92,517.28              | 80,634.80               |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 40.78                  | 42.22                 | -0.0002        | 0.0034         | 84                    | 0.000582                   | 83.82                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 91.35                  | 84                    | 90.01                 | 78                    | 73.87                 | 114.65          | 481,440.81             | 415,119.89              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 81.42                  | 66                    | 83.60                 | 60                    | 74.00                 | 110.97          | 213,357.94             | 183,967.80              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 81.42                  | 66                    | 83.60                 | 60                    | 74.00                 | 110.97          | 496,072.77             | 409,977.50              |

DESIGN YEAR: 2010  
 DESIGN CONDITION: OPTION NO. 5a  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 97,883.84  
 2010 Sew. Ac. = 19,299.64  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5x) = \$14,747,213.88 \$12,769,805.83

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5a  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BFH Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000-50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 88.77                  | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.33                  | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.35                  | 96                    | 102.88                | 96                    | 102.88                | 32.31           | 66,048.79              | 66,048.79              |
| M402A/0022+40         | M402A/0022+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.35                  | 96                    | 102.88                | 96                    | 102.88                | 177.22          | 135,716.69             | 135,716.69             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 91.37                  | 96                    | 102.91                | 96                    | 102.91                | 177.22          | 62,429.68              | 62,429.68              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 92.11                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 92.11                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 92.52                  | 90                    | 105.58                | 84                    | 87.84                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 92.64                  | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 92.76                  | 90                    | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 92.83                  | 90                    | 105.94                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 92.88                  | 90                    | 106.00                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.59             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.35                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 92.94                  | 90                    | 106.05                | 84                    | 88.35                 | 118.07          | 512,913.65             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 98.38                  | 90                    | 106.20                | 84                    | 88.35                 | 120.25          | 78,726.28              | 446,804.78             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 98.39                  | 90                    | 106.22                | 84                    | 88.37                 | 120.25          | 78,726.28              | 446,804.78             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 98.44                  | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,559.63             | 353,287.50             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 98.55                  | 90                    | 106.50                | 84                    | 88.60                 | 120.12          | 549,493.54             | 478,669.93             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 98.71                  | 90                    | 106.74                | 84                    | 88.80                 | 121.03          | 642,533.69             | 559,718.24             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 98.78                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.99             | 277,088.24             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 98.88                  | 90                    | 106.97                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 98.88                  | 90                    | 106.97                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 99.10                  | 90                    | 107.21                | 84                    | 88.99                 | 120.91          | 652,076.27             | 568,030.89             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 99.29                  | 90                    | 107.42                | 84                    | 89.37                 | 111.26          | 585,397.84             | 492,524.34             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 99.35                  | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 99.59                  | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 99.70                  | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 104.36                 | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 552,674.40             | 481,440.81             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 104.49                 | 90                    | 108.25                | 84                    | 90.06                 | 131.80          | 100,197.09             | 87,282.79              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 104.49                 | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 213,357.94             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 95.05                  | 72                    | 105.43                | 66                    | 83.60                 | 115.00          | 590,367.59             | 496,072.77             |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 107,643.23  
 2015 Sew. Ac. = 22,572.33  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,279,590.65 \$9,863,468.30  
 + Engr., ROW, Financ., Conting. (1.5x) = \$16,919,385.98 \$14,795,202.46

NOTES:  
 UPSTREAM MAIN/STATION Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 LENGTH Length of Pipe Segment in Feet  
 EXIST DIA. Existing Pipe Diameter in Inches  
 EXIST PIPE CAP Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 2000 MODEL FLOW Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 2020 MODEL FLOW Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 COEF. "A", COEF. "B" Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 MODEL PROP DIA. Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 MODEL H.G. SLOPE Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq. n = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4</sup>(8/3) ]<sup>1/2</sup>, n = 0.0145  
 DESIGN FLOW Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 PROP. REPL. PIPE Proposed Replacement Pipe in Inches  
 PROP. PARL. PIPE Proposed Replacement Pipe Capacity in MGD = [ D<sup>4</sup>(8/3) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 PARL. PIPE CAP. Proposed Parallel Pipe Capacity in MGD = [ D<sup>4</sup>(8/3) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 BOTH CAP. Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 ESTIM. REPL. PIPE COST Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 ESTIM. PARL. PIPE COST Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 5a**  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills; but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. CAP. (MGD) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 93.49                  | 96                    | 99.32            | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17         | M402A/0000+50           | 1728          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.10                  | 96                    | 102.85           | 86.59                 | 120.82          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.12                  | 96                    | 102.88           | 86.61                 | 16.04           | 66,048.79              | 58,050.89               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.12                  | 96                    | 102.88           | 86.61                 | 86.61           | 135,716.69             | 119,262.25              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 96.15                  | 96                    | 102.91           | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 96.91                  | 96                    | 103.85           | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 97.14                  | 96                    | 104.12           | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 97.34                  | 90                    | 105.58           | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 97.48                  | 90                    | 105.73           | 87.96                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 97.61                  | 90                    | 105.86           | 88.07                 | 121.89          | 444,525.17             | 387,230.81              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 97.73                  | 90                    | 106.00           | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 97.80                  | 90                    | 106.05           | 88.19                 | 119.91          | 200,394.17             | 174,565.59              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000565                   | 97.80                  | 90                    | 106.05           | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 104.81                 | 96                    | 126.17           | 106.20                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 104.87                 | 96                    | 126.30           | 106.22                | 138.10          | 89,573.01              | 78,726.28               |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 104.97                 | 96                    | 126.50           | 106.33                | 138.72          | 461,436.74             | 405,559.63              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000570                   | 105.13                 | 90                    | 106.74           | 106.50                | 124.56          | 625,201.54             | 549,493.54              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 105.20                 | 90                    | 106.85           | 106.80                | 121.03          | 642,533.69             | 559,718.24              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.69                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 105.30                 | 90                    | 106.91           | 118.20                | 119.20          | 318,085.99             | 277,088.24              |
| M402A/0085+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 105.55                 | 90                    | 107.21           | 113.41                | 120.91          | 133,596.11             | 116,377.06              |
| M402A/0088+51         | M402A/0085+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 105.75                 | 90                    | 107.48           | 89.37                 | 111.26          | 652,076.27             | 568,030.89              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 105.82                 | 90                    | 107.48           | 89.42                 | 142.89          | 565,397.84             | 492,524.34              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 106.07                 | 90                    | 107.78           | 107.78                | 114.75          | 107,354.02             | 93,517.28               |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 106.19                 | 90                    | 107.89           | 89.76                 | 129.15          | 641,738.46             | 559,025.52              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000586                   | 112.16                 | 90                    | 108.19           | 84                    | 130.79          | 274,349.16             | 238,988.61              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000586                   | 112.29                 | 90                    | 108.25           | 90.01                 | 131.80          | 552,674.40             | 481,440.81              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.76                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 112.29                 | 90                    | 108.38           | 90.06                 | 127.14          | 100,197.09             | 87,282.79               |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 112.29                 | 90                    | 108.38           | 90.17                 | 127.14          | 244,926.21             | 213,357.94              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 112.29                 | 90                    | 108.38           | 90.17                 | 127.14          | 590,367.59             | 496,072.77              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 101.61                 | 72                    | 105.43           | 83.60                 | 115.00          |                        |                         |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2020 Eq. Pop. = 117,402.63  
 2020 Sew. Ac. = 24,285.65  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,492,690.59 \$10,030,827.48  
 + Engr., ROW, Financ., Conting. (1.5x) = \$17,239,035.89 \$15,046,241.22

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP  
 ESTIM REPL. PIPE COST  
 ESTIM PARL. PIPE COST

DOWNSTREAM Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq. : s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(8/3) ]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Parallel Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5a  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BF X Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 97.10                  | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.11                  | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.13                  | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.89              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.13                  | 96                    | 102.88                | 90                    | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.15                  | 96                    | 102.91                | 90                    | 86.64                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 99.88                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 100.08                 | 96                    | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 100.31                 | 90                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 100.62                 | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 100.70                 | 90                    | 105.94                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 100.74                 | 90                    | 106.00                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0051+91         | M402A/0049+00           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 100.87                 | 90                    | 106.05                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.59             |
| M402A/0060+68         | M402A/0051+91           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 117.97                 | 96                    | 126.14                | 84                    | 88.19                 | 106.22          | 583,581.76             | 512,913.65             |
| M402A/0065+95         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 117.96                 | 96                    | 126.17                | 84                    | 88.35                 | 138.10          | 89,573.01              | 78,726.28              |
| M402A/0072+77         | M402A/0065+95           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 117.93                 | 96                    | 126.30                | 84                    | 88.46                 | 138.72          | 461,436.74             | 405,559.63             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 117.99                 | 96                    | 126.50                | 84                    | 88.60                 | 138.02          | 625,201.54             | 549,493.54             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 118.12                 | 96                    | 126.91                | 84                    | 88.89                 | 138.97          | 731,060.56             | 642,533.69             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 118.16                 | 96                    | 126.98                | 84                    | 88.94                 | 142.52          | 361,911.17             | 318,085.99             |
| M402A/0088+51         | M402A/0086+56           | 820           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 118.23                 | 96                    | 127.05                | 84                    | 88.99                 | 136.17          | 136,621.47             | 120,077.46             |
| M402A/0103+76         | M402A/0088+51           | 711           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 118.53                 | 96                    | 127.34                | 84                    | 89.19                 | 131.39          | 152,002.69             | 133,596.11             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 118.77                 | 96                    | 127.60                | 84                    | 89.37                 | 138.83          | 741,917.89             | 652,076.27             |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 118.85                 | 96                    | 127.87                | 84                    | 89.42                 | 129.31          | 643,297.10             | 565,397.84             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 119.10                 | 96                    | 128.02                | 84                    | 89.67                 | 160.95          | 122,145.02             | 107,354.02             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 119.26                 | 96                    | 128.15                | 84                    | 89.76                 | 132.88          | 312,148.38             | 274,349.16             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 133.60                 | 96                    | 128.51                | 84                    | 89.76                 | 148.97          | 628,820.65             | 552,674.40             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 133.69                 | 96                    | 128.74                | 84                    | 89.76                 | 145.35          | 278,671.60             | 244,926.21             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 117.16                 | 78                    | 130.52                | 72                    | 105.43                | 136.83          | 682,861.97             | 590,367.59             |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2050

F. W. Model Eq. Pop. = 57,207.50 93,287.50  
 F. W. Model Sew. Ac. = 9,004.81 20,981.33

2050 Eq. Pop. = 150,439.81  
 2050 Sew. Ac. = 28,610.82  
 Constant Intel Flow = 6.00

TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5a  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Hallom City, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Hallom City  
 to this line. Richland Hills omitted from this model.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 98.91             | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 100.56            | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 100.58            | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.69              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 100.58            | 96                    | 102.88                | 90                    | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 100.60            | 96                    | 102.91                | 90                    | 86.64                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 101.28            | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 101.49            | 96                    | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 101.73            | 84                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 101.90            | 84                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 102.07            | 84                    | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 102.16            | 84                    | 105.94                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,685.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 102.19            | 84                    | 106.00                | 84                    | 88.19                 | 119.91          | 209,394.17             | 174,565.59             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 102.35            | 84                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 125.38            | 96                    | 126.14                | 90                    | 106.20                | 135.92          | 583,581.76             | 512,913.65             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 125.35            | 96                    | 126.30                | 90                    | 106.33                | 138.10          | 89,573.01              | 78,726.28              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 125.38            | 96                    | 126.78                | 90                    | 106.85                | 142.52          | 361,911.17             | 318,085.99             |
| M402A/0072+77         | M402A/0065+95           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 125.36            | 96                    | 126.98                | 90                    | 106.91                | 136.17          | 136,621.47             | 120,077.46             |
| M402A/0080+78         | M402A/0072+77           | 400           | 54               | 29.26                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 125.42            | 96                    | 127.05                | 90                    | 106.97                | 131.39          | 152,002.69             | 133,596.11             |
| M402A/0085+50         | M402A/0080+78           | 151           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 125.49            | 96                    | 127.34                | 90                    | 107.21                | 138.93          | 741,917.89             | 652,076.27             |
| M402A/0088+51         | M402A/0085+50           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 126.09            | 96                    | 127.60                | 90                    | 107.42                | 129.31          | 643,297.10             | 565,397.84             |
| M402A/0096+65         | M402A/0088+51           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 126.18            | 96                    | 127.67                | 90                    | 107.48                | 160.95          | 122,145.02             | 107,354.02             |
| M402A/0103+76         | M402A/0096+65           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 126.43            | 96                    | 128.02                | 90                    | 107.78                | 132.86          | 730,155.78             | 647,739.48             |
| M402A/0105+11         | M402A/0103+76           | 807           | 54               | 25.08                  | 31.70                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 126.62            | 96                    | 128.15                | 90                    | 107.89                | 147.28          | 312,148.38             | 274,349.16             |
| M402A/0109+91         | M402A/0105+11           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000586                   | 145.87            | 96                    | 128.51                | 90                    | 108.19                | 148.97          | 628,820.65             | 552,674.40             |
| M402A/0113+81         | M402A/0109+91           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 145.90            | 96                    | 128.58                | 90                    | 108.25                | 149.99          | 114,002.02             | 100,197.09             |
| M402A/0117+43         | M402A/0113+81           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 145.94            | 96                    | 128.74                | 90                    | 108.38                | 145.35          | 278,671.60             | 244,926.21             |
| M402A/0120+25         | M402A/0117+43           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 145.94            | 96                    | 128.74                | 90                    | 108.38                | 145.35          | 278,671.60             | 244,926.21             |
| M402A/0120+25         | M402A/0120+25           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 125.99            | 78                    | 130.52                | 72                    | 105.43                | 136.83          | 692,861.97             | 590,367.59             |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 169,512.59  
 2070 Sew. Ac. = 31,075.63  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting (1.5%) = \$18,292,398.84 \$16,029,264.76

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST. DIA.  
 EXIST. PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP  
 ESTIM. REPL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Cobrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5a  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BF-X Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

**OPTION 5b**

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 4.92                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 4.93                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 4.95                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,605.65              | 0.00                   |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 4.97                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 4.98                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,773.91             | 0.00                   |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0038    | -0.0206   | 54                    | 0.000257                   | 4.98                   | 36                    | 10.00                 | 0                     | 0.00                  | 10.00           | 24,047.30              | 0.00                   |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 4.99                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,778.07              | 0.00                   |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 4.99                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 68,197.64              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 4.99                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 80,921.08              | 0.00                   |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 5.00                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 5.00                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 5.01                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 5.02                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 5.03                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 5.04                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 5.15                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC-A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 5.06                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC-A/0006+17       | TCWSC-A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 5.07                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC-A/0007+96       | TCWSC-A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 5.07                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC-A/0015+30       | TCWSC-A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 5.09                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC-A/0017+50       | TCWSC-A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 5.10                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC-A/0039+61       | TCWSC-A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 5.14                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 158,239.63             | 0.00                   |
| TCWSC-B/0001+14.8     | TCWSC-A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.10                   | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 715.69                 | 0.00                   |
| TCWSC-B/0001+28.94    | TCWSC-B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.10                   | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC-B/0001+34.94    | TCWSC-B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.10                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC-B/0001+46.94    | TCWSC-B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | 0.10                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | 0.10                   | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 5.16                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 5.17                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 26,065.38              | 0.00                   |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | -0.01                  | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.19                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.21                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: **OPTION NO. 5b**  
**2000**  
 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2000 Eq. Pop. = 7,909.96  
 2000 Sew. Ac. = 1,157.56  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr., ROW, Financ., Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

**NOTES:**  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet

Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{*(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 5b**  
 Includes Flow only from  
 Richland Hills, North  
 Richland Hills flow is assumed  
 to be diverted to the proposed  
 City of Fort Worth Outfall Sewer.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC0000+20          | L99570001+32            | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 5.23                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC0001+00          | TCWSC0000+20            | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 5.24                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC0004+27          | TCWSC0001+00            | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 5.26                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,605.65              | 0.00                   |
| TCWSC0009+33          | TCWSC0004+27            | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 5.28                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC0017+56          | TCWSC0009+33            | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 5.29                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC0019+45          | TCWSC0017+56            | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 5.29                   | 36                    | 10.00                 | 0                     | 0.00                  | 10.00           | 24,047.30              | 0.00                   |
| TCWSC0025+17          | TCWSC0019+45            | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 5.30                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,778.07              | 0.00                   |
| TCWSC0030+53          | TCWSC0025+17            | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 5.30                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 68,197.64              | 0.00                   |
| TCWSC0036+89          | TCWSC0030+53            | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 5.31                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 80,921.08              | 0.00                   |
| TCWSC0044+92          | TCWSC0036+89            | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 5.31                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC0053+70          | TCWSC0044+92            | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 5.31                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC0059+40          | TCWSC0053+70            | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 5.33                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC0059+99          | TCWSC0059+40            | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 5.34                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC0068+65          | TCWSC0059+99            | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 5.35                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC0076+00          | TCWSC0068+65            | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 5.36                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/A-B0000+00      | TCWSC0076+00            | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 5.47                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC-A0003+40        | TCWSC/A-B0000+00        | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 5.38                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC-A0006+17        | TCWSC-A0003+40          | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 5.39                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC-A0007+96        | TCWSC-A0006+17          | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 5.39                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC-A0015+30        | TCWSC-A0007+96          | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 5.40                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC-A0017+50        | TCWSC-A0015+30          | 220           | 27               | 21.09                  | 11.21                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 5.41                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC-A0039+61        | TCWSC-A0017+50          | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 5.46                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 158,239.83             | 0.00                   |
| TCWSC-B0001+14.8      | TCWSC-A0039+61          | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.11                   | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 715.69                 | 0.00                   |
| TCWSC-B0001+28.94     | TCWSC-B0001+14.8        | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.11                   | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC-B0001+34.94     | TCWSC-B0001+28.94       | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.11                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC-B0001+46.94     | TCWSC-B0001+34.94       | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | 0.10                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC-B0001+73.07     | TCWSC-B0001+46.94       | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | 0.10                   | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC-B0003+02        | TCWSC-B0001+73.07       | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 5.48                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC-B0005+96        | TCWSC-B0003+02          | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 5.49                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 26,065.38              | 0.00                   |
| TCWSC-B0008+15        | TCWSC-B0005+96          | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | -0.01                  | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC-B0011+93        | TCWSC-B0008+15          | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.45                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC-B0012+35        | TCWSC-B0011+93          | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.47                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION NO. 5b  
 2005 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2005 Eq. Pop. = 8,402.56  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2005 Sew. Ac. = 1,229.65  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr., ROW, Financ., Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.83</sup> ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.83</sup> / (1629.6 x n) ]<sup>1/2</sup> / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5b  
 Includes Flow only from  
 Richland Hills, North  
 Richland Hills flow is assumed  
 to be diverted to the proposed  
 City of Fort Worth Outfall Sewer.



| UPSTREAM MAINSTATION | DOWNSTREAM MAINSTATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|----------------------|------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20        | L9957/0001+32          | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 6.27                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00        | TCWSC/0000+20          | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 6.29                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC/0004+27        | TCWSC/0001+00          | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0189   | 54                    | 0.000228                   | 6.37                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,805.65              | 0.00                   |
| TCWSC/0009+33        | TCWSC/0004+27          | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 6.46                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC/0017+56        | TCWSC/0009+33          | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 6.56                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC/0019+45        | TCWSC/0017+56          | 189           | 36               | 10.20                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 6.58                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 24,047.30              | 0.00                   |
| TCWSC/0025+17        | TCWSC/0019+45          | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 6.63                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,778.07              | 0.00                   |
| TCWSC/0030+53        | TCWSC/0025+17          | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 6.67                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 80,197.64              | 0.00                   |
| TCWSC/0036+89        | TCWSC/0030+53          | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 6.70                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 68,921.08              | 0.00                   |
| TCWSC/0044+92        | TCWSC/0036+89          | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 6.74                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC/0053+70        | TCWSC/0044+92          | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 6.76                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC/0059+40        | TCWSC/0053+70          | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 6.78                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC/0059+99        | TCWSC/0059+40          | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 6.79                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC/0068+65        | TCWSC/0059+99          | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 6.80                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC/0076+00        | TCWSC/0068+65          | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 6.81                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/A-B/0000+00    | TCWSC/0076+00          | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 6.88                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC-A/0003+40      | TCWSC/A-B/0000+00      | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 6.82                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC-A/0006+17      | TCWSC-A/0003+40        | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 6.83                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC-A/0007+96      | TCWSC-A/0006+17        | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 6.83                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC-A/0015+30      | TCWSC-A/0007+96        | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 6.84                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC-A/0017+50      | TCWSC-A/0015+30        | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 6.85                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC-A/0039+61      | TCWSC-A/0017+50        | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 6.87                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 158,239.83             | 0.00                   |
| TCWSC-B/0001+14 B    | TCWSC-A/0039+61        | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.04                   | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 715.69                 | 0.00                   |
| TCWSC-B/0001+28.94   | TCWSC-B/0001+14 B      | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.04                   | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC-B/0001+34.94   | TCWSC-B/0001+28.94     | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.03                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC-B/0001+46.94   | TCWSC-B/0001+34.94     | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | 0.03                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC-B/0001+73.07   | TCWSC-B/0001+46.94     | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | 0.04                   | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC-B/0003+02      | TCWSC-B/0001+73.07     | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 6.89                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC-B/0005+96      | TCWSC-B/0003+02        | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 6.90                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 26,065.38              | 0.00                   |
| TCWSC-B/0008+15      | TCWSC-B/0005+96        | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | -0.01                  | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC-B/0011+93      | TCWSC-B/0008+15        | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.96                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC-B/0012+35      | TCWSC-B/0011+93        | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.97                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION NO. 5b  
 2010 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2010 Eq. Pop. = 8,895.16  
 2010 Sew. Ac. = 1,254.35  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr., ROW, Financ., Conting (1.5%) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn. s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup> ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup> / (1.48 x s<sup>1.48</sup>) ]<sup>1/2</sup> / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5b  
 Includes Flow only from  
 Richland Hills, North  
 Richland Hills flow is assumed  
 to be diverted to the proposed  
 City of Fort Worth Outfall Sewer.

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 TCWSC Option 5b.xls  
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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST DIA (in) | EXIST PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|----------------|-----------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36             | 142.07                | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 6.96                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36             | 44.89                 | 10.86                 | 16.86                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 6.99                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36             | 13.97                 | 10.91                 | 17.30                 | 0.0033    | -0.0169   | 54                    | 0.000228                   | 7.11                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,605.65              | 0.00                   |
| TCWSC/0009+33         | TCWSC/0004+27           | 508           | 36             | 10.16                 | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 7.26                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC/0017+58         | TCWSC/0009+33           | 823           | 36             | 10.25                 | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 7.43                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC/0019+45         | TCWSC/0017+58           | 189           | 36             | 10.00                 | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 7.45                   | 36                    | 10.00                 | 0                     | 0.00                  | 10.00           | 24,047.30              | 0.00                   |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36             | 10.20                 | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 7.53                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,778.07              | 0.00                   |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36             | 10.29                 | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 7.60                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 68,197.64              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36             | 10.13                 | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 7.66                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 80,921.08              | 0.00                   |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36             | 10.18                 | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 7.72                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36             | 10.25                 | 11.05                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 7.76                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36             | 10.20                 | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 7.78                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC/0068+65         | TCWSC/0059+40           | 59            | 36             | 9.95                  | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 7.78                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36             | 10.04                 | 11.11                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 7.79                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27             | 12.53                 | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 7.85                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36             | 10.22                 | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 7.81                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC/A/0006+17       | TCWSC/A/0003+40         | 277           | 36             | 10.13                 | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 7.82                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC/A/0007+96       | TCWSC/A/0006+17         | 179           | 30             | 8.88                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 7.82                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 734           | 30             | 10.86                 | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 7.82                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 220           | 27             | 21.09                 | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 7.82                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 2211          | 27             | 6.66                  | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 7.84                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 158,239.83             | 0.00                   |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 10            | 27             | 8.08                  | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.02                  | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 715.69                 | 0.00                   |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16             | -16.02                | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.02                  | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16             | 0.00                  | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.02                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16             | 0.00                  | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.02                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16             | 11.50                 | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.01                  | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27             | 8.97                  | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 7.85                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30             | 11.53                 | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 7.85                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 26,065.38              | 0.00                   |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27             | 9.86                  | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.00                   | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27             | 25.47                 | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.0002653                  | 5.27                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27             | 24.49                 | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 5.28                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION NO. 5b  
 2015 F.W. Model Eq. Pop. = 17,430.50 20657.50  
 2015 Sew. Ac. = 2,550.82 2,764.11  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr. ROW. Financ. Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING PIPE DIAMETER IN INCHES  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x Eq. Pop. + B x Sewered Acres  
 PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQN.: S = [1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup>(83)]<sup>1/2</sup>, n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 CAPACITY OF REPLACEMENT PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [D<sup>4.75</sup>(83) x S<sup>1.48</sup> / 1629.6 x n] / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 5b  
 Includes Flow only from Richland Hills, North Richland Hills flow is assumed to be diverted to the proposed City of Fort Worth Outfall Sewer.

12/31/1999, 10:41 AM  
 TCWSC Option 5b.xls  
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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 7.66                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 7.70                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 7.85                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,605.65              | 0.00                   |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 8.06                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 8.29                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0038    | -0.0206   | 54                    | 0.000257                   | 8.33                   | 36                    | 10.00                 | 0                     | 0.00                  | 10.00           | 24,047.30              | 0.00                   |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 8.43                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 27,778.07              | 0.00                   |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 8.54                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 68,197.64              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 8.62                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 80,921.08              | 0.00                   |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 8.70                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 8.75                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 8.77                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 8.77                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 8.78                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 8.79                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001098                   | 8.81                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC-A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 8.80                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC-A/0006+17       | TCWSC-A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 8.80                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC-A/0007+96       | TCWSC-A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 8.80                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC-A/0015+30       | TCWSC-A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 8.80                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC-A/0017+50       | TCWSC-A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 8.80                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC-A/0039+61       | TCWSC-A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 30                    | 0.000000                   | 8.80                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 158,239.83             | 0.00                   |
| TCWSC-B/0001+14.8     | TCWSC-A/0039+61         | 10            | 16               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.07                  | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 715.69                 | 0.00                   |
| TCWSC-B/0001+28.94    | TCWSC-B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.07                  | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC-B/0001+34.94    | TCWSC-B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.07                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC-B/0001+46.94    | TCWSC-B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.07                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.06                  | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 8.81                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 8.81                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 26,065.38              | 0.00                   |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.00                   | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 5.58                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 5.58                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION NO. 5b  
 2020 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2020 Eq. Pop. = 9,374.37  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2020 Sew. Ac. = 1,254.35  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr., ROW, Financ., Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

NOTES:  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5b  
 Includes Flow only from  
 Richland Hills, North  
 Richland Hills flow is assumed  
 to be diverted to the proposed  
 City of Fort Worth Outfall Sewer.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36              | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 7.09                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36              | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 7.16                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36              | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000221                   | 7.40                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,605.65              | 0.00                   |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36              | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000228                   | 7.76                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36              | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 8.15                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36              | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 8.23                   | 36                    | 10.00                 | 0                     | 0.00                  | 10.00           | 24,047.30              | 0.00                   |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36              | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 8.40                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,778.07              | 0.00                   |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36              | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 8.59                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 68,197.64              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36              | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 8.74                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 80,921.08              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0036+89           | 803           | 36              | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 8.88                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC/0044+92         | TCWSC/0036+89           | 878           | 36              | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 8.98                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC/0053+70         | TCWSC/0044+92           | 570           | 36              | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 8.99                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC/0059+40         | TCWSC/0053+70           | 95            | 36              | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 8.98                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC/0059+99         | TCWSC/0059+40           | 866           | 36              | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 8.98                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC/0068+65         | TCWSC/0059+99           | 735           | 36              | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 9.00                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/0076+00         | TCWSC/0068+65           | 750           | 27              | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 8.88                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 340           | 36              | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 8.97                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 277           | 36              | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 8.97                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC/A/0006+17       | TCWSC/A/0003+40         | 179           | 30              | 8.88                   | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 8.95                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC/A/0007+96       | TCWSC/A/0006+17         | 734           | 30              | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 8.95                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 220           | 27              | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 8.94                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 221           | 27              | 8.08                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 8.88                   | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 158,239.83             | 0.00                   |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 10            | 27              | 16.02                  | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 27                    | 16.02                 | 0                     | 0.00                  | -16.02          | 715.69                 | 0.00                   |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 13            | 16              | 16.02                  | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 16                    | 16.02                 | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 6             | 16              | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.26                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 12            | 16              | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.25                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 25            | 16              | 8.97                   | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.25                  | 16                    | 8.97                  | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 302           | 27              | 8.97                   | 11.39                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 8.85                   | 30                    | 8.97                  | 0                     | 0.00                  | 11.53           | 21,613.94              | 0.00                   |
| TCWSC/B/0003+02       | TCWSC/B/0001+73.07      | 295           | 30              | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 8.85                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 28,065.38              | 0.00                   |
| TCWSC/B/0005+96       | TCWSC/B/0003+02         | 150           | 27              | 9.86                   | -0.02                 | 0.00                  | 0.0000    | 0.0001    | 30                    | 0.000000                   | 0.01                   | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC/B/0008+15       | TCWSC/B/0005+96         | 360           | 27              | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.33                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC/B/0011+93       | TCWSC/B/0008+15         | 85            | 27              | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.31                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION NO. 5b 2050

F.W. Model Eq. Pop. = 17,430.50 20,657.50 2050 Eq. Pop. = 11,289.18

F.W. Model Sew. Ac. = 2,550.82 2,764.11 2050 Sew. Ac. = 1,254.35

TOTAL ESTIM. CONST. COST = \$1,446,203.47

+ Engr., ROW, Financ, Conting. (1.5x) = \$2,169,305.20

Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

NOTES:

UPSTREAM MAIN/STATION

UPSTREAM MAIN/STATION

LENGTH

EXIST DIA.

EXIST PIPE CAP

2000 MODEL FLOW

2020 MODEL FLOW

COEF. "A", COEF. "B"

MODEL PROP DIA.

MODEL H.G. SLOPE

DESIGN FLOW

PROP. REPL. PIPE

REPL. PIPE CAP.

PROP. PARL. PIPE

PARL. PIPE CAP.

BOTH CAP.

ESTIM. REPL. PIPE COST

ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey

Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey

Length of Pipe Segment in Feet

Existing Pipe Diameter in Inches

Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations

Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations

Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations

Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres

Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design

Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$

Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres

Proposed Replacement Pipe in Inches

Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations

Proposed Parallel Pipe in Inches

Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$

Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD

Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 5b**

Includes Flow only from Richland Hills, North to be diverted to the proposed City of Fort Worth Outfall Sewer.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 7.09                   | 36                    | 142.07                | 0                     | 3.52                  | 145.59          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | 0.0029    | 54                    | 0.000219                   | 7.16                   | 36                    | 44.89                 | 0                     | 3.54                  | 48.43           | 10,178.75              | 0.00                   |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 7.40                   | 36                    | 13.97                 | 0                     | 3.61                  | 17.58           | 41,605.65              | 0.00                   |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 7.76                   | 36                    | 10.16                 | 0                     | 3.70                  | 13.88           | 64,380.60              | 0.00                   |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000257                   | 8.15                   | 36                    | 10.25                 | 0                     | 3.81                  | 14.06           | 104,713.91             | 0.00                   |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 8.23                   | 36                    | 10.00                 | 0                     | 3.83                  | 13.83           | 24,047.30              | 0.00                   |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 8.40                   | 36                    | 10.20                 | 0                     | 3.88                  | 14.08           | 72,778.07              | 0.00                   |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 8.59                   | 36                    | 10.29                 | 0                     | 3.92                  | 14.21           | 88,197.64              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 8.74                   | 36                    | 10.13                 | 0                     | 3.96                  | 14.09           | 80,921.08              | 0.00                   |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 8.88                   | 36                    | 10.18                 | 0                     | 4.00                  | 14.18           | 102,169.22             | 0.00                   |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.33                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 8.98                   | 36                    | 10.25                 | 0                     | 4.02                  | 14.27           | 111,711.80             | 0.00                   |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 8.99                   | 36                    | 10.20                 | 0                     | 5.52                  | 15.72           | 72,523.61              | 0.00                   |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 8.98                   | 36                    | 9.95                  | 0                     | 5.53                  | 15.47           | 7,506.83               | 0.00                   |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 8.98                   | 36                    | 10.22                 | 0                     | 5.53                  | 15.75           | 110,184.99             | 0.00                   |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000538                   | 9.00                   | 36                    | 10.04                 | 0                     | 5.53                  | 15.57           | 93,517.28              | 0.00                   |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 9.00                   | 27                    | 12.53                 | 0                     | 4.37                  | 16.90           | 53,677.01              | 0.00                   |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 8.98                   | 36                    | 10.22                 | 0                     | 3.06                  | 13.28           | 43,299.69              | 0.00                   |
| TCWSC/A/0006+17       | TCWSC/A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 8.97                   | 36                    | 10.13                 | 0                     | 3.06                  | 13.28           | 43,299.69              | 0.00                   |
| TCWSC/A/0007+96       | TCWSC/A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 8.95                   | 30                    | 8.88                  | 0                     | 4.36                  | 15.22           | 64,854.20              | 0.00                   |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 8.95                   | 30                    | 10.86                 | 0                     | 4.36                  | 15.22           | 64,854.20              | 0.00                   |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 8.94                   | 27                    | 21.09                 | 0                     | 2.03                  | 23.12           | 15,745.26              | 0.00                   |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 8.88                   | 27                    | 6.66                  | 0                     | 2.03                  | 23.12           | 15,745.26              | 0.00                   |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 27                    | 8.08                  | 0                     | 0.04                  | 8.69            | 158,239.83             | 0.00                   |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 16                    | -16.02                | 0                     | 0.04                  | 8.12            | 715.69                 | 0.00                   |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 16                    | 0.00                  | 0                     | 0.04                  | 8.12            | 715.69                 | 0.00                   |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.26                  | 16                    | 0.00                  | 0                     | 0.04                  | 8.12            | 715.69                 | 0.00                   |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.25                  | 16                    | 11.50                 | 0                     | 0.04                  | 8.12            | 715.69                 | 0.00                   |
| TCWSC/B/0003+02       | TCWSC/B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 8.87                   | 27                    | 8.97                  | 0                     | 2.03                  | 11.00           | 21,613.94              | 0.00                   |
| TCWSC/B/0005+96       | TCWSC/B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 8.85                   | 30                    | 11.53                 | 0                     | 2.03                  | 13.56           | 26,065.38              | 0.00                   |
| TCWSC/B/0008+15       | TCWSC/B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.01                   | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC/B/0011+93       | TCWSC/B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.33                   | 27                    | 25.47                 | 0                     | 3.15                  | 28.62           | 25,764.96              | 0.00                   |
| TCWSC/B/0012+35       | TCWSC/B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.31                   | 27                    | 24.49                 | 0                     | 4.17                  | 28.66           | 6,083.39               | 0.00                   |

F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11

TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr., ROW, Financ., Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

DESIGN CONDITION:  
 2070

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(B/3)]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [D<sup>4.75</sup>(B/3) x s<sup>1/2</sup>] / 1629.6 x n / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 5b**  
 Includes Flow only from  
 Richland Hills, North  
 Richland Hills flow is assumed  
 to be diverted to the proposed  
 City of Fort Worth Outfall Sewer.

***OPTION 6a***

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                   | 0.000350                   | 60.14                  | 84                    | 69.57                 | 78              | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A0020+17          | M402A0000+50            | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 61.82                  | 84                    | 72.04                 | 78              | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A0020+90          | M402A0020+17            | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 61.83                  | 84                    | 72.06                 | 78              | 59.13                 | -11.44          | 50,568.60              | 43,602.52              |
| M402A0022+40          | M402A0020+90            | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 61.83                  | 84                    | 72.06                 | 78              | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A0023+09          | M402A0022+40            | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 61.85                  | 84                    | 72.08                 | 78              | 59.15                 | 133.46          | 47,797.72              | 41,213.34              |
| M402A0028+40          | M402A0023+09            | 870           | 54              | 25.04                  | 18.78                 | 87.63                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 62.33                  | 84                    | 72.74                 | 78              | 59.69                 | 84.73           | 602,666.92             | 519,646.47             |
| M402A0032+40          | M402A0028+40            | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                   | 0.000385                   | 62.48                  | 84                    | 72.93                 | 78              | 59.85                 | 95.52           | 276,395.52             | 238,320.62             |
| M402A0036+79          | M402A0032+40            | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 62.60                  | 78                    | 72.09                 | 66              | 46.17                 | 78.56           | 258,628.65             | 185,171.99             |
| M402A0040+28          | M402A0036+79            | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 62.68                  | 78                    | 72.19                 | 66              | 46.24                 | 75.27           | 215,623.42             | 154,381.27             |
| M402A0045+95          | M402A0040+28            | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 62.76                  | 78                    | 72.28                 | 66              | 46.29                 | 80.11           | 333,987.79             | 239,055.76             |
| M402A0049+00          | M402A0045+95            | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 62.81                  | 78                    | 72.33                 | 66              | 46.33                 | 75.04           | 183,369.50             | 131,288.22             |
| M402A0051+91          | M402A0049+00            | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 62.84                  | 78                    | 72.38                 | 66              | 46.36                 | 78.08           | 150,518.29             | 107,675.53             |
| M402A0054+21          | M402A0051+91            | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000563                   | 62.88                  | 78                    | 72.41                 | 66              | 46.38                 | 81.57           | 152,310.17             | 109,050.48             |
| M402A0060+68          | M402A0054+21            | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 66.28                  | 78                    | 72.51                 | 66              | 46.44                 | 76.16           | 385,255.15             | 275,833.57             |
| M402A0061+67          | M402A0060+68            | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 66.28                  | 78                    | 72.52                 | 66              | 46.45                 | 78.33           | 59,132.19              | 42,337.24              |
| M402A0065+95          | M402A0061+67            | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 66.32                  | 78                    | 72.60                 | 66              | 46.50                 | 78.89           | 304,620.35             | 218,100.96             |
| M402A0072+77          | M402A0065+95            | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 66.39                  | 78                    | 72.71                 | 66              | 46.57                 | 78.09           | 412,730.71             | 295,505.42             |
| M402A0080+78          | M402A0072+77            | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 66.49                  | 78                    | 72.88                 | 66              | 46.68                 | 78.91           | 482,614.20             | 345,540.34             |
| M402A0085+50          | M402A0080+78            | 400           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 66.54                  | 78                    | 72.95                 | 66              | 46.73                 | 82.40           | 238,917.92             | 171,059.58             |
| M402A0086+56          | M402A0085+50            | 151           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                   | 0.000572                   | 66.57                  | 78                    | 72.99                 | 66              | 46.75                 | 76.01           | 90,191.51              | 64,574.99              |
| M402A0088+51          | M402A0086+56            | 820           | 54              | 31.72                  | 31.56                 | 88.99                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 66.60                  | 78                    | 73.00                 | 66              | 46.78                 | 71.20           | 100,345.53             | 71,845.02              |
| M402A0096+65          | M402A0088+51            | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000577                   | 66.75                  | 78                    | 73.34                 | 66              | 46.98                 | 68.87           | 424,676.60             | 304,058.40             |
| M402A0103+76          | M402A0096+65            | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 66.91                  | 78                    | 73.39                 | 66              | 47.00                 | 100.47          | 80,634.80              | 57,732.61              |
| M402A0109+91          | M402A0103+76            | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 67.07                  | 78                    | 73.59                 | 66              | 47.14                 | 72.22           | 482,016.90             | 345,112.69             |
| M402A0113+81          | M402A0109+91            | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 67.14                  | 78                    | 73.66                 | 66              | 47.18                 | 86.57           | 206,066.71             | 147,538.88             |
| M402A0117+43          | M402A0113+81            | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 70.06                  | 78                    | 73.87                 | 66              | 47.31                 | 88.09           | 415,119.89             | 297,216.01             |
| M402A0120+25          | M402A0117+43            | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 70.08                  | 78                    | 73.91                 | 66              | 47.34                 | 89.08           | 75,259.14              | 53,883.77              |
| M402B0123+40          | M402A0120+25            | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                   | 0.000588                   | 70.14                  | 78                    | 74.00                 | 66              | 47.40                 | 84.37           | 183,966.80             | 131,715.87             |
| M402B0136+74          | M402B0123+40            | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001823                   | 64.06                  | 66                    | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 6a  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50  
 F.W. Model Sew. Ac. = 9,004.81  
 2000 Eq. Pop. = 69,948.30  
 2000 Sew. Ac. = 14,709.75  
 TOTAL ESTIM. CONST. COST = \$8,569,370.81  
 + Engr., ROW, Finance, Conting. (1.5x) = \$12,854,056.21  
 \$9,800,478.44

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.  $s = [1629.6 \times n \times \text{MGD}^{1.48} / D^{4.75}]^{0.2}$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} \times s^{0.2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} \times s^{0.2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 65.97                  | 84                    | 69.57                 | 78                    | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 67.90                  | 84                    | 72.04                 | 78                    | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | 70.57                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 67.91                  | 84                    | 72.06                 | 78                    | 59.13                 | -11.44          | 43,602.52              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 67.91                  | 84                    | 72.06                 | 78                    | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 67.93                  | 84                    | 72.08                 | 78                    | 59.15                 | 133.46          | 47,797.72              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.67                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 68.48                  | 84                    | 72.74                 | 78                    | 59.69                 | 84.73           | 276,666.92             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 32.39                  | 18.87                 | 87.66                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 68.77                  | 78                    | 72.09                 | 78                    | 59.85                 | 95.52           | 238,320.62             | 238,320.62             |
| M402A/0040+28         | M402A/0032+40           | 433           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 68.86                  | 78                    | 72.19                 | 78                    | 59.85                 | 75.27           | 276,395.52             | 276,395.52             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 68.94                  | 78                    | 72.28                 | 78                    | 59.85                 | 80.11           | 333,887.79             | 239,055.76             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | -18.99                | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 69.00                  | 78                    | 72.33                 | 78                    | 59.85                 | 75.04           | 183,369.50             | 131,288.22             |
| M402A/0054+21         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 69.03                  | 78                    | 72.38                 | 78                    | 59.85                 | 76.08           | 150,518.29             | 107,767.53             |
| M402A/0061+67         | M402A/0054+21           | 285           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 69.07                  | 78                    | 72.41                 | 78                    | 59.85                 | 81.57           | 152,310.17             | 109,050.48             |
| M402A/0066+68         | M402A/0061+67           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 71.97                  | 84                    | 88.35                 | 78                    | 72.51                 | 102.23          | 446,804.79             | 385,255.15             |
| M402A/0066+95         | M402A/0066+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 71.98                  | 84                    | 88.37                 | 78                    | 72.52                 | 104.40          | 468,579.34             | 59,132.19              |
| M402A/0072+77         | M402A/0066+95           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 72.03                  | 84                    | 88.46                 | 78                    | 72.60                 | 104.99          | 353,287.50             | 304,620.35             |
| M402A/0085+50         | M402A/0072+77           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 72.11                  | 84                    | 88.60                 | 78                    | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0086+56         | M402A/0085+50           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 72.23                  | 84                    | 88.80                 | 78                    | 72.88                 | 105.11          | 559,718.24             | 482,614.20             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 72.29                  | 84                    | 88.89                 | 78                    | 72.95                 | 108.62          | 277,088.24             | 238,917.92             |
| M402A/0103+76         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 72.52                  | 84                    | 89.19                 | 78                    | 73.03                 | 97.45           | 116,377.06             | 100,345.53             |
| M402A/0109+91         | M402A/0103+76           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 72.65                  | 84                    | 89.37                 | 78                    | 73.34                 | 95.23           | 482,524.34             | 424,676.60             |
| M402A/0109+91         | M402A/0109+91           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 72.69                  | 84                    | 89.42                 | 78                    | 73.39                 | 126.86          | 93,517.28              | 80,634.80              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 72.87                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 75.46                  | 84                    | 90.01                 | 78                    | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 75.49                  | 84                    | 90.06                 | 78                    | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 75.56                  | 84                    | 90.17                 | 78                    | 74.00                 | 110.97          | 213,357.94             | 183,966.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 69.29                  | 66                    | 83.60                 | 60                    | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 6a  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 83,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 75,006.22  
 2005 Sew. Ac. = 16,002.64  
 TOTAL ESTIM. CONST. COST = \$9,277,334.79 \$7,792,254.93  
 + Engr., ROW, Financ., Conting. (1.5%) = \$13,916,002.18 \$11,688,382.40  
 Constant Intel Flow = 6.00

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6a  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil plus Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Intel Facility Flow.  
 The Cities of NRH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

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 COW Option 6a.xls  
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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | 2010 MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                         | 0.000350                   | 70.24                  | 90                    | 83.62                 | 84                    | 69.57                 | 291.68          | \$81,111.93            | \$70,657.50            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                         | 0.000375                   | 72.31                  | 90                    | 86.59                 | 84                    | 72.04                 | 106.07          | 1,372,541.04           | 1,195,635.75           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                         | 0.000375                   | 72.32                  | 90                    | 86.61                 | 84                    | 72.06                 | 1.49            | 58,050.69              | 50,568.60              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                         | 0.000375                   | 72.32                  | 90                    | 86.61                 | 84                    | 72.06                 | 72.06           | 119,908.09             | 103,908.09             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                         | 0.000376                   | 72.34                  | 90                    | 86.64                 | 84                    | 72.08                 | 146.39          | 54,869.83              | 47,797.72              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                         | 0.000383                   | 72.92                  | 90                    | 87.43                 | 84                    | 72.74                 | 97.78           | 691,837.02             | 602,666.92             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                         | 0.000385                   | 73.10                  | 90                    | 87.66                 | 84                    | 72.93                 | 108.60          | 317,290.77             | 276,395.52             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                         | 0.000558                   | 73.24                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 299,948.02             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                         | 0.000559                   | 73.34                  | 84                    | 87.96                 | 78                    | 72.19                 | 101.22          | 250,072.13             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 599           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                         | 0.000561                   | 73.43                  | 84                    | 88.07                 | 78                    | 72.28                 | 106.10          | 387,230.81             | 333,887.79             |
| M402A/0051+91         | M402A/0045+95           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                         | 0.000562                   | 73.48                  | 84                    | 88.14                 | 78                    | 72.33                 | 101.04          | 212,665.22             | 183,369.50             |
| M402A/0060+68         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                         | 0.000563                   | 73.56                  | 84                    | 88.23                 | 78                    | 72.41                 | 107.60          | 176,643.75             | 152,310.17             |
| M402A/0061+67         | M402A/0060+68           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                         | 0.000564                   | 76.57                  | 84                    | 88.35                 | 78                    | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0065+95         | M402A/0061+67           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                         | 0.000565                   | 76.58                  | 84                    | 88.37                 | 78                    | 72.52                 | 104.40          | 68,579.34              | 59,132.19              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                         | 0.000566                   | 76.63                  | 84                    | 88.46                 | 78                    | 72.60                 | 104.99          | 353,287.50             | 304,620.35             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                         | 0.000568                   | 76.72                  | 84                    | 88.60                 | 78                    | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                         | 0.000570                   | 76.85                  | 84                    | 88.80                 | 78                    | 72.88                 | 105.11          | 599,119.24             | 482,614.20             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                         | 0.000571                   | 76.91                  | 84                    | 88.89                 | 78                    | 72.95                 | 108.62          | 277,088.24             | 236,917.92             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                         | 0.000572                   | 76.95                  | 84                    | 88.94                 | 78                    | 72.99                 | 102.25          | 104,600.81             | 90,191.51              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                         | 0.000573                   | 77.16                  | 84                    | 89.19                 | 78                    | 73.03                 | 97.45           | 116,377.06             | 100,345.53             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.53                 | 89.37                 | -0.0004        | 0.0060         | 84                         | 0.000577                   | 77.30                  | 84                    | 89.37                 | 78                    | 73.20                 | 104.92          | 568,030.89             | 489,781.73             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                         | 0.000578                   | 77.35                  | 84                    | 89.42                 | 78                    | 73.39                 | 126.86          | 93,517.28              | 80,634.80              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                         | 0.000581                   | 77.54                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                         | 0.000582                   | 77.62                  | 84                    | 89.76                 | 78                    | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                         | 0.000586                   | 80.23                  | 84                    | 90.01                 | 78                    | 73.87                 | 114.65          | 481,440.81             | 415,119.89             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                         | 0.000586                   | 80.26                  | 84                    | 90.06                 | 78                    | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                         | 0.000588                   | 80.34                  | 84                    | 90.17                 | 78                    | 74.00                 | 110.97          | 213,357.94             | 183,968.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                         | 0.001829                   | 73.88                  | 66                    | 83.60                 | 60                    | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 6a  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 80,064.14  
 2010 Sew. Ac. = 17,107.83  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5x) = \$14,747,213.88  
 \$12,724,913.30

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 6a**  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil, plus Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Intel Facility Flow.  
 The Cities of NRH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

COFW Option 6a.xls

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 88.34                  | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.33                  | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,946.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.35                  | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,048.79              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.35                  | 96                    | 102.88                | 90                    | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0090         | 90                    | 0.000376                   | 91.38                  | 96                    | 102.91                | 90                    | 86.64                 | 160.95          | 52,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 92.17                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 92.40                  | 96                    | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 92.57                  | 90                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 92.69                  | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 92.80                  | 90                    | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 92.87                  | 90                    | 106.00                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 92.87                  | 90                    | 106.00                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.59             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000564                   | 92.92                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 92.16                  | 90                    | 106.20                | 84                    | 88.35                 | 118.07          | 512,913.65             | 446,804.78             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 92.18                  | 90                    | 106.22                | 84                    | 88.37                 | 120.25          | 78,726.28              | 68,579.34              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 92.28                  | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,559.63             | 353,287.50             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 92.42                  | 90                    | 106.50                | 84                    | 88.60                 | 120.12          | 549,493.54             | 478,669.93             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 92.63                  | 90                    | 106.74                | 84                    | 88.80                 | 121.03          | 642,533.69             | 559,718.24             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 92.72                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.98             | 277,088.24             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 92.77                  | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 92.82                  | 90                    | 106.97                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 93.01                  | 90                    | 107.21                | 84                    | 89.19                 | 120.91          | 652,076.27             | 568,030.89             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 93.18                  | 90                    | 107.42                | 84                    | 89.37                 | 111.26          | 565,397.84             | 492,524.34             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 93.23                  | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 93.48                  | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 41.74                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 93.56                  | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 36.97                  | 42.20                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 93.06                  | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 552,674.40             | 481,440.81             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.20                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 93.22                  | 90                    | 108.38                | 84                    | 90.06                 | 131.80          | 100,197.09             | 87,282.79              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 93.22                  | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 213,357.94             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 87.25                  | 72                    | 105.43                | 66                    | 83.60                 | 115.00          | 590,367.59             | 496,072.77             |

DESIGN CONDITION: OPTION NO. 6a  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 89,256.39  
 2015 Sew. Ac. = 20,353.79  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,279,590.65 \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5x) = \$16,919,385.98 \$14,747,213.88

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST. DIA.  
 EXIST. PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn.:  $s = 1 / (1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75})$   $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / (1629.6 \times n)] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / (1629.6 \times n)] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6a  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil, plus Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Inlet Facility Flow.  
 The Cities of NRH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 98.86             | 96                    | 99.32                 | 90              | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 101.52            | 96                    | 102.85                | 90              | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 101.54            | 96                    | 102.88                | 90              | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 101.54            | 96                    | 102.88                | 90              | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0090         | 90                    | 0.000376                   | 101.57            | 96                    | 102.91                | 90              | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 102.37            | 96                    | 103.85                | 90              | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A/0036+79         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 102.37            | 96                    | 103.85                | 90              | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 102.82            | 90                    | 105.58                | 84              | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 102.97            | 90                    | 105.86                | 84              | 87.96                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 103.19            | 90                    | 106.00                | 84              | 88.07                 | 121.89          | 444,525.17             | 387,230.81              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 103.19            | 90                    | 106.00                | 84              | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 103.33            | 90                    | 106.05                | 84              | 88.19                 | 119.91          | 200,394.17             | 174,565.59              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 112.36            | 96                    | 126.14                | 90              | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 112.36            | 96                    | 126.14                | 90              | 106.20                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 112.40            | 96                    | 126.17                | 90              | 106.22                | 138.10          | 89,573.01              | 78,726.28               |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 112.50            | 96                    | 126.30                | 90              | 106.33                | 138.72          | 461,436.74             | 405,559.63              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 112.66            | 96                    | 126.78                | 90              | 106.50                | 138.02          | 625,201.54             | 549,493.54              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 112.77            | 96                    | 126.98                | 90              | 106.85                | 142.52          | 731,060.56             | 642,533.69              |
| M402A/0088+51         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 112.77            | 96                    | 126.98                | 90              | 106.91                | 136.17          | 361,911.17             | 318,085.99              |
| M402A/0096+55         | M402A/0088+51           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 112.84            | 96                    | 127.05                | 90              | 106.97                | 131.39          | 152,002.69             | 120,077.46              |
| M402A/0103+76         | M402A/0096+55           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 113.10            | 96                    | 127.34                | 90              | 107.21                | 138.93          | 741,917.89             | 632,076.27              |
| M402A/0105+11         | M402A/0103+76           | 711           | 54               | 21.89                  | 31.63                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 113.32            | 96                    | 127.60                | 90              | 107.42                | 129.31          | 643,297.10             | 565,397.84              |
| M402A/0109+91         | M402A/0105+11           | 135           | 54               | 53.47                  | 31.66                 | 89.47                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 113.66            | 96                    | 127.67                | 90              | 107.48                | 160.95          | 122,145.02             | 107,354.02              |
| M402A/0113+81         | M402A/0109+91           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 113.79            | 96                    | 128.02                | 90              | 107.78                | 132.86          | 730,155.78             | 641,738.48              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 121.44            | 96                    | 128.15                | 90              | 107.89                | 147.28          | 312,148.38             | 274,349.16              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 121.44            | 96                    | 128.15                | 90              | 108.19                | 148.97          | 628,820.65             | 552,674.40              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 121.58            | 96                    | 128.58                | 90              | 108.25                | 149.99          | 114,002.02             | 100,197.09              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 109.37            | 78                    | 130.52                | 72              | 105.43                | 145.35          | 278,671.60             | 244,926.21              |
|                       |                         |               |                  |                        |                       |                       |                |                |                       |                            |                   |                       |                       |                 |                       |                 | 692,861.97             | 590,367.59              |

DESIGN CONDITION: OPTION NO. 6a  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 129,181.14  
 2050 Sew. Ac. = 26,316.11  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ. Conting (1.5x) = \$18,292,398.84 \$16,029,264.76

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = \left[ \frac{1629.6 \times n \times \text{MGD}^{-1.54}}{D \times (8/3)^{1/2}} \right]^2$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $\left[ \frac{D \times (8/3)}{1629.6 \times n} \right] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $\left[ \frac{D \times (8/3)}{1629.6 \times n} \right] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6a  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil, plus Main Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Intel Facility Flow.  
 The Cities of NRH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 100.68                 | 96                    | 99.32                 | 90              | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1728          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0088         | 90                    | 0.000375                   | 102.98                 | 96                    | 102.85                | 90              | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 102.99                 | 96                    | 102.88                | 90              | 86.61                 | 16.04           | 66,048.79              | 58,050.69              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 102.99                 | 96                    | 102.88                | 90              | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 103.02                 | 96                    | 102.91                | 90              | 86.64                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A/0023+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 103.78                 | 96                    | 103.85                | 90              | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0028+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 104.02                 | 96                    | 104.12                | 90              | 87.66                 | 123.33          | 317,290.77             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 104.25                 | 96                    | 125.41                | 90              | 105.58                | 137.97          | 391,768.84             | 344,328.08             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 104.41                 | 96                    | 125.58                | 90              | 105.73                | 134.76          | 326,624.83             | 287,072.60             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 104.56                 | 96                    | 125.74                | 90              | 105.86                | 139.68          | 505,770.86             | 444,525.17             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 104.65                 | 96                    | 125.84                | 90              | 105.94                | 134.65          | 277,766.82             | 244,131.00             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 104.69                 | 96                    | 125.91                | 90              | 106.00                | 137.72          | 228,004.04             | 200,394.17             |
| M402A/0060+68         | M402A/0051+91           | 645           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 104.81                 | 96                    | 125.97                | 90              | 106.05                | 141.24          | 230,718.37             | 202,779.82             |
| M402A/0061+87         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 119.76                 | 96                    | 126.14                | 90              | 106.22                | 138.10          | 583,581.76             | 512,913.65             |
| M402A/0065+95         | M402A/0061+87           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 119.75                 | 96                    | 126.30                | 90              | 106.33                | 138.72          | 461,436.74             | 405,559.63             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.50                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 119.83                 | 96                    | 126.50                | 90              | 106.54                | 138.02          | 625,201.54             | 549,493.54             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 119.94                 | 96                    | 126.78                | 90              | 106.74                | 138.97          | 731,060.56             | 642,533.69             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 119.99                 | 96                    | 126.91                | 90              | 106.85                | 142.52          | 361,911.17             | 318,085.99             |
| M402A/0088+51         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.45                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 120.04                 | 96                    | 126.98                | 90              | 106.91                | 136.17          | 136,621.47             | 120,077.46             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 120.41                 | 96                    | 127.05                | 90              | 106.97                | 131.39          | 152,002.69             | 133,596.11             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 120.72                 | 96                    | 127.67                | 90              | 107.21                | 138.93          | 741,917.89             | 652,076.27             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 120.99                 | 96                    | 128.02                | 90              | 107.48                | 160.95          | 643,297.10             | 565,397.84             |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 121.15                 | 96                    | 128.15                | 90              | 107.78                | 132.86          | 730,155.78             | 641,738.48             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 121.15                 | 96                    | 128.15                | 90              | 107.89                | 147.28          | 312,148.38             | 274,349.16             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 133.71                 | 96                    | 128.51                | 90              | 108.19                | 148.97          | 628,802.65             | 552,674.40             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 133.75                 | 96                    | 128.58                | 90              | 108.25                | 149.99          | 114,000.02             | 100,197.09             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 133.83                 | 96                    | 128.74                | 90              | 108.38                | 145.35          | 278,671.60             | 244,926.21             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 118.20                 | 78                    | 130.52                | 72              | 105.43                | 138.83          | 692,861.97             | 590,367.59             |

DESIGN CONDITION: OPTION NO. 6A  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 148,253.92  
 2070 Sew. Ac. = 28,760.92  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$12,432,355.48 \$10,908,281.81  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,648,533.22 \$16,362,422.72

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST. PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 6a**  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil, plus Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Intel Facility Flow.  
 The Cities of NPH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

**OPTION 6b**

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 20.01                  | 60                    | 22.34                 | 54                    | 16.87                 | 158.94          | \$7,068.58             | \$5,725.55              |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 20.12                  | 60                    | 22.46                 | 54                    | 16.96                 | 61.85           | 28,274.31              | 22,902.19               |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 20.55                  | 60                    | 23.91                 | 54                    | 17.30                 | 31.27           | 115,571.24             | 93,612.71               |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 21.13                  | 60                    | 23.52                 | 54                    | 17.76                 | 27.92           | 178,835.01             | 144,856.36              |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 21.76                  | 60                    | 24.18                 | 54                    | 18.26                 | 28.51           | 290,871.96             | 235,608.29              |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0204   | 54                    | 0.000257                   | 21.87                  | 60                    | 24.30                 | 54                    | 18.35                 | 28.35           | 66,796.06              | 54,106.43               |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0216   | 54                    | 0.000263                   | 22.16                  | 60                    | 24.61                 | 54                    | 18.58                 | 28.78           | 202,161.32             | 163,750.67              |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 22.45                  | 60                    | 24.91                 | 54                    | 18.81                 | 29.10           | 189,437.88             | 153,444.68              |
| TCWSC/0036+89         | TCWSC/0030+53           | 638           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 22.68                  | 60                    | 25.15                 | 54                    | 18.99                 | 29.12           | 224,780.76             | 182,072.42              |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 22.91                  | 60                    | 25.39                 | 54                    | 19.17                 | 29.35           | 283,803.39             | 229,880.74              |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 23.06                  | 60                    | 25.55                 | 54                    | 19.29                 | 29.54           | 310,310.55             | 251,351.55              |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 23.11                  | 54                    | 26.46                 | 48                    | 19.33                 | 29.53           | 163,178.11             | 128,930.85              |
| TCWSC/0059+99         | TCWSC/0059+40           | 866           | 36               | 9.95                   | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 23.13                  | 54                    | 26.49                 | 48                    | 19.35                 | 29.57           | 247,916.22             | 195,884.42              |
| TCWSC/0068+65         | TCWSC/0059+99           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 23.16                  | 54                    | 26.53                 | 48                    | 19.38                 | 29.42           | 210,413.88             | 166,252.94              |
| TCWSC/0076+00         | TCWSC/0068+65           | 340           | 36               | 10.22                  | 11.16                 | 19.42                 | 0.0040    | -0.0238   | 42                    | 0.001099                   | 23.18                  | 54                    | 27.96                 | 42                    | 19.42                 | 40.26           | 214,708.04             | 169,645.86              |
| TCWSC/A/B/0000+00     | TCWSC/A/B/0000+00       | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 23.18                  | 54                    | 27.70                 | 42                    | 19.40                 | 28.28           | 40,468.81              | 30,999.25               |
| TCWSC/A/0006+17       | TCWSC/A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 23.18                  | 48                    | 27.70                 | 42                    | 19.40                 | 30.26           | 166,026.75             | 127,114.23              |
| TCWSC/A/0007+96       | TCWSC/A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 23.17                  | 48                    | 27.70                 | 42                    | 19.40                 | 40.49           | 49,762.79              | 38,099.63               |
| TCWSC/A/0015+30       | TCWSC/A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 23.16                  | 48                    | 27.70                 | 42                    | 19.40                 | 26.06           | 500,116.00             | 382,901.31              |
| TCWSC/A/0017+50       | TCWSC/A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 23.16                  | 48                    | 27.70                 | 42                    | 19.40                 | 8.47            | 2,261.94               | 1,731.80                |
| TCWSC/B/0001+14.8     | TCWSC/B/0001+14.8       | 10            | 17               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.23                  | 48                    | 0.56                  | 42                    | 0.39                  | -15.63          | 2,940.53               | 2,051.34                |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+28.94      | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.23                  | 48                    | 0.56                  | 42                    | 0.39                  | 0.39            | 1,357.17               | 1,039.08                |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+34.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.23                  | 48                    | 0.56                  | 42                    | 0.39                  | 0.39            | 2,714.33               | 2,078.16                |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+46.94      | 12            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.21                  | 48                    | 0.49                  | 42                    | 0.34                  | 11.84           | 5,654.86               | 4,329.50                |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 23.18                  | 48                    | 27.73                 | 42                    | 19.42                 | 28.39           | 68,310.73              | 52,300.40               |
| TCWSC/B/0003+02       | TCWSC/B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001098                   | 23.18                  | 48                    | 27.73                 | 42                    | 19.42                 | 30.95           | 66,727.37              | 51,088.14               |
| TCWSC/B/0005+86       | TCWSC/B/0005+86         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.00                   | 36                    | 0.00                  | 30                    | 0.00                  | 9.86            | 19,085.16              | 13,253.58               |
| TCWSC/B/0008+15       | TCWSC/B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 14.41                  | 36                    | 20.00                 | 30                    | 12.30                 | 37.77           | 45,804.38              | 31,808.60               |
| TCWSC/B/0011+93       | TCWSC/B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 14.41                  | 30                    | 16.29                 | 18                    | 4.17                  | 28.66           | 7,510.36               | 2,703.73                |

DESIGN CONDITION: OPTION 6b  
 2000 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2000 Eq. Pop. = 23,952.45  
 2000 Sew. Ac. = 3,176.17  
 TOTAL ESTIM. CONST. COST = \$3,906,414.01  
 + Engr., ROW, Financ., Conting. (1.5x) = \$5,859,821.02  
 \$3,092,629.89  
 \$4,638,944.84

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6b  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition. Assumes R. Hills and NRH will not be connected to the COFW Big Fossil line.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL DIA. (in) | MODEL SLOPE (ft/100) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------|----------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | 19957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54              | 0.000217             | 21.10                  | 60                    | 22.34                 | 54                    | 16.87                 | 158.94          | \$7,068.58             | \$5,725.55             |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54              | 0.000219             | 21.22                  | 60                    | 22.46                 | 54                    | 16.96                 | 61.85           | 28,274.31              | 22,902.19              |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54              | 0.000228             | 21.66                  | 60                    | 22.91                 | 54                    | 17.30                 | 31.27           | 115,571.24             | 93,612.71              |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54              | 0.000241             | 22.27                  | 60                    | 23.52                 | 54                    | 17.76                 | 27.92           | 178,835.01             | 144,866.36             |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54              | 0.000254             | 22.93                  | 60                    | 24.18                 | 54                    | 18.26                 | 28.51           | 290,871.96             | 235,606.29             |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54              | 0.000257             | 23.05                  | 60                    | 24.30                 | 54                    | 18.35                 | 28.35           | 66,798.06              | 54,106.43              |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54              | 0.000263             | 23.35                  | 60                    | 24.61                 | 54                    | 18.58                 | 28.78           | 202,161.32             | 163,750.67             |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54              | 0.000270             | 23.66                  | 60                    | 24.91                 | 54                    | 18.81                 | 29.10           | 189,437.88             | 153,444.68             |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54              | 0.000275             | 23.90                  | 60                    | 25.15                 | 54                    | 18.99                 | 29.12           | 224,780.76             | 182,072.42             |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54              | 0.000280             | 24.13                  | 60                    | 25.39                 | 54                    | 19.17                 | 29.35           | 283,803.39             | 229,880.74             |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54              | 0.000284             | 24.29                  | 60                    | 25.55                 | 54                    | 19.29                 | 29.54           | 310,310.55             | 251,351.55             |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0041    | -0.0240   | 48              | 0.000534             | 24.34                  | 54                    | 26.46                 | 48                    | 19.33                 | 29.53           | 163,178.11             | 128,930.85             |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48              | 0.000534             | 24.34                  | 54                    | 26.46                 | 48                    | 19.33                 | 29.57           | 247,916.22             | 195,884.42             |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48              | 0.000537             | 24.36                  | 54                    | 26.48                 | 48                    | 19.35                 | 29.42           | 210,413.88             | 166,252.94             |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48              | 0.000538             | 24.40                  | 54                    | 26.53                 | 48                    | 19.38                 | 40.26           | 214,708.04             | 169,645.86             |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.40                 | 0.0041    | -0.0231   | 42              | 0.001099             | 24.43                  | 48                    | 27.96                 | 48                    | 27.73                 | 40.26           | 97,334.31              | 76,906.12              |
| TCWSC-A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.42                 | 0.0041    | -0.0238   | 48              | 0.000538             | 24.43                  | 54                    | 26.56                 | 48                    | 19.40                 | 29.62           | 79,298.84              | 62,655.87              |
| TCWSC-A/0006+17       | TCWSC-A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48              | 0.000538             | 24.42                  | 54                    | 26.56                 | 48                    | 19.40                 | 29.53           | 40,488.81              | 30,999.25              |
| TCWSC-A/0007+96       | TCWSC-A/0006+17         | 179           | 30               | 8.86                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42              | 0.001097             | 24.42                  | 48                    | 27.70                 | 42                    | 19.40                 | 30.26           | 166,026.75             | 127,114.23             |
| TCWSC-A/0015+30       | TCWSC-A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42              | 0.001097             | 24.42                  | 48                    | 27.70                 | 42                    | 19.40                 | 40.49           | 49,762.79              | 38,099.63              |
| TCWSC-A/0017+50       | TCWSC-A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42              | 0.001097             | 24.41                  | 48                    | 27.70                 | 42                    | 19.40                 | 26.06           | 500,116.00             | 382,901.31             |
| TCWSC-A/0039+61       | TCWSC-A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42              | 0.001097             | 24.40                  | 48                    | 27.70                 | 42                    | 19.40                 | 15.63           | 2,261.94               | 1,731.80               |
| TCWSC-B/0001+14.8     | TCWSC-A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30              | 0.000000             | -0.24                  | 48                    | 0.56                  | 42                    | 0.39                  | -15.63          | 2,940.53               | 2,251.34               |
| TCWSC-B/0001+28.94    | TCWSC-B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30              | 0.000000             | -0.24                  | 48                    | 0.56                  | 42                    | 0.39                  | 0.39            | 1,357.17               | 1,039.08               |
| TCWSC-B/0001+34.94    | TCWSC-B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30              | 0.000000             | -0.24                  | 48                    | 0.56                  | 42                    | 0.39                  | 0.39            | 2,714.33               | 2,078.16               |
| TCWSC-B/0001+46.94    | TCWSC-B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30              | 0.000000             | -0.24                  | 48                    | 0.56                  | 42                    | 0.34                  | 11.84           | 5,654.86               | 4,329.50               |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30              | 0.000000             | -0.21                  | 48                    | 0.49                  | 42                    | 0.34                  | 11.84           | 6,630.73               | 5,200.40               |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42              | 0.001099             | 24.42                  | 48                    | 27.73                 | 42                    | 19.42                 | 28.39           | 66,727.37              | 51,088.14              |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42              | 0.001099             | 24.42                  | 48                    | 27.73                 | 42                    | 19.42                 | 30.95           | 19,085.16              | 13,253.58              |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30              | 0.000000             | 0.00                   | 36                    | 0.00                  | 30                    | 0.00                  | 9.86            | 45,804.38              | 31,808.60              |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30              | 0.002653             | 15.22                  | 36                    | 20.00                 | 30                    | 12.30                 | 37.77           | 7,510.36               | 5,804.38               |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27              | 0.004854             | 15.22                  | 30                    | 16.29                 | 18                    | 4.17                  | 28.66           | 7,510.36               | 5,804.38               |

DESIGN CONDITION: OPTION 6b  
 2005  
 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2005 Eq. Pop. = 25,333.66  
 2005 Sew. Ac. = 3,363.38  
 TOTAL ESTIM. CONST. COST = \$3,906,414.01  
 + Engr. ROW, Financ., Conting. (1.5x) = \$5,859,621.02  
 \$3,092,629.89  
 \$4,638,944.84

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FL WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FL WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FL WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on FL Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.: s = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup>(83) ]<sup>0.2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup>(83) x s<sup>0.2</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(83) x s<sup>0.2</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6b  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COFW Big Fossil line.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|-----------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                | 10.84                 | 18.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 23.81                  | 66                    | 28.81                 | 28.81                 | 60              | 22.34                 | 164.41          | \$8,532.98             | \$7,068.58              |
| TCWSC/0001+27         | TCWSC/0000+20           | 80            | 36               | 44.89                 | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 23.96                  | 66                    | 28.96                 | 28.96                 | 60              | 22.46                 | 67.35           | 34,211.92              | 28,274.31               |
| TCWSC/0003+33         | TCWSC/0001+00           | 327           | 36               | 13.97                 | 10.91                 | 17.30                 | 0.0031    | -0.0189   | 54                    | 0.000228                   | 24.54                  | 66                    | 29.54                 | 29.54                 | 60              | 22.91                 | 36.88           | 139,841.20             | 115,571.24              |
| TCWSC/0017+56         | TCWSC/0004+27           | 506           | 36               | 10.16                 | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 25.34                  | 66                    | 30.33                 | 30.33                 | 60              | 23.52                 | 33.68           | 216,390.36             | 178,835.01              |
| TCWSC/0019+45         | TCWSC/0009+33           | 823           | 36               | 10.25                 | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 26.22                  | 66                    | 31.18                 | 31.18                 | 60              | 24.18                 | 34.43           | 351,955.08             | 290,871.96              |
| TCWSC/0025+17         | TCWSC/0017+56           | 189           | 36               | 10.00                 | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 26.38                  | 66                    | 31.34                 | 31.34                 | 60              | 24.18                 | 34.43           | 80,825.65              | 54,106.43               |
| TCWSC/0030+53         | TCWSC/0019+45           | 572           | 36               | 10.20                 | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 27.19                  | 66                    | 31.73                 | 31.73                 | 60              | 24.18                 | 34.43           | 229,219.83             | 163,750.67              |
| TCWSC/0036+88         | TCWSC/0025+17           | 536           | 36               | 10.29                 | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 27.51                  | 66                    | 32.12                 | 32.12                 | 60              | 24.18                 | 34.43           | 224,780.76             | 153,444.68              |
| TCWSC/0044+92         | TCWSC/0036+88           | 636           | 36               | 10.13                 | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 27.82                  | 66                    | 32.74                 | 32.74                 | 60              | 24.18                 | 34.43           | 229,219.83             | 163,750.67              |
| TCWSC/0053+70         | TCWSC/0044+92           | 803           | 36               | 10.18                 | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 28.04                  | 66                    | 32.94                 | 32.94                 | 60              | 24.18                 | 34.43           | 229,219.83             | 163,750.67              |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                 | 11.05                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 28.09                  | 66                    | 33.05                 | 33.05                 | 60              | 24.18                 | 34.43           | 229,219.83             | 163,750.67              |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                  | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 28.09                  | 60                    | 35.05                 | 35.05                 | 48              | 19.33                 | 29.53           | 375,475.77             | 251,351.55              |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.04                 | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 28.10                  | 60                    | 35.08                 | 35.08                 | 48              | 19.33                 | 29.53           | 201,454.46             | 128,930.85              |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.22                 | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 28.14                  | 60                    | 35.14                 | 35.14                 | 48              | 19.33                 | 29.53           | 306,069.41             | 195,884.42              |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 36               | 12.53                 | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 28.15                  | 54                    | 37.96                 | 37.96                 | 42              | 19.38                 | 29.42           | 259,770.22             | 166,252.94              |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                 | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 28.15                  | 54                    | 37.96                 | 37.96                 | 48              | 19.40                 | 29.53           | 214,708.04             | 169,645.86              |
| TCWSC/A/0005+17       | TCWSC/A/0003+40         | 277           | 36               | 10.13                 | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 28.14                  | 54                    | 37.92                 | 37.92                 | 48              | 19.40                 | 29.53           | 97,334.31              | 76,906.12               |
| TCWSC/A/0007+96       | TCWSC/A/0005+17         | 179           | 30               | 8.88                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 28.14                  | 54                    | 37.92                 | 37.92                 | 42              | 19.40                 | 28.28           | 79,298.84              | 62,655.87               |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 734           | 30               | 10.86                 | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 28.12                  | 54                    | 37.92                 | 37.92                 | 42              | 19.40                 | 30.26           | 51,243.65              | 30,999.25               |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 220           | 27               | 21.09                 | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 28.11                  | 54                    | 37.92                 | 37.92                 | 42              | 19.40                 | 40.48           | 210,127.60             | 127,114.23              |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 221           | 27               | 6.66                  | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 28.06                  | 54                    | 37.92                 | 37.92                 | 42              | 19.40                 | 26.06           | 62,981.03              | 38,099.63               |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 10            | 27               | 8.08                  | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.42                  | 48                    | 0.56                  | 0.56                  | 30              | 0.16                  | 8.24            | 632,959.31             | 382,901.31              |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16               | -16.02                | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.42                  | 48                    | 0.56                  | 0.56                  | 30              | 0.16                  | -15.86          | 2,261.94               | 883.57                  |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16               | 0.00                  | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.42                  | 48                    | 0.56                  | 0.56                  | 30              | 0.16                  | 0.16            | 2,940.53               | 1,148.64                |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16               | 0.00                  | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.41                  | 48                    | 0.56                  | 0.56                  | 30              | 0.16                  | 0.16            | 1,357.17               | 530.14                  |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 25            | 16               | 11.50                 | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.37                  | 48                    | 0.49                  | 0.49                  | 30              | 0.14                  | 11.64           | 2,714.33               | 1,060.29                |
| TCWSC/B/0003+02       | TCWSC/B/0001+73.07      | 302           | 27               | 8.97                  | 11.37                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 28.06                  | 48                    | 27.73                 | 27.73                 | 30              | 7.92                  | 16.89           | 68,310.73              | 2,209.93                |
| TCWSC/B/0005+96       | TCWSC/B/0003+02         | 295           | 30               | 11.53                 | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 28.05                  | 48                    | 27.73                 | 27.73                 | 30              | 7.92                  | 19.45           | 66,727.37              | 26,683.88               |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                  | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.01                   | 36                    | 0.00                  | 0.00                  | 30              | 0.00                  | 9.86            | 19,085.16              | 26,065.38               |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                 | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 16.58                  | 36                    | 20.00                 | 20.00                 | 30              | 12.30                 | 37.77           | 45,804.38              | 13,253.58               |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                 | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 16.56                  | 30                    | 16.29                 | 16.29                 | 27              | 12.30                 | 36.79           | 7,510.36               | 31,808.60               |

DESIGN CONDITION: **OPTION 6b**  
 2010 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 2010 Sew. Ac. = 2,550.82 2,764.11  
 2010 Eq. Pop. = 26,714.86  
 2010 Sew. Ac. = 3,446.17  
 TOTAL ESTIM. CONST. COST = \$4,608,436.86 + Engr., ROW, Financ. Conting. (1.5x) = \$6,912,655.28 \$3,157,689.96 \$4,736,534.94

UPSTREAM MAIN/STATION LENGTH EXIST DIA. EXIST. PIPE CAP (MGD) 2000 MODEL FLOW (MGD) 2020 MODEL FLOW (MGD) COEF. "A" COEF. "B" MODEL PROP. DIA. (in) MODEL H.G. SLOPE (ft/foot) 2010 DESIGN FLOW (MGD) PROP. REPL. PIPE (in) PROP. PIPE CAP. (MGD) PARL. PIPE CAP. (MGD) BOTH CAP. (MGD) ESTIM. REPL. PIPE COST ESTIM. PARAL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING PIPE DIAMETER IN INCHES  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON F.I. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN F.I. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN F.I. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN F.I. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQN.: S = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup> ]<sup>2</sup>, n = 0.0145  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGD = [ D<sup>4.75</sup> / (1629.6 x n) ] / 1.54  
 PROPOSED PARALLEL PIPE IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [ D<sup>4.75</sup> x S<sup>0.154</sup> / (1629.6 x n) ] / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

**OPTION 6b**  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COFW Big Fossil line.



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. CAP. (MGD) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|------------------|-----------------------|-----------------|------------------------|-------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 25.73                  | 66                    | 28.81            | 22.34                 | 164.41          | \$8,552.98             | \$7,068.58              |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 25.91                  | 66                    | 28.96            | 22.46                 | 67.35           | 34,211.92              | 28,274.31               |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 26.59                  | 66                    | 29.54            | 22.91                 | 33.88           | 139,841.20             | 115,571.24              |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 27.53                  | 66                    | 30.33            | 23.52                 | 33.68           | 216,390.36             | 178,835.01              |
| TCWSC/0017+55         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 28.58                  | 66                    | 31.18            | 24.18                 | 34.43           | 351,955.08             | 290,871.96              |
| TCWSC/0025+17         | TCWSC/0017+55           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 28.77                  | 66                    | 31.34            | 24.30                 | 34.30           | 80,825.65              | 66,798.06               |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 29.24                  | 66                    | 31.73            | 24.61                 | 34.81           | 244,615.19             | 202,161.32              |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 29.73                  | 66                    | 32.12            | 24.91                 | 35.20           | 229,219.83             | 189,437.88              |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0230   | 54                    | 0.000280                   | 30.12                  | 66                    | 32.43            | 25.15                 | 35.28           | 271,984.73             | 224,780.76              |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.05                 | 19.42                 | 0.0042    | -0.0236   | 54                    | 0.000284                   | 30.49                  | 66                    | 32.74            | 25.39                 | 35.57           | 343,402.10             | 283,803.39              |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0041    | -0.0241   | 48                    | 0.000534                   | 30.78                  | 66                    | 35.05            | 26.46                 | 36.56           | 375,475.77             | 310,310.55              |
| TCWSC/0068+65         | TCWSC/0059+40           | 866           | 36               | 9.95                   | 11.07                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 30.81                  | 60                    | 35.08            | 26.46                 | 36.41           | 201,454.46             | 163,178.11              |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 30.85                  | 60                    | 35.14            | 26.49                 | 36.71           | 306,069.41             | 247,916.22              |
| TCWSC/A-B/0000+00     | TCWSC/A-B/0000+00       | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 30.72                  | 60                    | 35.17            | 26.53                 | 36.57           | 259,770.22             | 210,413.88              |
| TCWSC/A-B/0003+40     | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 30.85                  | 60                    | 35.17            | 27.73                 | 40.26           | 265,071.66             | 169,645.86              |
| TCWSC/A-B/0006+17     | TCWSC/A-B/0003+40       | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 30.83                  | 60                    | 35.17            | 29.52                 | 35.72           | 120,165.82             | 76,906.12               |
| TCWSC/A-B/0007+96     | TCWSC/A-B/0006+17       | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 30.80                  | 54                    | 37.92            | 19.40                 | 28.28           | 97,899.80              | 62,655.87               |
| TCWSC/A-B/0015+30     | TCWSC/A-B/0007+96       | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 30.83                  | 54                    | 37.92            | 19.40                 | 30.26           | 51,243.65              | 30,999.25               |
| TCWSC/A-B/0017+50     | TCWSC/A-B/0015+30       | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 30.78                  | 54                    | 37.92            | 19.40                 | 40.49           | 62,981.03              | 38,059.63               |
| TCWSC/A-B/0039+61     | TCWSC/A-B/0017+50       | 221           | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 30.69                  | 54                    | 37.92            | 19.40                 | 26.06           | 632,959.31             | 382,901.31              |
| TCWSC/B/0001+14.8     | TCWSC/A-B/0039+61       | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.56                  | 48                    | 0.56             | 0.16                  | 8.24            | 2,261.94               | 863.57                  |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.56                  | 48                    | 0.56             | 0.16                  | 15.86           | 2,940.53               | 1,148.64                |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.56                  | 48                    | 0.56             | 0.16                  | 0.16            | 1,357.17               | 530.14                  |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.54                  | 48                    | 0.56             | 0.16                  | 0.16            | 2,714.33               | 1,060.29                |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 25            | 16               | 11.50                  | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 30.69                  | 48                    | 0.49             | 11.64                 | 11.64           | 5,654.86               | 2,208.93                |
| TCWSC/B/0005+96       | TCWSC/B/0001+73.07      | 302           | 27               | 8.97                   | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 30.67                  | 48                    | 27.73            | 19.42                 | 28.39           | 68,310.73              | 52,300.40               |
| TCWSC/B/0008+15       | TCWSC/B/0005+96         | 295           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 42                    | 0.000000                   | 0.02                   | 36                    | 0.00             | 0.00                  | 9.86            | 66,727.37              | 51,088.14               |
| TCWSC/B/0011+93       | TCWSC/B/0008+15         | 150           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 17.48                  | 30                    | 20.00            | 12.30                 | 37.77           | 45,804.38              | 13,253.58               |
| TCWSC/B/0012+35       | TCWSC/B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 17.45                  | 30                    | 16.29            | 12.30                 | 36.79           | 7,510.36               | 31,808.60               |

DESIGN CONDITION: **OPTION 6b**  
 2015 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2015 Eq. Pop. = 27,521.61  
 2015 Sew. Ac. = 3,472.90  
 TOTAL ESTIM. CONST. COST = \$4,747,436.90  
 + Engr., ROW, Financ., Conting. (1.5x) = \$7,121,155.35 5,377,499.41

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 BOTH CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / \text{D}^4(8/3)]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^4(8/3) \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^4(8/3) \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6b  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COFW  
 Big Fossil line.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------------|-----------------------|-----------------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9857/0001+32           | 20            | 36              | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 27.65                  | 66                          | 28.81                 | 60                          | 22.34           | 164.41                 | \$7,068.58             |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36              | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 27.85                  | 66                          | 28.96                 | 60                          | 22.46           | 67.35                  | 34,211.92              |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36              | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0189   | 54                    | 0.000228                   | 28.63                  | 66                          | 29.54                 | 60                          | 22.91           | 36.88                  | 119,841.20             |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36              | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0165   | 54                    | 0.000241                   | 29.73                  | 66                          | 30.33                 | 60                          | 23.52           | 33.68                  | 216,390.36             |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36              | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 30.93                  | 66                          | 31.18                 | 60                          | 24.18           | 34.43                  | 351,955.08             |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36              | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 31.17                  | 66                          | 31.34                 | 60                          | 24.30           | 34.30                  | 80,825.65              |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36              | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 31.71                  | 66                          | 31.73                 | 60                          | 24.61           | 34.81                  | 244,615.19             |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36              | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 32.78                  | 66                          | 32.12                 | 60                          | 24.91           | 35.70                  | 229,219.83             |
| TCWSC/0036+88         | TCWSC/0030+53           | 636           | 36              | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 32.73                  | 66                          | 32.43                 | 60                          | 25.15           | 35.28                  | 271,984.73             |
| TCWSC/0044+92         | TCWSC/0036+88           | 803           | 36              | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 33.15                  | 66                          | 32.74                 | 60                          | 25.39           | 35.57                  | 343,402.10             |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36              | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 33.45                  | 66                          | 32.94                 | 60                          | 25.55           | 35.80                  | 375,475.77             |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36              | 10.20                  | 11.05                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 33.51                  | 60                          | 35.05                 | 54                          | 26.46           | 36.66                  | 201,454.46             |
| TCWSC/0068+65         | TCWSC/0059+40           | 866           | 36              | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 33.48                  | 60                          | 35.05                 | 54                          | 26.46           | 36.41                  | 306,069.41             |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36              | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 33.51                  | 60                          | 35.08                 | 54                          | 26.49           | 36.71                  | 259,770.22             |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 36              | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 33.56                  | 60                          | 35.14                 | 54                          | 26.53           | 36.57                  | 247,916.22             |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36              | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 33.35                  | 60                          | 50.27                 | 54                          | 37.96           | 50.49                  | 210,413.88             |
| TCWSC/A/0006+17       | TCWSC/A/0003+40         | 277           | 36              | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 33.54                  | 60                          | 35.17                 | 54                          | 26.56           | 36.78                  | 120,165.82             |
| TCWSC/A/0007+96       | TCWSC/A/0006+17         | 179           | 30              | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 33.51                  | 60                          | 35.17                 | 54                          | 26.56           | 36.69                  | 97,899.80              |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 734           | 30              | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 33.47                  | 54                          | 37.92                 | 48                          | 27.70           | 36.58                  | 51,243.65              |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 220           | 27              | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 33.45                  | 54                          | 37.92                 | 48                          | 27.70           | 36.56                  | 210,127.60             |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 2211          | 27              | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 33.33                  | 54                          | 37.92                 | 48                          | 27.70           | 34.36                  | 632,959.31             |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 10            | 27              | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.71                  | 48                          | 0.56                  | 48                          | 0.56            | 8.64                   | 2,261.94               |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16              | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.71                  | 48                          | 0.56                  | 48                          | 0.56            | 15.46                  | 2,940.53               |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16              | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.71                  | 48                          | 0.56                  | 48                          | 0.56            | 1,357.17               | 1,357.17               |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16              | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.68                  | 48                          | 0.56                  | 48                          | 0.56            | 2,714.33               | 2,714.33               |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 25            | 16              | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.63                  | 48                          | 0.49                  | 48                          | 11.99           | 5,654.86               | 5,654.86               |
| TCWSC/B/0003+02       | TCWSC/B/0001+73.07      | 302           | 27              | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 33.31                  | 48                          | 27.73                 | 48                          | 27.73           | 66,310.73              | 66,310.73              |
| TCWSC/B/0005+96       | TCWSC/B/0003+02         | 295           | 30              | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 33.28                  | 48                          | 27.73                 | 48                          | 27.73           | 39,226                 | 66,727.37              |
| TCWSC/B/0008+15       | TCWSC/B/0005+96         | 150           | 27              | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.03                   | 36                          | 0.00                  | 36                          | 0.00            | 9.86                   | 19,085.16              |
| TCWSC/B/0011+93       | TCWSC/B/0008+15         | 360           | 27              | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 18.38                  | 36                          | 20.00                 | 36                          | 20.00           | 45,804.38              | 45,804.38              |
| TCWSC/B/0012+35       | TCWSC/B/0011+93         | 85            | 27              | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 18.34                  | 30                          | 16.29                 | 30                          | 16.29           | 7,510.36               | 7,510.36               |

DESIGN CONDITION: OPTION 6b 2020 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2020 Eq. Pop. = 28,328.36 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2020 Sew. Ac. = 3,499.63

TOTAL ESTIM. CONST. COST = \$4,747,436.90 + Engr., ROW, Financ., Conting. (1.5%) = \$7,121,155.35 \$5,859,621.02

NOTES:  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2020 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6b  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COFW  
 Big Fossil line

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. CAP. (MGD) | REPL. PIPE (in) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|------------------|-----------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 26.09                  | 66                    | 28.81            | 60              | 22.34           | 164.41                | \$8,552.98      | \$7,068.58             |                         |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 26.33                  | 66                    | 28.96            | 60              | 22.46           | 67.35                 | 34,211.92       | 28,274.31              |                         |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 27.27                  | 66                    | 29.54            | 60              | 22.91           | 36.88                 | 139,841.20      | 115,571.24             |                         |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 28.61                  | 66                    | 30.33            | 60              | 23.52           | 33.68                 | 216,390.36      | 178,835.01             |                         |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 30.10                  | 66                    | 31.18            | 60              | 24.18           | 34.43                 | 351,955.08      | 290,871.96             |                         |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0038    | -0.0206   | 54                    | 0.000257                   | 30.35                  | 66                    | 31.73            | 60              | 24.30           | 34.30                 | 80,825.65       | 66,798.06              |                         |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 31.08                  | 66                    | 32.12            | 60              | 24.61           | 34.81                 | 244,615.19      | 202,161.32             |                         |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 31.77                  | 66                    | 32.43            | 60              | 25.15           | 35.20                 | 229,219.83      | 189,437.88             |                         |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 32.33                  | 66                    | 32.74            | 60              | 25.39           | 35.28                 | 271,984.73      | 224,780.76             |                         |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 32.85                  | 66                    | 32.94            | 60              | 25.55           | 35.57                 | 343,402.10      | 283,803.39             |                         |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 33.22                  | 66                    | 32.94            | 60              | 25.55           | 35.80                 | 375,475.77      | 310,310.55             |                         |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 33.27                  | 60                    | 35.05            | 54              | 26.46           | 36.66                 | 201,454.46      | 163,178.11             |                         |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 33.22                  | 60                    | 35.05            | 54              | 26.46           | 36.41                 | 20,852.30       | 16,890.37              |                         |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 33.24                  | 60                    | 35.08            | 54              | 26.49           | 36.71                 | 306,069.41      | 247,916.22             |                         |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 33.26                  | 60                    | 35.14            | 54              | 26.53           | 36.57                 | 259,770.22      | 210,413.88             |                         |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 32.84                  | 48                    | 50.27            | 54              | 27.70           | 38.56                 | 210,127.60      | 166,026.75             |                         |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 33.22                  | 60                    | 35.17            | 54              | 26.56           | 36.78                 | 120,165.82      | 97,334.31              |                         |
| TCWSC/A/0006+17       | TCWSC/A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 33.17                  | 60                    | 35.17            | 54              | 26.56           | 36.69                 | 97,899.80       | 79,298.84              |                         |
| TCWSC/A/0007+96       | TCWSC/A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 33.17                  | 54                    | 37.92            | 48              | 27.70           | 38.56                 | 51,243.65       | 40,488.81              |                         |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 33.10                  | 54                    | 37.92            | 48              | 27.70           | 38.56                 | 62,981.03       | 49,762.79              |                         |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 33.05                  | 54                    | 37.92            | 48              | 27.70           | 38.56                 | 62,981.03       | 49,762.79              |                         |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 32.83                  | 54                    | 37.92            | 48              | 27.70           | 38.56                 | 632,959.31      | 500,116.00             |                         |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56             | 42              | 0.39            | 8.47                  | 2,261.94        | 1,731.80               |                         |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56             | 42              | 0.39            | -15.63                | 2,940.53        | 2,251.54               |                         |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56             | 42              | 0.39            | 0.39                  | 1,357.17        | 1,039.08               |                         |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -1.02                  | 48                    | 0.56             | 42              | 0.39            | 0.39                  | 2,714.33        | 2,078.16               |                         |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.95                  | 48                    | 0.49             | 42              | 0.34            | 11.84                 | 5,654.86        | 4,329.50               |                         |
| TCWSC/B/0003+02       | TCWSC/B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 32.72                  | 48                    | 27.73            | 42              | 19.42           | 28.39                 | 68,310.73       | 52,300.40              |                         |
| TCWSC/B/0005+96       | TCWSC/B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 32.72                  | 48                    | 27.73            | 42              | 19.42           | 30.95                 | 66,727.37       | 51,088.14              |                         |
| TCWSC/B/0008+15       | TCWSC/B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.05                   | 36                    | 0.00             | 30              | 0.00            | 0.00                  | 9.86            | 19,085.16              | 13,253.58               |
| TCWSC/B/0011+93       | TCWSC/B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 15.73                  | 36                    | 20.00            | 30              | 12.30           | 37.77                 | 45,804.38       | 31,808.60              |                         |
| TCWSC/B/0012+35       | TCWSC/B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 15.66                  | 30                    | 16.29            | 24              | 8.98            | 33.47                 | 7,510.36        | 4,806.63               |                         |

DESIGN CONDITION: OPTION 6b  
 2050 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2050 Eq. Pop. = 32,547.85 TOTAL ESTIM. CONST. COST = \$4,747,436.90  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2050 Sew. Ac. = 3,549.06 + Engr., ROW, Financ., Conting. (1.5x) = \$7,121,155.35 \$5,773,101.63

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING PIPE DIAMETER IN INCHES  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQN.: S = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>5.49</sup> ]<sup>1/2</sup>, n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [ D<sup>5.49</sup> / (83) x S<sup>1/2</sup> ] / 1629.6 x n ] / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 6b  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COPW Big Fossil line.

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 TCWSC Option 6b.xls  
 Page 1 of 1

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 26.09                  | 66                    | 28.81            | 60                    | 22.34                 | 164.41          | \$8,552.98             | \$7,068.58             |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 26.33                  | 66                    | 28.96            | 60                    | 22.46                 | 67.35           | 34,211.92              | 28,274.31              |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 27.21                  | 66                    | 29.54            | 60                    | 22.92                 | 36.88           | 139,841.20             | 115,571.24             |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 28.67                  | 66                    | 30.33            | 60                    | 23.52                 | 33.68           | 216,390.36             | 178,835.01             |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 30.10                  | 66                    | 31.18            | 60                    | 24.18                 | 34.43           | 351,955.08             | 290,871.96             |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0038    | -0.0206   | 54                    | 0.000257                   | 30.38                  | 66                    | 31.34            | 60                    | 24.30                 | 34.30           | 66,798.06              | 56,798.06              |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 31.05                  | 66                    | 32.12            | 60                    | 24.91                 | 34.81           | 80,825.65              | 202,161.32             |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0230   | 54                    | 0.000270                   | 31.77                  | 66                    | 32.43            | 60                    | 25.15                 | 35.20           | 229,219.83             | 189,437.88             |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 32.33                  | 66                    | 32.74            | 60                    | 25.39                 | 35.57           | 271,984.73             | 224,780.76             |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 32.85                  | 66                    | 32.74            | 60                    | 25.55                 | 35.80           | 343,402.10             | 283,803.39             |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 33.22                  | 66                    | 32.94            | 60                    | 26.46                 | 36.66           | 375,475.77             | 310,310.55             |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 33.27                  | 60                    | 35.05            | 54                    | 26.55                 | 35.80           | 201,454.46             | 163,178.11             |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 33.22                  | 60                    | 35.05            | 54                    | 26.46                 | 36.41           | 20,852.30              | 16,890.37              |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 33.24                  | 60                    | 35.08            | 54                    | 26.49                 | 36.71           | 306,069.41             | 247,916.22             |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 33.28                  | 60                    | 35.14            | 54                    | 26.53                 | 36.57           | 306,069.41             | 247,916.22             |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 27            | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 32.84                  | 60                    | 50.27            | 54                    | 37.96                 | 50.49           | 265,071.66             | 214,708.04             |
| TCWSC-A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 33.22                  | 60                    | 35.17            | 54                    | 26.56                 | 36.78           | 120,165.82             | 97,334.31              |
| TCWSC-A/0006+17       | TCWSC-A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 33.17                  | 60                    | 35.17            | 54                    | 26.56                 | 36.69           | 97,989.80              | 79,298.84              |
| TCWSC-A/0007+96       | TCWSC-A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 33.17                  | 54                    | 37.92            | 48                    | 27.70                 | 38.58           | 51,243.65              | 40,468.81              |
| TCWSC-A/0015+30       | TCWSC-A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 33.10                  | 54                    | 37.92            | 48                    | 27.70                 | 38.58           | 210,127.60             | 166,026.75             |
| TCWSC-A/0017+50       | TCWSC-A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 33.05                  | 54                    | 37.92            | 48                    | 27.70                 | 38.58           | 62,981.03              | 49,762.79              |
| TCWSC-A/0039+61       | TCWSC-A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 32.83                  | 54                    | 37.92            | 48                    | 27.70                 | 34.36           | 632,959.31             | 500,116.00             |
| TCWSC-B/0001+14.8     | TCWSC-A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56             | 42                    | 0.39                  | 8.47            | 2,261.94               | 1,731.80               |
| TCWSC-B/0001+28.94    | TCWSC-B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56             | 42                    | 0.39                  | -15.63          | 2,940.53               | 2,251.34               |
| TCWSC-B/0001+34.94    | TCWSC-B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56             | 42                    | 0.39                  | 0.39            | 1,357.17               | 1,039.08               |
| TCWSC-B/0001+46.94    | TCWSC-B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.95                  | 48                    | 0.49             | 42                    | 0.34                  | 11.84           | 5,654.86               | 4,329.50               |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0020    | 30                    | 0.001089                   | 32.77                  | 48                    | 27.73            | 42                    | 19.42                 | 28.39           | 66,310.73              | 52,300.40              |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001089                   | 32.72                  | 48                    | 27.73            | 42                    | 19.42                 | 30.95           | 66,727.37              | 51,088.14              |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001089                   | 32.72                  | 48                    | 27.73            | 42                    | 19.42                 | 30.95           | 19,085.16              | 13,253.58              |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0001    | -0.0001   | 30                    | 0.000000                   | 0.05                   | 36                    | 0.00             | 30                    | 0.00                  | 0.00            | 45,804.38              | 31,808.60              |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 15.73                  | 36                    | 20.00            | 30                    | 12.30                 | 37.77           | 7,510.36               | 4,806.63               |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 15.66                  | 30                    | 16.29            | 24                    | 8.98                  | 33.47           | 7,510.36               | 4,806.63               |

DESIGN CONDITION: **OPTION 6b** 2070 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2070 Eq. Pop. = 32,547.85 TOTAL ESTIM. CONST. COST = \$4,747,436.90 \$3,848,734.42  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2070 Sew. Ac. = 3,549.06 + Engr., ROW, Financ., Conting. (1.5X) = \$7,121,155.35 \$5,773,101.63

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP  
 PROP. PIPE CAP  
 PARL. PIPE CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Gravity Flow Capacity in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design.  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in Inches  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n]^{1/2}$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n]^{1/2}$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 6b**  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COFW (Big Fossil line).

| PIPE DIA. | 1997 F.W.M.P. CONST. COST. (Per Ft.) | 2000 ESTIM. CONST. COST (Per Ft.) | ESTIM. CONST. COST (Per In.) | PIPE AREA (sq. in.) | ESTIM. CONST. COST (Per S.I.) |
|-----------|--------------------------------------|-----------------------------------|------------------------------|---------------------|-------------------------------|
| 4         | 32.31                                | 34.41                             | 8.60                         | 12.57               | 2.7383                        |
| 6         | 83.04                                | 88.44                             | 14.74                        | 28.27               | 3.1279                        |
| 8         | 87.32                                | 93.00                             | 11.62                        | 50.27               | 1.8501                        |
| 10        | 95.88                                | 102.11                            | 10.21                        | 78.54               | 1.3001                        |
| 12        | 99.03                                | 105.47                            | 8.79                         | 113.10              | 0.9325                        |
| 15        | 102.18                               | 108.82                            | 7.25                         | 176.71              | 0.6158                        |
| 18        | 105.33                               | 112.18                            | 6.23                         | 254.47              | 0.4408                        |
| 24        | 108.47                               | 115.52                            | 4.81                         | 452.39              | 0.2554                        |
| 30        | 122.64                               | 130.61                            | 4.35                         | 706.86              | 0.1848                        |
| 36        | 142.45                               | 151.71                            | 4.21                         | 1,017.87            | 0.1490                        |
| 42        | 195.22                               | 207.91                            | 4.95                         | 1,385.44            | 0.1501                        |
| 48        | 229.84                               | 244.78                            | 5.10                         | 1,809.55            | 0.1353                        |
| 54        | 276.31                               | 294.27                            | 5.45                         | 2,290.21            | 0.1285                        |
| 60        | 325.13                               | 346.26                            | 5.77                         | 2,827.42            | 0.1225                        |
| 66        | 366.75                               | 390.59                            | 5.92                         | 3,421.18            | 0.1142                        |
| 72        | 457.97                               | 487.74                            | 6.77                         | 4,071.49            | 0.1198                        |
| 78        | 506.32                               | 539.23                            | 6.91                         | 4,778.34            | 0.1128                        |
| 84        | 566.77                               | 603.61                            | 7.19                         | 5,541.75            | 0.1089                        |
| 90        | 662.43                               | 705.49                            | 7.84                         | 6,361.70            | 0.1109                        |
| 96        | 743.15                               | 791.45                            | 8.24                         | 7,238.20            | 0.1093                        |
| 108       | 990.71                               | 1,055.11                          | 9.77                         | 9,160.85            | 0.1152                        |
| 120       | 1,429.60                             | 1,522.52                          | 12.69                        | 11,309.69           | 0.1346                        |

Avg = 0.1239  
(Above 30")

**TAB 8**

**TEXAS WATER DEVELOPMENT BOARD**

**CONTRACT**

**ENGINEERING SERVICES AGREEMENT**

**AND**

**MISCELLANEOUS CORRESPONDENCE**

CITY OF  
NORTH RICHLAND HILLS

(copy)

Department: Public Works Department

Council Meeting Date: 6/14/99

Subject: Approve Regional Facility Planning Contract with the  
Texas Water Development Board for the Big Fossil Creek  
Wastewater System - Resolution No. 99-38

Agenda Number: \_\_\_\_\_

The Big Fossil Creek Wastewater Outfall System affects four separate entities. Richland Hills has a 36-inch wastewater outfall that was installed in the 1950's by the previous owner of Richland Hills and North Richland Hills water and sewer systems. North Richland Hills has a large amount of wastewater that flows down this outfall. The city of Fort Worth has a 48-inch wastewater outfall down this same creek bottom that carries flows from the city of Fort Worth customers as well as Haltom City's wastewater flows.

All four cities have received Administrative Orders (AO) from the United States Environmental Protection Agency (EPA) with this Big Fossil Creek Wastewater Outfall System being recognized as needing to be studied in detail to decide the best plan for increasing the capacity to meet ultimate needs. Only a portion of the Big Fossil Creek service area has been developed.

Previously, the planning grant application was submitted to the Texas Water Development Board (TWDB) by the city of Fort Worth, but was not approved. The TWDB staff gave indications that it would be better received if one of the other three cities (North Richland Hills, Richland Hills, or Haltom City) involved be the one submitting for the grant. North Richland Hills offered to be the lead city on this grant. When we resubmitted the application early this year, it was approved.

The TWDB has sent a revised contract for North Richland Hills to execute and return. Staff previously reviewed the contract and made comments. The main items covered by the contract are listed below.

1. Contract execution deadline is July 8, 1999.
2. Study completion date is August 31, 1999 with the final report deadline being October 31, 1999.
3. The study will identify three cost-effective alternatives for providing wastewater system capacity for the four cities.
4. Total study costs are \$59,950 with the TWDB paying \$29,975 of the total.
5. The City of North Richland Hills is responsible for \$29,975. This cost will be split evenly between Richland Hills, Fort Worth, Haltom City, and North Richland Hills.

Finance Review

Source of Funds:

Bonds (GO/Rev.) \_\_\_\_\_  
 Operating Budget \_\_\_\_\_  
 Other \_\_\_\_\_

Account Number \_\_\_\_\_

Sufficient Funds Available \_\_\_\_\_

*Jany Kerner*

Finance Director

*[Handwritten Signature]*  
Department Head Signature

\_\_\_\_\_  
City Manager Signature

**CITY OF  
NORTH RICHLAND HILLS**

The other three cities have obligated themselves for one-fourth of the study costs, up to \$7,500 each. North Richland Hills has sufficient money in the Unspecified Utility CIP Fund for paying it's share (approximately \$7,500).

Recommendation: To approve Resolution No. 99-38.



RESOLUTION NO. 99-38

BE IT RESOLVED by the City Council of the City of North Richland Hills, Texas,  
that:

1.

The City Manager be, and is hereby authorized to execute the attached Agreement with the Texas Water Development Board concerning the Regional Facility Planning Grant for a study on the Big Fossil Creek Wastewater Outfall System serving North Richland Hills, Richland Hills, Fort Worth, and Haltom City, as an act and deed of the City.

PASSED AND APPROVED this the 14<sup>th</sup> day June, 1999.

\_\_\_\_\_  
Charles Scoma, Mayor

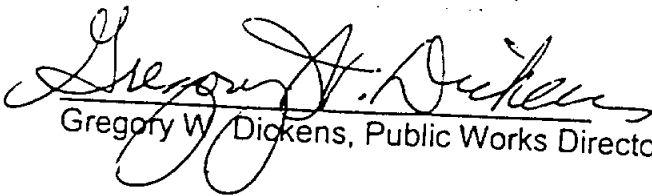
ATTEST:

\_\_\_\_\_  
Patricia Hutson, City Secretary

APPROVED AS TO LEGALITY:

\_\_\_\_\_  
Rex McEntire, Attorney for the City

APPROVED AS TO CONTENT:

  
\_\_\_\_\_  
Gregory W. Dickens, Public Works Director



# TEXAS WATER DEVELOPMENT BOARD

*W. J. Gile*

William B. Madden, *Chairman*  
Elaine M. Barrón, M.D., *Member*  
Charles L. Geren, *Member*

Craig D. Pedersen  
*Executive Administrator*

RECEIVED MAY 24 1999

Fernández, *Vice-Chairman*  
Jack Hunt, *Member*  
Wales H. Madden, Jr., *Member*

May 14, 1999

Mr. Larry J. Cunningham  
City Manager  
City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, Texas 76180

Re: Regional Facility Planning Contract Between the City of North Richland Hills (City) and the Texas Water Development Board (Board)

Dear Mr. Cunningham:

Enclosed are three copies of a regional facility planning contract between the Board and the City. The deadline for execution of this contract is July 8, 1999.

The Board's share of the \$59,950.00 facility plan is \$29,975.00 or 50 percent to be provided from the Research and Planning Fund. The local share of the plan will be provided by the City in the amount of \$29,975.00 in cash and \$0.00 in in-kind services.

Please sign and date all three copies of the contract by July 8, 1999, retain a copy for your files and return the remaining two executed copies, along with the City's federal or state vendor identification number, to the attention of the Board's Research and Planning Fund Grants Management Division.

A Payment Request Checklist and return address labels are enclosed for your information and use. If you have any questions concerning this contract, please contact Mr. Ralph Boeker, the Board's designated Contract Manager for this study, at (512) 936-0851.

Sincerely,

*Tommy Knowles*  
Tommy Knowles, Ph.D., P.E.  
Deputy Executive Administrator  
Office of Planning

Enclosures

Cc: Gregory W. Dickens, P.E. ✓  
Ralph Boeker, TWDB

*Our Mission*

*Provide leadership, technical services and financial assistance to support planning, conservation, and responsible development of water for Texas.*

P.O. Box 13231 • 1700 N. Congress Avenue • Austin, Texas 78711-3231  
Telephone (512) 463-7347 • Telefax (512) 475-2053 • 1-800-RELAY TX (for the hearing impaired)  
URL Address: <http://www.twdh.state.tx.us> • E-Mail Address: [info@twdh.state.tx.us](mailto:info@twdh.state.tx.us)

Printed on Recycled Paper

:STATE OF TEXAS

TWDB Contract No. 99-483-308

COUNTY OF TRAVIS

Research and Planning Fund

Regional Facility Planning

THIS Contract, (hereinafter "CONTRACT"), between the Texas Water Development Board (hereinafter "BOARD") and the City of North Richland Hills (hereinafter "CONTRACTOR (S)"), is composed of two parts: Section I. Specific Conditions and Exceptions to the Standard Agreement and Section II. Standard Agreement. The terms and conditions set forth in Section I will take precedence over terms and conditions in Section II.

**SECTION I. SPECIFIC CONDITIONS AND EXCEPTIONS  
TO STANDARD AGREEMENT**

**ARTICLE I. DEFINITIONS:** For the purposes of this Contract, the following terms or phrases shall have the meaning ascribed therewith:

- A. BOARD - The Texas Water Development Board, or its designated representative
- B. CONTRACTOR (S) - City of North Richland Hills
- C. EXECUTIVE ADMINISTRATOR - The Executive Administrator of the Board or his designated representative
- D. PARTICIPANT (S) - City of North Richland Hills, City of Fort Worth, City of Richland Hills, and City of Haltom City
- E. REQUIRED INTERLOCAL AGREEMENT (S) -Not applicable
- F. REGIONAL PLAN - Regional wastewater facility
- G. BOARD APPROVAL DATE - April 8, 1999
- H. PLANNING AREA - The planning area is the Fossil Creek Basin of the Trinity River. The project area is more specifically defined in Exhibit A (the original grant application).
- I. DEADLINE FOR CONTRACT EXECUTION - July 8, 1999
- J. CONTRACT INITIATION DATE - April 8, 1999
- K. STUDY COMPLETION DATE - August 31, 1999

## SECTION II. STANDARD AGREEMENT

### ARTICLE I. RECITALS

Whereas, the CONTRACTOR (S) applied to the BOARD, Austin, Texas for a planning grant to develop a REGIONAL FACILITY PLAN;

Whereas, the CONTRACTOR (S) and PARTICIPANT (S) will commit cash and/or in-kind services to pay for the local share of this planning project;

Whereas, the CONTRACTOR (S) is the entity who will act as administrator of the BOARD's planning grant and will be responsible for the execution of this contract;

Whereas, on the BOARD APPROVAL DATE, the BOARD approved the CONTRACTOR (S)'s application for financial assistance;

Now, therefore, the BOARD and the CONTRACTOR (S), agree as follows:

### ARTICLE II. PROJECT DESCRIPTION AND SERVICES TO BE PERFORMED

1. Services and activities provided under this Contract shall be in strict accordance with requirements of the Texas Water Code, Chapter 15; associated rules of the Texas Administrative Code, Chapter 355, Sections 355.1-355.11, Subchapter A; Exhibit A, the original grant application, which is incorporated herein and made a permanent part of this Contract; and this Contract.
2. The CONTRACTOR (S) will prepare a REGIONAL FACILITY PLAN for the PLANNING AREA, as delineated and described in Exhibit A, according to the Scope of Work contained in Exhibit B. The CONTRACTOR (S) will consider BOARD population and water use projections, and if not used in the REGIONAL FACILITY PLAN, provide an explanation of why not used. Where applicable, the CONTRACTOR (S) will develop water conservation plans according to Texas Administrative Code, Chapters 363.15, 363.71, 375.37, and 375.101.
3. The CONTRACTOR (S) will establish formal, direct, and continuous liaisons with all cities, counties, councils of governments, river authorities, regional water planning groups designated under Texas Water Code §16.053 and 31 Texas Administrative Code §357.4, and all applicable state agencies, federal agencies, and other governmental entities in the PLANNING AREA, and all entities providing water and/or wastewater service in the PLANNING AREA for the purpose of coordinating the scope of work and REGIONAL FACILITY PLAN with all existing studies, plans, or activities for the purpose of providing information and obtaining available data for the development of the REGIONAL FACILITY PLAN.

ready original, and nine (9) bound double-sided copies of the final report to the EXECUTIVE ADMINISTRATOR no later than the FINAL REPORT DEADLINE. The CONTRACTOR (S) will submit one (1) electronic copy of any computer programs, maps, or models and an operations manual developed under the terms of this Contract.

5. The CONTRACTOR (S) will submit progress reports with submittal of vouchers according to the VOUCHER SUBMISSION SCHEDULE. Progress reports shall be in written form and shall include a brief statement of the overall progress made since the last status report; a brief description of any problems that have been encountered during the previous reporting period that will affect the study, delay the timely completion of any portion of this Contract, inhibit the completion of or cause a change in any of the study's products or objectives; and a description of any action the CONTRACTOR (S) plans to take to correct any problems that have been encountered.
6. The EXECUTIVE ADMINISTRATOR can extend the COMPLETION DATE and the FINAL REPORT DEADLINE upon written approval. The CONTRACTOR (S) should submit a written request to the EXECUTIVE ADMINISTRATOR at least thirty (30) working days prior to the COMPLETION DATE or thirty (30) days prior to the FINAL REPORT DEADLINE for an extension to the respective dates and explanation of why the deadlines have not been met.

#### ARTICLE IV. COMPENSATION AND REIMBURSEMENT

1. The BOARD agrees to compensate and reimburse the CONTRACTOR (S) in a total amount not to exceed the BOARD'S SHARE OF THE TOTAL STUDY COSTS for costs incurred and paid by the CONTRACTOR (S) pursuant to performance of this Contract. The CONTRACTOR (S) will contribute local matching funds in sources and amounts defined as the LOCAL SHARE OF THE TOTAL STUDY COSTS. The BOARD shall reimburse the CONTRACTOR (S) for ninety percent (90%) of the BOARD's share of each invoice pending the CONTRACTOR (S)'s performance, completion of a Final Report, and written acceptance of said Final Report by the EXECUTIVE ADMINISTRATOR, at which time the BOARD shall pay the retained ten percent (10%) to the CONTRACTOR (S).
2. The CONTRACTOR (S) shall submit vouchers and documentation for reimbursement billing according to the VOUCHER SUBMISSION SCHEDULE and in accordance with the approved task and expense budgets contained in Exhibit C to this Contract. At the discretion of the EXECUTIVE ADMINISTRATOR and upon written memorandum to the contract file, the CONTRACTOR (S) has budget flexibility within task and expense budget categories to the extent that the resulting change in amount in any one task or

- C. For travel and subsistence expenses, including such expenses for subcontractors --
- (1) names, dates, work locations, time periods at work locations, itemization of subsistence expenses of each employee, limited, however, to travel expenses authorized for state employees by the General Appropriations Act, Tex. Law Regular Session, 1997, Art. IX, Sec. 13 through 21, at IX-54 or as amended or superseded;
  - (2) other transportation costs -- copies of invoices covering tickets for transportation or, if not available, names, dates, and points of travel of individuals; and
  - (3) all other reimbursable expenses -- invoices or purchase vouchers showing reason for expense with receipts to evidence the amount incurred.

#### ARTICLE V. OWNERSHIP, PUBLICATION, AND SUBCONTRACTING

1. The BOARD shall have unlimited rights to technical or other data resulting directly from the performance of services under this Contract. It is agreed that all reports, drafts of reports, or other material, data, drawings, computer programs and codes associated with this Contract and developed by the CONTRACTOR(S) or its subcontractors pursuant to this Contract shall become the joint property of the CONTRACTOR(S) and the BOARD. These materials shall not be copyrighted or patented by the CONTRACTOR (S) or by any consultants involved in this Contract unless the EXECUTIVE ADMINISTRATOR approves in writing the right to establish copyright or patent; provided, however, that copyrighting or patenting by the CONTRACTOR (S) or its subcontractors will in no way limit the BOARD's access to or right to request and receive or distribute data and information obtained or developed pursuant to this Contract. Any material subject to a BOARD copyright and produced by the CONTRACTOR (S) or BOARD pursuant to this Contract may be printed by the CONTRACTOR (S) or the BOARD at their own cost and distributed by either at their discretion. The CONTRACTOR (S) may otherwise utilize such material provided under this Contract as it deems necessary and appropriate, including the right to publish and distribute the materials or any parts thereof under its own name, provided that any BOARD copyright is appropriately noted on the printed materials.
2. The CONTRACTOR (S) agrees to acknowledge the BOARD in any news releases or other publications relating to the work performed under this Contract.
3. No work herein called for by the CONTRACTOR (S) shall be reimbursed for expenses by the BOARD to the CONTRACTOR (S) without prior written approval

**ARTICLE VIII.**

**LICENSES, PERMIT, AND INSURANCE**

1. For the purpose of this Contract, the CONTRACTOR (S) will be considered an independent contractor and therefore solely responsible for liability resulting from negligent acts or omissions. The CONTRACTOR (S) shall obtain all necessary insurance, in the judgement of the CONTRACTOR (S), to protect themselves, the BOARD, and employees and officials of the BOARD from liability arising out of this Contract. The CONTRACTOR (S) shall indemnify and hold the BOARD and the State of Texas harmless, to the extent the CONTRACTOR (S) may do so in accordance with state law, from any and all loses, damages, liability, or claims therefore, on account of personal injury, death, or property damage of any nature whatsoever caused by the CONTRACTOR (S), arising out of the activities under this Contract.
2. The CONTRACTOR (S) shall be solely and entirely responsible for procuring all appropriate licenses and permits, which may be required by any competent authority for the CONTRACTOR (S) to perform the subject, work.

**ARTICLE IX. SEVERANCE PROVISION**

1. Should any one or more provisions of this Contract be held to be null, void, voidable, or for any reason whatsoever, of no force and effect, such provision(s) shall be construed as severable from the remainder of this Contract and shall not affect the validity of all other provisions of this Contract which shall remain of full force and effect.

**ARTICLE X. CORRESPONDENCE**

All correspondence between the parties shall be made to the following addresses:

For the **BOARD**:

Mr. Craig D. Pedersen  
Executive Administrator  
Texas Water Development Board  
P.O. Box 13231, Capitol Station  
Austin, Texas 78711-3231

For the **CONTRACTOR(S)**:

Mr. Gregory W. Dickens, P.E.  
Public Works Director  
City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, Texas 76180

Attention: Research and Planning Fund  
Grants Management Division

EXHIBIT A

ORIGINAL GRANT APPLICATION



EXHIBIT B

SCOPE OF WORK

Discussion of the year 2000 baseline calibration table, "7-0":

**Upstream and Downstream Stations** -- these stations correspond to the same station numbers used in the Fort Worth Master Plan report and are shown on the attached Appendix "D" table on pages 192, and 193, for the line segment between the Fort Worth West Fork 96" S.S. and Broadway Blvd. The Richland Hills meter is located below Station M402A/0040+28, which is delineated with a horizontal line.

**Length (ft.)** -- The length of each line segment is shown, and corresponds to the Master Plan length. It is assumed that the proposed parallel line will be roughly equivalent in length to the existing line.

**Existing Diameter (in)** -- The existing pipe diameter is noted. The siphon section has been changed to show the revised pipe diameter of 50.71-inches which is equivalent to the existing parallel 24-inch and 48-inch diameter siphon pipes. The Fort Worth Master Plan table only shows the 24-inch pipe.

**Existing Pipe Capacity (MGD)** -- This is the computed capacity of the existing pipe based on the Colbrook-White equations. Capacities of the proposed replacement and parallel pipes are based on the Mannings Equation, and compare favorably with the results of the Colbrook-White equation when using existing pipe flowline grades for the hydraulic slope and a Mannings "n" factor of 0.0145.

**2000 Model Flow (MGD)** -- This column shows the flow rates presented in the Fort Worth Master Plan for the year 2000. These flows include a uniform 10 MGD rate for the Intel Plant Site. The 10 MGD is subtracted from each flow value before computing the calibration coefficients "A" and "B", which are based only on equivalent population and sewered areas. The equivalent population of 57,207.5 and sewered area of 9,004.81 are shown at the bottom of this column.

**2020 Model Flow (MGD)** -- These flow rates correspond to the projected flows in the year 2020 from the Fort Worth Master Plan. The equivalent population of 93,287.50 and sewered area of 20,981.33 are shown at the bottom of this column. The flow rates vary from a minimum of 18.71 MGD to a maximum flow of **42.22 MGD**. The value of **42.22 MGD** was the basis for the calibration equation.

**2000 Coefficient "A"** -- This is the first coefficient in the calibration equation and is computed for each line segment based on the year 2000 Master Plan modeled flow using the formula presented in Table "CALIB-1".

**2000 Coefficient "B"** -- This is the second coefficient in the calibration equation and is computed for each line segment based on the year 2000 Master Plan modeled flow using the formula presented in Table "CALIB-1".

**Model Proposed Diameter (In.)** -- This is the proposed replacement pipe diameter for the year 2020 condition as presented in the Fort Worth Master Plan Appendix "D" table.

**Design Hydraulic Gradient Slope (Ft./Foot)** -- This is the average flowline grade of the existing pipe between major line segments. It is assumed that the proposed replacement and parallel pipes will follow the approximate grade of the existing line. This grade is based on pipe flowline elevations and line segment lengths presented in the Fort Worth Master Plan Appendix "D" table.

**2000 Design Flow (MGD)** -- The year 2000 design flow values are computed using the calibration equations discussed above, and are equivalent to the existing year 2000 flows listed in the column "2000 Model Flow". The value used for equivalent population of 57,207.50 and sewered area of 9,004.81 acres is the same as the model 2000 flow values, and the results of the flow rate calculations confirms that the calibration equations are correct. The flow rates vary from a minimum of 18.71 MGD to a maximum flow of **42.22 MGD**, which agree with the year 2000 model flows.

**Proposed Replacement Pipe Diameter (In.)** -- The proposed replacement pipe diameters shown are set equal to the existing pipe diameters for purposes of comparing the existing pipe capacities shown in the Master Plan versus the computed capacities calculated using the Mannings Equation and existing pipe flowline slopes.

**Replacement Pipe Capacity (MGD)** -- This column shows the computed replacement pipe capacity using the existing pipe flowline grade and a Mannings Equation "n" factor of 0.0145. Note that these capacities compare favorably with the existing pipe capacities shown in the Master Plan using the Colbrook-White equations, except for the very downstream end and the siphon section. Average grades through these two line segments are used for calculations in this column.

**Proposed Parallel Pipe Diameter (In.)** -- No proposed parallel pipe is recommended for the existing year 2000 conditions since the existing pipe has sufficient capacity to handle existing flow rates based on the Fort Worth year 2000 model flows shown.

**Parallel Pipe Capacity (MGD)** -- This column shows the computed parallel pipe capacity using the existing pipe flowline grade and a Mannings Equation "n" factor of 0.0145. See the year 2020 table for capacity calculations for the 2020 design conditions.

**Combined Capacity of Both Pipes (MGD)** -- This is the sum of the existing pipe capacity, from the Master Plan, plus the proposed replacement pipe capacity. This value should generally exceed the Design Flow rate, which it does for most line segments within the study limits.

**Estimated Replacement Pipe Costs** -- This is the estimated pipe replacement costs in current year 2000 dollars based on an average estimated unit price of \$0.125 per square inch of pipe diameter.

**Estimated Parallel Pipe Costs** -- This is the estimated pipe replacement costs in current year 2000 dollars based on an average estimated unit price of \$0.125 per square inch of pipe diameter.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA (in) | DESIGN H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PROF. PIPE (in) | P.A.R.L. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|-----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------|--------------------------|-----------------|------------------------|-------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0013        | 0.0094         | 90                   | 0.000800                    | 18.94                  | 54                    | 32.38                 | 0               | 0.00            | 0.00                     | 222.11          | \$29,200.29            | \$0.00                  |
| M402A0020+17          | M402A0000+50            | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0014        | 0.0099         | 90                   | 0.000800                    | 18.71                  | 54                    | 32.38                 | 0               | 0.00            | 0.00                     | 34.03           | 494,114.77             | 0.00                    |
| M402A0020+17          | M402A0020+17            | 73            | 50.71           | -70.57                 | 18.71                 | 86.61                 | -0.0014        | 0.0099         | 90                   | 0.000800                    | 18.71                  | 50.71                 | 27.38                 | 0               | 0.00            | 0.00                     | -70.57          | 18,429.33              | 0.00                    |
| M402A0022+40 (24+48)  | M402A0000+50            | 150           | 50.71           | 0.00                   | 18.71                 | 86.61                 | -0.0014        | 0.0099         | 90                   | 0.000800                    | 18.71                  | 50.71                 | 27.38                 | 0               | 0.00            | 0.00                     | 0.00            | 37,668.49              | 0.00                    |
| M402A0022+40 (24+48)  | M402A0022+40            | 69            | 50.71           | 74.31                  | 18.71                 | 86.64                 | -0.0014        | 0.0099         | 90                   | 0.000800                    | 18.71                  | 50.71                 | 27.38                 | 0               | 0.00            | 0.00                     | 74.31           | 17,419.51              | 0.00                    |
| M402A0023+09 (24+48)  | M402A0023+09            | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0014        | 0.0100         | 90                   | 0.000800                    | 18.78                  | 54                    | 32.38                 | 0               | 10.00           | 0.00                     | 25.04           | 249,061.33             | 0.00                    |
| M402A0032+40          | M402A0028+40            | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0014        | 0.0101         | 90                   | 0.000800                    | 18.81                  | 54                    | 32.38                 | 0               | 0.00            | 0.00                     | 35.67           | 114,224.68             | 0.00                    |
| M402A0036+79          | M402A0032+40            | 433           | 54              | 32.38                  | 18.87                 | 87.84                 | -0.0014        | 0.0101         | 90                   | 0.000800                    | 18.87                  | 54                    | 33.01                 | 0               | 0.00            | 0.00                     | 32.38           | 123,958.11             | 0.00                    |
| M402A0040+28          | M402A0036+79            | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0014        | 0.0101         | 84                   | 0.000665                    | 18.92                  | 54                    | 29.52                 | 0               | 0.00            | 0.00                     | 29.03           | 103,346.14             | 0.00                    |
| M402A0045+95          | M402A0040+28            | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0014        | 0.0101         | 84                   | 0.000694                    | 18.97                  | 54                    | 34.24                 | 0               | 0.00            | 0.00                     | 33.82           | 160,029.06             | 0.00                    |
| M402A0049+00          | M402A0045+95            | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0014        | 0.0101         | 84                   | 0.000651                    | 18.99                  | 54                    | 29.22                 | 0               | 0.00            | 0.00                     | 28.71           | 87,867.16              | 0.00                    |
| M402A0051+91          | M402A0049+00            | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0014        | 0.0101         | 84                   | 0.000794                    | 18.99                  | 54                    | 32.25                 | 0               | 0.00            | 0.00                     | 31.72           | 72,141.90              | 0.00                    |
| M402A0054+21          | M402A0051+91            | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0014        | 0.0101         | 84                   | 0.000980                    | 19.06                  | 54                    | 35.85                 | 0               | 0.00            | 0.00                     | 35.19           | 73,000.73              | 0.00                    |
| M402A0060+68          | M102A0054+21            | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0007        | 0.0068         | 84                   | 0.000698                    | 31.63                  | 54                    | 30.24                 | 0               | 0.00            | 0.00                     | 29.72           | 184,648.92             | 0.00                    |
| M402A0061+67          | M402A0060+68            | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0007        | 0.0069         | 84                   | 0.000824                    | 31.61                  | 54                    | 32.54                 | 0               | 0.00            | 0.00                     | 31.88           | 28,341.46              | 0.00                    |
| M402A0065+95          | M402A0061+67            | 691           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0007        | 0.0069         | 84                   | 0.000781                    | 31.54                  | 54                    | 32.85                 | 0               | 0.00            | 0.00                     | 32.39           | 146,001.47             | 0.00                    |
| M402A0072+77          | M402A0065+95            | 808           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0007        | 0.0069         | 84                   | 0.000817                    | 31.50                  | 54                    | 32.72                 | 0               | 0.00            | 0.00                     | 31.52           | 197,817.68             | 0.00                    |
| M402A0080+78          | M402A0072+77            | 400           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0007        | 0.0070         | 84                   | 0.000817                    | 31.45                  | 54                    | 32.72                 | 0               | 0.00            | 0.00                     | 32.23           | 231,312.13             | 0.00                    |
| M402A0085+50          | M402A0080+78            | 151           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0007        | 0.0070         | 84                   | 0.000800                    | 31.43                  | 54                    | 32.38                 | 0               | 0.00            | 0.00                     | 35.67           | 114,510.96             | 0.00                    |
| M402A0086+56          | M402A0085+50            | 168           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0007        | 0.0070         | 84                   | 0.000800                    | 31.43                  | 54                    | 24.98                 | 0               | 0.00            | 0.00                     | 29.26           | 43,227.89              | 0.00                    |
| M402A0088+51          | M402A0086+56            | 188           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0007        | 0.0070         | 84                   | 0.000476                    | 31.45                  | 54                    | 24.98                 | 0               | 0.00            | 0.00                     | 24.42           | 48,094.60              | 0.00                    |
| M402A0096+65          | M402A0088+51            | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0007        | 0.0070         | 84                   | 0.000793                    | 31.56                  | 54                    | 32.23                 | 0               | 0.00            | 0.00                     | 31.72           | 234,747.46             | 0.00                    |
| M402A0103+76          | M402A0096+65            | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0007        | 0.0070         | 84                   | 0.000380                    | 31.63                  | 54                    | 22.31                 | 0               | 0.00            | 0.00                     | 21.89           | 203,543.22             | 0.00                    |
| M402A0105+11          | M402A0103+76            | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0007        | 0.0070         | 84                   | 0.001360                    | 31.66                  | 54                    | 42.22                 | 0               | 0.00            | 0.00                     | 53.47           | 38,647.45              | 0.00                    |
| M402A0109+91          | M402A0105+11            | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0007        | 0.0070         | 84                   | 0.001360                    | 31.70                  | 54                    | 42.22                 | 0               | 0.00            | 0.00                     | 25.08           | 31,025.85              | 0.00                    |
| M402A0113+81          | M402A0109+91            | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0007        | 0.0070         | 84                   | 0.001217                    | 31.77                  | 54                    | 39.94                 | 0               | 0.00            | 0.00                     | 39.39           | 98,765.70              | 0.00                    |
| M402A0117+43          | M402A0113+81            | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | -0.0001        | 0.0044         | 84                   | 0.001309                    | 42.22                  | 54                    | 41.43                 | 0               | 0.00            | 0.00                     | 40.78           | 198,962.79             | 0.00                    |
| M402A0120+25          | M402A0117+43            | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | -0.0001        | 0.0044         | 84                   | 0.001349                    | 42.22                  | 54                    | 37.47                 | 0               | 0.00            | 0.00                     | 41.74           | 36,070.95              | 0.00                    |
| M402B0123+40          | M402A0120+25            | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0001        | 0.0044         | 84                   | 0.001071                    | 42.20                  | 54                    | 43.02                 | 0               | 0.00            | 0.00                     | 36.97           | 88,173.44              | 0.00                    |
| M402B0136+74          | M402B0123+40            | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0005        | 0.0055         | 66                   | 0.002647                    | 33.78                  | 48                    | 43.02                 | 0               | 0.00            | 0.00                     | 31.40           | 262,385.60             | 0.00                    |

DESIGN CONDITION: OPTION NO. 0  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50  
 F.W. Model Sew. Ac. = 9,004.81  
 Constant Intel Flow = 10.00  
 2000 Eq. Pop. = 57,207.50  
 2000 Sew. Ac. = 9,004.81  
 Constant Intel Flow = 10.00  
 TOTAL ESTIM. CONST. COST = \$3,966,959.05  
 + Engr., ROW, Financ., Conting. (1.5x) = \$5,950,438.57  
 Avg. Estimated Per Foot Cost = \$420.97

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 DESIGN H.G. SLOPE  
 DESIGN FLOW  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGD =  $[D^4(8/3) \times s^{1/2} / 1629.6 \times n] / 1.54$   
 PROPOSED PARALLEL PIPE CAPACITY IN MGD =  $[D^4(8/3) \times s^{1/2} / 1629.6 \times n] / 1.54$   
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) X \$0.125/SQ. IN. X LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) X \$0.125/SQ. IN. X LENGTH (FT.)

OPTION 0  
 Exist. 2000 Conditions Big Fossil C.O.F.W. Line  
 Serving Fort Worth, Haltom City (not including Little Fossil), and estimated 10.0 MGD flow from the Intel Facility Plant. Future BFX area and Marine Creek areas not included in this scenario.  
 This is baseline 2000 Condition from the Fort Worth Sanitary Sewer Master Plan.  
 Est. Cost Above R.H. Meter = \$2,779,336.40  
 Est. Cost Below R.H. Meter = \$1,187,622.65  
 Percent R.H. Cost of Total Line = 29.94%  
 Est. Richland Hills Cost Share = \$1,781,433.98

**Discussion of the year 2020 baseline calibration table, "7-0a":**

**Upstream and Downstream Stations** -- these stations correspond to the same station numbers used in the Fort Worth Master Plan report and are shown on the attached Appendix "D" table on pages 192, and 193, for the line segment between the Fort Worth West Fork 96" S.S. and Broadway Blvd. The Richland Hills meter is located below Station M402A/0040+28, which is delineated with a horizontal line.

**Length (ft.)** -- The length of each line segment is shown, and corresponds to the Master Plan length. It is assumed that the proposed parallel line will be roughly equivalent in length to the existing line.

**Existing Diameter (in)** -- The existing pipe diameter is noted. The siphon section has been changed to show the revised pipe diameter of 50.71-inches which is equivalent to the existing parallel 24-inch and 48-inch diameter siphon pipes. The Fort Worth Master Plan table only shows the 24-inch pipe.

**Existing Pipe Capacity (MGD)** -- This is the computed capacity of the existing pipe based on the Colbrook-White equations. Capacities of the proposed replacement and parallel pipes are based on the Mannings Equation, and compare favorably with the results of the Colbrook-White equation when using existing pipe flowline grades for the hydraulic slope and a Mannings "n" factor of 0.0145.

**2000 Model Flow (MGD)** -- This column shows the flow rates presented in the Fort Worth Master Plan for the year 2000. These flows include a uniform 10 MGD rate for the Intel Plant Site. The 10 MGD is subtracted from each flow value before computing the calibration coefficients "A" and "B", which are based only on equivalent population and sewered areas. The equivalent population of 57,207.5 and sewered area of 9,004.81 are shown at the bottom of this column.

**2020 Model Flow (MGD)** -- These flow rates correspond to the projected flows in the year 2020 from the Fort Worth Master Plan. The equivalent population of 93,287.50 and sewered area of 20,981.33 are shown at the bottom of this column. The flow rates vary from a minimum of 18.71 MGD to a maximum flow of **42.22 MGD**. The value of **42.22 MGD** was the basis for the calibration equation.

**2020 Coefficient "A"** -- This is the first coefficient in the calibration equation and is computed for each line segment based on the year 2020 Master Plan modeled flow using the formula presented in Table "CALIB-1".

**2020 Coefficient "B"** -- This is the second coefficient in the calibration equation and is computed for each line segment based on the year 2020 Master Plan modeled flow using the formula presented in Table "CALIB-1".

**Model Proposed Diameter (In.)** -- This is the proposed replacement pipe diameter for the year 2020 condition as presented in the Fort Worth Master Plan Appendix "D" table.

**Design Hydraulic Gradient Slope (Ft./Foot)** -- This is the average flowline grade of the existing pipe between major line segments. It is assumed that the proposed replacement and parallel pipes will follow the approximate grade of the existing line. This grade is based on pipe flowline elevations and line segment lengths presented in the Fort Worth Master Plan Appendix "D" table.

**2020 Design Flow (MGD)** -- The year 2020 design flow values are computed using the calibration equations discussed above, and are equivalent to the year 2020 flows listed in the column "2020 Maxflow (MGD)". The value used for equivalent population of 93,287.50 and sewered area of 20,981.33 acres is the same as the model 2020 flow values, and the results of the flow rate calculations confirms that the calibration equations are correct. The flow rates vary from a minimum of 83.61 MGD to a maximum flow of **90.17 MGD**, which agree with the year 2020 model flows.

**Proposed Replacement Pipe Diameter (In.)** -- The proposed replacement pipe diameters shown are set equal to the proposed Master Plan pipe diameters for purposes of comparing the design pipe capacities shown in the Master Plan versus the computed capacities calculated using the Mannings Equation and existing pipe flowline slopes.

**Replacement Pipe Capacity (MGD)** -- This column shows the computed replacement pipe capacity using the existing pipe flowline grade and a Mannings Equation "n" factor of 0.0145. Note that these capacities compare favorably with the design pipe capacities shown in the Master Plan using the Colbrook-White equations, except for the very downstream end and the siphon section. Average grades through these two line segments are used for calculations in this column.

**Proposed Parallel Pipe Diameter (In.)** -- The proposed parallel pipe diameters recommended for the year 2020 design conditions are the same as those shown in the Master Plan for purposes of comparison.

**Parallel Pipe Capacity (MGD)** -- This column shows the computed parallel pipe capacity using the existing pipe flowline grade and a Mannings Equation "n" factor of 0.0145. These values compare favorably with the values shown in the Fort Worth Master plan Appendix "D" table.

**Combined Capacity of Both Pipes (MGD)** -- This is the sum of the existing pipe capacity, from the Master Plan, plus the proposed replacement pipe capacity. This value should generally exceed the Design Flow rate, which it does for most line segments within the study limits.

**Estimated Replacement Pipe Costs** -- This is the estimated pipe replacement costs in current year 2000 dollars based on an average estimated unit price of \$0.125 per square inch of pipe diameter.

**Estimated Parallel Pipe Costs** -- This is the estimated pipe replacement costs in current year 2000 dollars based on an average estimated unit price of \$0.125 per square inch of pipe diameter.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | DESIGN H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. PIPE (in) | REPL. PIPE (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|-----------------------------|------------------------|-----------------|------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0013        | 0.0094         | 90                    | 0.000800                    | 83.62                  | 90              | 126.44           | 78              | 86.33                 | 308.44          | \$81,111.93            | \$60,924.07            |
| M402A0020+17          | M402A0000+50            | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0014        | 0.0099         | 90                    | 0.000800                    | 86.59                  | 90              | 126.44           | 78              | 86.33                 | 120.36          | 1,372,541.04           | 1,030,930.82           |
| M402A0020+90 (24+48)  | M402A0020+17            | 73            | 50.71            | -70.57                 | 18.71                 | 86.61                 | -0.0014        | 0.0099         | 90                    | 0.000800                    | 86.61                  | 90              | 126.44           | 90              | 126.44                | 55.87           | 58,050.69              | 58,050.69              |
| M402A0022+40 (24+48)  | M402A0020+90            | 150           | 50.71            | 0.00                   | 18.71                 | 86.61                 | -0.0014        | 0.0099         | 90                    | 0.000800                    | 86.61                  | 90              | 126.44           | 90              | 126.44                | 126.44          | 119,282.25             | 119,282.25             |
| M402A0023+09 (24+48)  | M402A0022+40            | 69            | 50.71            | 74.31                  | 18.71                 | 86.64                 | -0.0014        | 0.0099         | 90                    | 0.000800                    | 86.64                  | 90              | 126.44           | 90              | 126.44                | 200.75          | 54,869.83              | 54,869.83              |
| M402A0028+40          | M402A0023+09            | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0014        | 0.0100         | 90                    | 0.000800                    | 87.43                  | 90              | 126.44           | 78              | 86.33                 | 111.37          | 691,837.02             | 519,646.47             |
| M402A0032+40          | M402A0028+40            | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0014        | 0.0101         | 90                    | 0.000800                    | 87.66                  | 90              | 126.44           | 78              | 86.33                 | 122.00          | 317,290.77             | 238,320.62             |
| M402A0036+79          | M402A0032+40            | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0014        | 0.0101         | 84                    | 0.000831                    | 87.84                  | 84              | 107.24           | 66              | 55.37                 | 88.76           | 299,948.02             | 185,171.99             |
| M402A0040+28          | M402A0036+79            | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0014        | 0.0101         | 84                    | 0.000655                    | 87.96                  | 84              | 95.89            | 66              | 50.41                 | 79.44           | 250,072.13             | 154,381.27             |
| M402A0045+95          | M402A0040+28            | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0014        | 0.0101         | 84                    | 0.000894                    | 88.07                  | 84              | 111.23           | 66              | 58.47                 | 92.29           | 387,230.81             | 239,055.76             |
| M402A0049+00          | M402A0045+95            | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0014        | 0.0101         | 84                    | 0.000651                    | 88.14                  | 84              | 94.93            | 66              | 49.90                 | 78.61           | 212,665.22             | 131,286.22             |
| M402A0051+91          | M402A0049+00            | 252           | 54               | 31.72                  | 18.98                 | 88.19                 | -0.0014        | 0.0101         | 84                    | 0.000794                    | 88.19                  | 84              | 104.77           | 66              | 55.08                 | 86.80           | 174,565.59             | 107,767.53             |
| M402A0054+21          | M402A0051+91            | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0014        | 0.0101         | 84                    | 0.000980                    | 88.23                  | 84              | 116.45           | 66              | 61.21                 | 96.40           | 176,643.75             | 108,050.48             |
| M402A0060+68          | M402A0054+21            | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0007        | 0.0068         | 84                    | 0.000698                    | 88.35                  | 84              | 98.24            | 66              | 51.64                 | 81.36           | 446,804.78             | 275,633.57             |
| M402A0061+67          | M402A0060+68            | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0007        | 0.0068         | 84                    | 0.000824                    | 88.37                  | 84              | 105.72           | 66              | 55.57                 | 87.45           | 68,579.34              | 42,337.24              |
| M402A0065+95          | M402A0061+67            | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0007        | 0.0069         | 84                    | 0.000824                    | 88.46                  | 84              | 106.73           | 66              | 56.10                 | 88.49           | 353,287.50             | 218,100.96             |
| M402A0072+77          | M402A0065+95            | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0007        | 0.0069         | 84                    | 0.000781                    | 88.60                  | 84              | 103.97           | 66              | 54.65                 | 86.17           | 478,669.93             | 295,505.42             |
| M402A0080+78          | M402A0072+77            | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0007        | 0.0070         | 84                    | 0.000817                    | 88.80                  | 84              | 106.29           | 66              | 55.30                 | 88.10           | 559,718.24             | 345,540.34             |
| M402A0085+50          | M402A0080+78            | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0007        | 0.0070         | 84                    | 0.000800                    | 88.89                  | 84              | 105.19           | 66              | 55.30                 | 90.97           | 277,088.24             | 171,059.58             |
| M402A0086+56          | M402A0085+50            | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0007        | 0.0070         | 84                    | 0.000800                    | 88.94                  | 84              | 105.19           | 66              | 55.30                 | 84.56           | 104,600.81             | 64,574.99              |
| M402A0088+51          | M402A0086+56            | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0007        | 0.0070         | 84                    | 0.000476                    | 88.99                  | 84              | 81.16            | 66              | 42.66                 | 67.08           | 116,377.06             | 71,845.02              |
| M402A0096+65          | M402A0088+51            | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0007        | 0.0070         | 84                    | 0.000793                    | 89.19                  | 84              | 104.71           | 66              | 55.04                 | 86.76           | 568,030.89             | 350,672.13             |
| M402A0103+76          | M402A0096+65            | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0007        | 0.0070         | 84                    | 0.000380                    | 89.37                  | 84              | 72.48            | 66              | 38.10                 | 59.99           | 492,524.34             | 304,058.40             |
| M402A0105+11          | M402A0103+76            | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0007        | 0.0070         | 84                    | 0.001360                    | 89.42                  | 84              | 137.15           | 66              | 72.10                 | 125.57          | 93,517.28              | 57,732.61              |
| M402A0109+91          | M402A0105+11            | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0007        | 0.0070         | 84                    | 0.001360                    | 89.67                  | 84              | 137.15           | 66              | 72.10                 | 97.18           | 559,025.52             | 345,112.69             |
| M402A0113+81          | M402A0109+91            | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0007        | 0.0070         | 84                    | 0.001217                    | 89.76                  | 84              | 129.76           | 66              | 68.21                 | 107.60          | 238,988.61             | 147,538.88             |
| M402A0117+43          | M402A0113+81            | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0001        | 0.0044         | 84                    | 0.001309                    | 90.01                  | 84              | 134.58           | 66              | 70.74                 | 111.52          | 481,440.81             | 297,216.01             |
| M402A0120+25          | M402A0117+43            | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0001        | 0.0044         | 84                    | 0.001349                    | 90.06                  | 84              | 136.61           | 66              | 71.81                 | 113.55          | 87,282.79              | 53,883.77              |
| M402B0123+40          | M402A0120+25            | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0001        | 0.0044         | 84                    | 0.001071                    | 90.17                  | 84              | 121.74           | 66              | 63.99                 | 100.96          | 213,357.94             | 131,715.87             |
| M402B0136+74          | M402B0123+40            | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0005        | 0.0055         | 66                    | 0.002647                    | 83.60                  | 66              | 100.57           | 48              | 43.02                 | 74.42           | 496,072.77             | 262,385.60             |

DESIGN CONDITION: OPTION NO. 0a  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50 2020 Eq. Pop. = 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33 2020 Sew. Ac. = 20,981.33  
 Constant Intel Flow = 10.00 Constant Intel Flow = 10.00  
 Avg. Estimated Per Foot Cost = \$1,043.31

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 DESIGN H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

14135  
 Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Design Hydraulic Gradient Slope = Approximate Flowline Slope of Existing Pipe (Average through siphon area used)  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $(D^5/83) \times s^{1/2} / 1629.6 \times n / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $(D^5/83) \times s^{1/2} / 1629.6 \times n / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (ft)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (ft)

OPTION 0a  
 Projected 2020 Conditions. Big Fossil C O F W Line  
 Serving Fort Worth, Haltom City (not including Little Fossil), BFX Area, Marine Creek, and with BFX Area, and estimated constant 10.0 MGD flow from the Inlet Facility Plant.  
 This is baseline 2020 Condition from the Fort Worth Sanitary Sewer Master Plan.  
 Estim. Cost Above R.H. Meter = \$6,586,472.24 \$4,022,275.07  
 Estim. Cost Below R.H. Meter = \$3,245,003.68 \$2,421,578.02  
 Percent R.H. Cost of Total Line = 33.01% 37.58%  
 Estim. Richland Hills Cost Share = \$4,867,505.52 \$3,632,367.03







FW 10 1.  
BROADWAY  
# 8, 103, 460 \$ 5, 543, 782

| Project | Model Link | Main/UpStation | Main/DownStation | Existing | 2000 | 2020 | Parallel | Length | 2000 Cost | 2020 Cost   | Parallel Cost | Subbasin       | Group | Note |
|---------|------------|----------------|------------------|----------|------|------|----------|--------|-----------|-------------|---------------|----------------|-------|------|
| bf_cm_1 | BF000390.1 | M402A/0000+50  | M280A/0304+97    | 54       | 72   | 90   | 78       | 102    | \$46,713  | \$67,568    | \$51,645      | CDUAL          |       |      |
| bf_cm_1 | BF000400.1 | M402A/0020+17  | M402A/0000+50    | 54       | 72   | 90   | 78       | 1726   | \$790,456 | \$1,143,354 | \$873,908     | CDUAL          |       |      |
| bf_cm_1 | BF000404.1 | M402A/0020+90  | M468/0020+17     | 24       | 72   | 90   | 90       | 73     | \$33,432  | \$48,357    | \$48,357      | CDUAL          |       |      |
| bf_cm_1 | BF000406.1 | M402A/0022+40  | M402A/0020+90    | 24       | 72   | 90   | 90       | 150    | \$68,696  | \$99,365    | \$99,365      | CDUAL          |       |      |
| bf_cm_1 | BF000410.1 | M402A/0023+09  | M402A/0020+17    | 24       | 72   | 90   | 90       | 69     | \$31,600  | \$45,708    | \$45,708      | CDUAL          |       |      |
| bf_cm_1 | BF000430.1 | M402A/0028+40  | M402A/0023+09    | 54       | 72   | 90   | 78       | 870    | \$398,434 | \$576,314   | \$440,498     | CDUAL          |       |      |
| bf_cm_1 | BF000440.1 | M402A/0032+40  | M402A/0028+40    | 54       | 72   | 90   | 78       | 399    | \$182,730 | \$264,310   | \$202,022     | CDUAL          |       |      |
| bf_cm_1 | BF000450.1 | M402A/0036+79  | M402A/0036+79    | 54       | 72   | 84   | 66       | 433    | \$198,301 | \$245,411   | \$158,803     | CDUAL          |       |      |
| bf_cm_1 | BF000460.1 | M402A/0040+28  | M402A/0036+79    | 54       | 72   | 84   | 66       | 361    | \$165,327 | \$204,604   | \$132,397     | CDUAL          |       |      |
| bf_cm_1 | BF000470.1 | M402A/0045+95  | M402A/0040+28    | 54       | 72   | 84   | 66       | 559    | \$256,005 | \$316,824   | \$205,073     | CDUAL          |       |      |
| bf_cm_1 | BF000480.1 | M402A/0049+00  | M402A/0045+95    | 54       | 72   | 84   | 66       | 307    | \$140,597 | \$173,998   | \$112,592     | CDUAL          |       |      |
| bf_cm_1 | BF000490.1 | M402A/0051+91  | M402A/0049+00    | 54       | 72   | 84   | 66       | 252    | \$115,408 | \$142,826   | \$92,421      | CDUAL          |       |      |
| bf_cm_1 | BF000500.1 | M402A/0060+68  | M402A/0051+91    | 54       | 72   | 84   | 66       | 255    | \$116,782 | \$144,528   | \$93,521      | CDUAL          |       |      |
| bf_cm_1 | BF000510.1 | M402A/0061+67  | M402A/0060+68    | 54       | 72   | 84   | 66       | 645    | \$295,391 | \$365,567   | \$236,554     | CDUAL          |       |      |
| bf_cm_1 | BF000520.1 | M402A/0065+95  | M402A/0061+67    | 54       | 72   | 84   | 66       | 99     | \$45,339  | \$56,110    | \$36,308      | CDUAL          |       |      |
| bf_cm_1 | BF000530.1 | M402A/0072+77  | M402A/0065+95    | 54       | 72   | 84   | 66       | 510    | \$233,565 | \$289,053   | \$187,043     | CDUAL          |       |      |
| bf_cm_1 | BF000540.1 | M402A/0080+78  | M402A/0072+77    | 54       | 72   | 84   | 66       | 691    | \$316,457 | \$391,638   | \$253,424     | CDUAL          |       |      |
| bf_cm_1 | BF000550.1 | M402A/0085+50  | M402A/0080+78    | 54       | 72   | 84   | 66       | 808    | \$370,040 | \$457,950   | \$296,334     | CDUAL          |       |      |
| bf_cm_1 | BF000560.1 | M402A/0086+56  | M402A/0085+50    | 54       | 72   | 84   | 66       | 400    | \$183,188 | \$226,708   | \$146,700     | CDUAL          |       |      |
| bf_cm_1 | BF000570.1 | M402A/0088+51  | M402A/0086+56    | 54       | 72   | 84   | 66       | 151    | \$69,153  | \$86,582    | \$55,379      | CDUAL          |       |      |
| bf_cm_1 | BF000580.1 | M402A/0103+76  | M402A/0088+51    | 54       | 72   | 84   | 66       | 168    | \$76,939  | \$95,217    | \$61,614      | CDUAL          |       |      |
| bf_cm_1 | BF000590.1 | M402A/0105+11  | M402A/0103+76    | 54       | 72   | 84   | 66       | 820    | \$375,335 | \$464,751   | \$300,735     | CDUAL          |       |      |
| bf_cm_1 | BF000600.1 | M402A/0109+91  | M402A/0105+11    | 54       | 72   | 84   | 66       | 711    | \$325,617 | \$402,973   | \$260,759     | CDUAL          |       |      |
| bf_cm_1 | BF000610.1 | M402A/0113+81  | M402A/0109+91    | 54       | 72   | 84   | 66       | 135    | \$61,826  | \$76,514    | \$49,511      | CDUAL          |       |      |
| bf_cm_1 | BF000620.1 | M402A/0117+43  | M402A/0113+81    | 54       | 72   | 84   | 66       | 807    | \$369,582 | \$467,383   | \$295,967     | CDUAL          |       |      |
| bf_cm_1 | BF000630.1 | M402A/0120+25  | M402A/0117+43    | 54       | 72   | 84   | 66       | 345    | \$158,000 | \$195,636   | \$126,529     | CDUAL          |       |      |
| bf_cm_1 | BF000640.1 | M402B/0123+40  | M402A/0120+25    | 54       | 66   | 84   | 66       | 595    | \$254,891 | \$393,905   | \$254,891     | CDUAL          |       |      |
| bf_cm_1 | BF000650.1 | M402B/0136+74  | M402B/0123+40    | 54       | 66   | 84   | 66       | 126    | \$46,211  | \$71,413    | \$46,211      | CDUAL          |       |      |
| bf_cm_1 | BF000660.1 | M402B/0138+97  | M402B/0136+74    | 48       | 60   | 66   | 48       | 308    | \$112,959 | \$174,565   | \$112,959     | CDUAL          |       |      |
| bf_cm_1 | BF000670.1 | M402B/0145+84  | M402B/0138+97    | 48       | 60   | 66   | 48       | 1180   | \$377,151 | \$425,430   | \$266,614     | CDUAL          |       |      |
| bf_cm_1 | BF000680.1 | M402B/0151+18  | M402B/0145+84    | 48       | 60   | 66   | 48       | 214    | \$69,578  | \$78,485    | \$49,186      | CDUAL          |       |      |
| bf_cm_1 | BF000690.1 | M402B/0157+28  | M402B/0151+18    | 48       | 60   | 66   | 48       | 630    | \$204,832 | \$231,053   | \$144,799     | CDUAL          |       |      |
| bf_cm_1 | BF000700.1 | M402B/0162+84  | M402B/0157+28    | 48       | 60   | 66   | 48       | 1469   | \$477,616 | \$538,756   | \$337,635     | CDUAL          |       |      |
| bf_cm_1 | BF000710.1 | M402B/0167+42  | M402B/0162+84    | 48       | 60   | 66   | 48       | 725    | \$235,719 | \$265,894   | \$166,634     | CDUAL          |       |      |
| bf_cm_1 | BF000720.1 | M402B/0191+73  | M402B/0167+42    | 48       | 60   | 66   | 48       | 553    | \$179,797 | \$202,813   | \$127,102     | CDUAL          |       |      |
| bf_cm_1 | BF000730.1 | M402B/0193+88  | M402B/0191+73    | 48       | 60   | 66   | 48       | 2364   | \$768,607 | \$866,997   | \$543,342     | Hallom City -A |       |      |
| bf_cm_1 | BF000740.1 | M402B/0197+14  | M402B/0193+88    | 48       | 60   | 66   | 48       | 436    | \$141,757 | \$159,903   | \$100,210     | Hallom City -A |       |      |
| bf_cm_1 | BF000750.1 | M402B/0199+39  | M402B/0197+14    | 48       | 60   | 66   | 48       | 215    | \$69,903  | \$78,851    | \$49,415      | Hallom City -A |       |      |
| bf_cm_1 | BF000760.1 | M402B/0201+77  | M402B/0199+39    | 48       | 60   | 66   | 48       | 312    | \$101,441 | \$114,426   | \$71,710      | Hallom City -A |       |      |
| bf_cm_1 | BF000770.1 | M402B/0211+90  | M402B/0201+77    | 48       | 60   | 66   | 48       | 91     | \$29,567  | \$33,374    | \$20,915      | Hallom City -A |       |      |
| bf_cm_1 | BF000780.1 | M402B/0223+26  | M402B/0211+90    | 48       | 60   | 66   | 48       | 197    | \$64,051  | \$72,250    | \$45,278      | Hallom City -A |       |      |
| bf_cm_1 | BF000790.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 191    | \$62,100  | \$70,049    | \$43,899      | Hallom City -A |       |      |
| bf_cm_1 | BF000800.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 1018   | \$330,982 | \$373,352   | \$233,977     | Hallom City -A |       |      |
| bf_cm_1 | BF000810.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 877    | \$285,139 | \$321,640   | \$201,570     | Hallom City -A |       |      |
| bf_cm_1 | BF000820.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 242    | \$78,681  | \$88,754    | \$55,621      | Hallom City -A |       |      |
| bf_cm_1 | BF000830.1 | M402B/0223+26  | M402B/0223+26    | 48       | 60   | 66   | 48       | 417    | \$135,579 | \$152,935   | \$95,943      | Hallom City -A |       |      |

Parallel pipes were calculated based on equivalent area for 2020 pipe sizes. Minimum velocity and grade were not reviewed. Replacement or parallel pipe decisions and final pipe sizes must be determined during design.

| OPTION NO. | OPTION DESCRIPTION   | YEAR 2000 |           | YEAR 2005  |           | YEAR 2010  |           | YEAR 2015  |           | YEAR 2020  |           | YEAR 2050  |           | YEAR 2070  |           |
|------------|--|-----------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|
|            |  | EQ. POP.  | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  | EQ. POP.   | SEW. AC.  |
| 1          | All Cities Served By C.O.F.W. Big Fossil Outfall, including NRH, Haltom City, Richland Hills, Marine Creek Area, Year 2020 BFX Area, and 6.0 MGD Intel Flow, Plus Haltom City Little Fossil Area Extra | 93,900.75 | 17,885.92 | 100,339.88 | 19,366.02 | 106,779.00 | 20,554.00 | 116,778.00 | 23,826.69 | 126,777.00 | 25,540.00 | 161,728.99 | 29,865.17 | 180,801.77 | 32,329.98 |
| 2          | Same as Option 1 above, but less Marine Creek Area   | 90,518.25 | 15,473.77 | 96,946.88  | 16,882.20 | 103,375.50 | 17,998.52 | 112,980.75 | 20,730.07 | 122,586.00 | 21,884.42 | 156,708.49 | 24,835.40 | 175,228.27 | 26,431.99 |
| 3          | Same As Option 2, but also less Intel Facility Flow  | 90,518.25 | 15,473.77 | 96,946.88  | 16,882.20 | 103,375.50 | 17,998.52 | 112,980.75 | 20,730.07 | 122,586.00 | 21,884.42 | 156,708.49 | 24,835.40 | 175,228.27 | 26,431.99 |
| 4          | Same As Option 1, but less Haltom City Little Fossil Area  | 80,931.25 | 16,091.36 | 87,431.63  | 17,571.46 | 93,932.00  | 18,759.44 | 103,938.50 | 22,032.13 | 113,945.00 | 23,745.44 | 149,156.99 | 28,070.61 | 168,403.10 | 30,535.42 |
| 5          | All Cities Served by C.O.F.W. Big Fossil Outfall except Richland Hills Which will be served by the TCWSC Line. (includes L.F.)   |           |           |            |           |            |           |            |           |            |           |            |           |            |           |
| 5a         | Big Fossil Data (H.C. + NRH + F.W.)  | 85,990.79 | 16,728.36 | 91,937.31  | 18,136.37 | 97,883.84  | 19,299.64 | 107,643.23 | 22,572.33 | 117,402.63 | 24,285.65 | 150,439.81 | 28,610.82 | 169,512.59 | 31,075.63 |
| 5b         | TCWSC Data (Richland Hills Only)   | 7,909.96  | 1,157.56  | 8,402.56   | 1,229.65  | 8,895.16   | 1,254.35  | 9,134.77   | 1,254.35  | 9,374.37   | 1,254.35  | 11,289.18  | 1,254.35  | 11,289.18  | 1,254.35  |
| 6          | Only Fort Worth and Haltom City served by the Big Fossil Line, with Richland Hills and NRH served by the TCWSC Line  |           |           |            |           |            |           |            |           |            |           |            |           |            |           |
| 6a         | Big Fossil Data (H.C. + F.W.)  | 69,948.30 | 14,709.75 | 75,006.22  | 16,002.64 | 80,064.14  | 17,107.83 | 89,256.39  | 20,353.79 | 98,448.64  | 22,040.38 | 129,181.14 | 26,316.11 | 148,253.92 | 28,780.92 |
| 6b         | TCWSC Data (R.Hills + NRH)   | 23,952.45 | 3,176.17  | 25,333.66  | 3,363.38  | 26,714.86  | 3,446.17  | 27,521.61  | 3,472.90  | 28,328.36  | 3,499.63  | 32,547.85  | 3,549.06  | 32,547.85  | 3,549.06  |

**OPTION NUMBERING REVISIONS:**

**OPTION 1 = OPTION 1a**

**OPTION 2 = OPTION 1b**

**OPTION 3 = OPTION 1c**

**OPTION 4 = OPTION 1d**

**OPTION 5a = OPTION 2a**

**OPTION 5b = OPTION 2b**

**OPTION 6a = OPTION 3a**

**OPTION 6b = OPTION 3b**

***OPTION 1***

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0030+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 63.09                  | 84              | 69.57                 | 78              | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 64.37                  | 84              | 72.04                 | 78              | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 64.38                  | 84              | 72.06                 | 78              | 59.13                 | -11.44          | 50,568.60              | 43,602.52               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 64.39                  | 84              | 72.06                 | 78              | 59.13                 | 59.13           | 103,908.09             | 89,594.22               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.63                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 64.39                  | 84              | 72.08                 | 78              | 59.15                 | 133.46          | 47,797.72              | 41,213.34               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 64.84                  | 84              | 72.74                 | 78              | 159.69                | 84.73           | 519,646.47             | 412,133.34              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 64.98                  | 84              | 72.93                 | 78              | 159.69                | 95.52           | 276,395.52             | 238,320.62              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 65.12                  | 78              | 72.09                 | 66              | 46.17                 | 78.56           | 258,628.65             | 185,171.99              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 65.22                  | 78              | 72.19                 | 66              | 46.24                 | 75.27           | 215,823.42             | 154,381.27              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.92                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000551                   | 65.31                  | 78              | 72.28                 | 66              | 46.29                 | 80.11           | 333,887.79             | 239,055.76              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 65.36                  | 78              | 72.33                 | 66              | 46.33                 | 75.04           | 183,369.50             | 131,288.22              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 65.39                  | 78              | 72.38                 | 66              | 46.36                 | 78.08           | 150,518.29             | 107,767.53              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 65.47                  | 78              | 72.41                 | 66              | 46.38                 | 81.57           | 152,310.17             | 109,050.48              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 76.05                  | 84              | 88.35                 | 78              | 72.51                 | 102.23          | 446,804.78             | 385,255.15              |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 76.04                  | 84              | 88.37                 | 78              | 72.52                 | 104.40          | 68,579.34              | 59,132.19               |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 76.03                  | 84              | 88.46                 | 78              | 72.60                 | 104.99          | 353,287.50             | 304,620.35              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 76.07                  | 84              | 88.60                 | 78              | 72.71                 | 104.23          | 478,669.93             | 412,730.71              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 76.12                  | 84              | 88.80                 | 78              | 72.88                 | 105.11          | 559,718.24             | 482,614.20              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 76.15                  | 84              | 88.89                 | 78              | 72.95                 | 108.62          | 277,088.24             | 238,917.92              |
| M402A/0088+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 76.17                  | 84              | 88.94                 | 78              | 72.99                 | 102.25          | 104,600.81             | 90,191.51               |
| M402A/0088+51         | M402A/0088+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 76.22                  | 84              | 88.99                 | 78              | 73.03                 | 97.45           | 116,377.06             | 100,345.53              |
| M402A/0098+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 76.41                  | 84              | 89.19                 | 78              | 73.20                 | 104.92          | 568,030.89             | 489,781.73              |
| M402A/0103+76         | M402A/0098+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 76.55                  | 84              | 89.37                 | 78              | 73.34                 | 95.23           | 492,524.34             | 424,676.60              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 76.60                  | 84              | 89.42                 | 78              | 73.39                 | 126.86          | 93,517.28              | 80,634.80               |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 76.76                  | 84              | 89.67                 | 78              | 73.59                 | 98.67           | 559,025.52             | 482,016.90              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 76.86                  | 84              | 90.11                 | 78              | 73.66                 | 113.05          | 238,988.61             | 206,066.71              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 85.74                  | 84              | 90.11                 | 78              | 73.87                 | 114.65          | 481,440.81             | 415,119.89              |
| M402A/0120+25         | M402A/0117+43           | 128           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 85.76                  | 84              | 90.06                 | 78              | 73.91                 | 115.65          | 87,282.79              | 75,259.14               |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 85.80                  | 84              | 90.17                 | 78              | 74.00                 | 110.97          | 213,357.94             | 183,966.80              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 75.51                  | 66              | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50              |

DESIGN CONDITION: OPTION NO. 1  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 93,900.75  
 2000 Sew. Ac. = 17,885.92  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,277,334.79 \$7,792,254.93  
 + Engr., ROW, Financ., Conting. (1.5x) = \$13,916,002.18 \$11,688,382.40  
 Avg. Estimated Per Foot Cost = \$984.51 \$826.91

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq. n = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup> ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>5</sup>(8/3) x s<sup>1.49</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>5</sup>(8/3) x s<sup>1.49</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, Manne Creek Area, year 2020  
 BF X Area, and Constant 6.0 MGD Inlet Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line.  
 Estim. Cost Above R.H. Meter = \$6,455,452.62 \$5,428,469.60  
 Estim. Cost Below R.H. Meter = \$2,821,882.17 \$2,363,785.33  
 Percent R.H. Cost of Total Line = 30.42% 30.34%  
 Estim. Richland Hills Cost Share = \$4,232,823.25 \$3,545,678.00

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. P/F/L (%) | PARL. PIPE CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 69.13                  | 86                    | 74.07                 | 78              | 57.09                 | \$74,062.20            | \$60,924.07            |
| M402A/0020+10         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 70.63                  | 86                    | 76.70                 | 78              | 59.12                 | 1,253,248.58           | 1,030,930.82           |
| M402A/0020+17         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 70.64                  | 86                    | 76.72                 | 78              | 59.13                 | 53,005.30              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 70.64                  | 86                    | 76.72                 | 78              | 59.13                 | 108,915.00             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 70.65                  | 86                    | 76.75                 | 78              | 59.15                 | 50,100.90              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 71.16                  | 86                    | 77.45                 | 78              | 59.69                 | 631,706.99             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 71.32                  | 86                    | 77.65                 | 78              | 59.85                 | 289,713.90             | 238,320.62             |
| M402A/0036+79         | M402A/0032+40           | 433           | 307              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 71.47                  | 86                    | 93.53                 | 78              | 72.09                 | 314,401.30             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 71.58                  | 86                    | 93.66                 | 78              | 72.19                 | 262,122.10             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 71.74                  | 86                    | 93.85                 | 78              | 72.28                 | 405,889.89             | 333,887.79             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 71.85                  | 86                    | 93.90                 | 78              | 72.38                 | 182,971.20             | 150,518.29             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 71.77                  | 86                    | 93.85                 | 78              | 72.33                 | 222,912.70             | 183,369.50             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 71.85                  | 86                    | 94.07                 | 78              | 72.41                 | 185,155.50             | 152,310.17             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 82.34                  | 86                    | 94.09                 | 78              | 72.51                 | 468,334.49             | 385,255.15             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 82.33                  | 86                    | 94.09                 | 78              | 72.52                 | 370,310.99             | 304,620.35             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000565                   | 82.33                  | 86                    | 94.09                 | 78              | 72.52                 | 501,735.09             | 412,730.71             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000570                   | 82.44                  | 86                    | 94.19                 | 78              | 72.59                 | 586,688.79             | 482,614.20             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 82.50                  | 86                    | 94.75                 | 78              | 72.95                 | 290,440.00             | 238,917.92             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 82.48                  | 86                    | 94.65                 | 78              | 72.98                 | 109,641.10             | 90,191.51              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 82.55                  | 86                    | 94.75                 | 78              | 73.03                 | 121,984.80             | 100,345.53             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 82.75                  | 86                    | 94.97                 | 78              | 73.20                 | 595,401.99             | 489,781.73             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 82.55                  | 86                    | 94.75                 | 78              | 73.03                 | 516,257.09             | 424,676.60             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 82.75                  | 86                    | 95.16                 | 78              | 73.34                 | 98,023.50              | 80,634.80              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 82.97                  | 86                    | 95.21                 | 78              | 73.39                 | 585,962.69             | 482,016.90             |
| M402A/0109+81         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 83.14                  | 86                    | 95.48                 | 78              | 73.59                 | 250,504.50             | 208,066.71             |
| M402A/0113+81         | M402A/0109+81           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000586                   | 83.25                  | 86                    | 95.57                 | 78              | 73.66                 | 504,639.49             | 415,119.89             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 92.06                  | 86                    | 95.84                 | 78              | 73.87                 | 91,488.60              | 75,259.14              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 92.08                  | 86                    | 95.89                 | 78              | 74.00                 | 223,638.80             | 183,966.80             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.001829                   | 92.13                  | 86                    | 96.01                 | 78              | 74.00                 | 496,072.77             | 409,977.50             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 54               | 31.40                  | 33.78                 | 93.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 81.42                  | 66                    | 83.60                 | 78              | 64.84                 | \$9,917,220.12         | \$8,159,877.51         |

DESIGN CONDITION: OPTION NO. 1  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 100,339.88  
 2005 Sew. Ac. = 19,366.02  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,917,220.12  
 + Engr., ROW, Financ., Conting (1.5x) = \$14,875,830.18 \$12,239,816.26

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

Estim. Cost Above R.H. Meter = \$6,879,943.87  
 Estim. Cost Below R.H. Meter = \$3,037,276.25 \$2,496,484.14  
 Percent R.H. Cost of Total Line = 30.63% 30.62%  
 Estim. Richland Hills Cost Share = \$4,555,914.38 \$3,747,726.21

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Manne Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line.

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 Cofw Option 1.xls  
 Page 1 of 1

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                   | 0.000350                   | 72.72                  | 86                    | 74.07                 | 78                    | 57.09                 | 279.20          | \$74,082.20            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 74.29                  | 86                    | 76.70                 | 78                    | 59.12                 | 93.15           | 1,253,248.58           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 74.30                  | 86                    | 76.72                 | 78                    | 59.13                 | -11.44          | 53,005.30              | 43,602.52              |
| M402A/0020+40         | M402A/0020+90           | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 74.30                  | 86                    | 76.72                 | 78                    | 59.13                 | 59.13           | 108,915.00             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 74.31                  | 86                    | 76.75                 | 78                    | 59.15                 | 133.46          | 50,100.90              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 74.85                  | 86                    | 77.45                 | 78                    | 59.89                 | 84.73           | 631,708.99             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                   | 0.000385                   | 75.01                  | 86                    | 77.65                 | 78                    | 59.85                 | 95.52           | 289,713.90             | 238,320.62             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 75.17                  | 86                    | 93.53                 | 78                    | 72.09                 | 104.48          | 314,401.30             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 75.29                  | 86                    | 93.66                 | 78                    | 72.19                 | 101.22          | 262,122.10             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 75.40                  | 86                    | 93.77                 | 78                    | 72.28                 | 106.10          | 405,889.89             | 333,887.79             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 75.46                  | 86                    | 93.85                 | 78                    | 72.33                 | 101.04          | 222,912.70             | 183,369.50             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 75.49                  | 86                    | 93.90                 | 78                    | 72.38                 | 104.10          | 182,977.20             | 150,518.29             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000563                   | 75.57                  | 86                    | 93.94                 | 78                    | 72.41                 | 107.60          | 185,155.50             | 152,310.17             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 86.91                  | 86                    | 94.07                 | 78                    | 72.51                 | 102.23          | 488,334.49             | 385,255.15             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000565                   | 86.91                  | 86                    | 94.09                 | 78                    | 72.52                 | 104.40          | 59,132.19              | 304,620.35             |
| M402A/0063+95         | M402A/0061+67           | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 86.90                  | 86                    | 94.19                 | 78                    | 72.58                 | 104.99          | 370,310.99             | 412,730.71             |
| M402A/0072+77         | M402A/0063+95           | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 86.95                  | 86                    | 94.34                 | 78                    | 72.60                 | 104.99          | 290,440.00             | 238,917.92             |
| M402A/0072+77         | M402A/0072+77           | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 87.02                  | 86                    | 94.55                 | 78                    | 72.88                 | 105.11          | 586,688.79             | 482,614.20             |
| M402A/0083+50         | M402A/0080+78           | 400           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 87.06                  | 86                    | 94.65                 | 78                    | 72.99                 | 102.25          | 109,641.10             | 90,191.51              |
| M402A/0088+51         | M402A/0083+50           | 151           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                   | 0.000572                   | 87.09                  | 86                    | 94.70                 | 78                    | 73.03                 | 97.45           | 121,984.80             | 100,345.53             |
| M402A/0088+51         | M402A/0088+51           | 168           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                   | 0.000573                   | 87.13                  | 86                    | 94.75                 | 78                    | 73.03                 | 97.45           | 121,984.80             | 100,345.53             |
| M402A/0103+76         | M402A/0103+76           | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 87.35                  | 86                    | 94.97                 | 78                    | 73.20                 | 104.92          | 595,401.99             | 489,781.73             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000577                   | 87.52                  | 86                    | 95.16                 | 78                    | 73.34                 | 95.23           | 516,237.09             | 424,676.60             |
| M402A/0109+91         | M402A/0103+76           | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 87.58                  | 86                    | 95.21                 | 78                    | 73.39                 | 126.86          | 98,023.50              | 80,634.80              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 87.76                  | 86                    | 95.21                 | 78                    | 73.59                 | 126.86          | 98,023.50              | 80,634.80              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 87.88                  | 86                    | 95.57                 | 78                    | 73.66                 | 113.05          | 585,962.69             | 482,016.90             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 97.39                  | 86                    | 95.84                 | 78                    | 73.87                 | 114.65          | 504,639.49             | 415,119.89             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 97.47                  | 86                    | 95.89                 | 78                    | 73.91                 | 115.65          | 91,488.60              | 75,259.14              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                   | 0.000588                   | 97.47                  | 86                    | 96.01                 | 78                    | 74.00                 | 110.97          | 223,638.80             | 183,966.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001829                   | 86.02                  | 72                    | 105.43                | 66                    | 83.60                 | 115.00          | 590,367.59             | 496,072.77             |

DESIGN CONDITION: OPTION NO. 1  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 106,779.00  
 2010 Sew. Ac. = 20,564.00  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$10,011,514.95  
 + Engr., ROW, Financ., Conting. (1.5x) = \$15,017,272.42  
 \$12,368,959.17

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST PIPE DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line.

Estim. Cost Above R.H. Meter = \$6,974,238.69  
 Estim. Cost Below R.H. Meter = \$3,037,276.25  
 Percent R.H. Cost of Total Line = 30.34%  
 Estim. Richland Hills Cost Share = \$4,555,914.38  
 \$3,747,726.21

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 COFW Option 1.xls  
 Page 1 of 1



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 90.26             | 96                    | 99.32                 | 90              | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A00020+17         | M402A0000+50            | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 92.68             | 96                    | 102.85                | 90              | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A00020+90         | M402A0020+17            | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 92.70             | 96                    | 102.88                | 90              | 86.61                 | 16.04           | 66,048.79              | 58,050.69              |
| M402A00022+40         | M402A0022+40            | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 92.70             | 96                    | 102.88                | 90              | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A00023+09         | M402A0023+09            | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 92.73             | 96                    | 102.91                | 90              | 86.64                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A00028+40         | M402A0028+40            | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 93.45             | 96                    | 103.85                | 90              | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A00036+79         | M402A0036+79            | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 93.67             | 96                    | 104.12                | 90              | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A00040+28         | M402A0040+28            | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 93.87             | 90                    | 105.58                | 84              | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A00045+95         | M402A0045+95            | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 94.00             | 90                    | 105.73                | 84              | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A00049+00         | M402A0049+00            | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 94.13             | 90                    | 105.86                | 84              | 88.07                 | 119.91          | 444,525.17             | 387,230.81             |
| M402A00051+91         | M402A0051+91            | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 94.20             | 90                    | 105.94                | 84              | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A00054+21         | M402A0054+21            | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 94.24             | 90                    | 106.00                | 84              | 88.19                 | 119.91          | 200,394.17             | 174,565.59             |
| M402A00060+68         | M402A0060+68            | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 94.32             | 90                    | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A00061+67         | M402A0061+67            | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 102.36            | 90                    | 106.20                | 84              | 88.35                 | 118.07          | 512,913.65             | 446,604.78             |
| M402A00065+95         | M402A0065+95            | 99            | 54              | 31.86                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 102.37            | 90                    | 106.22                | 84              | 88.37                 | 120.25          | 78,726.28              | 68,579.34              |
| M402A00072+77         | M402A0072+77            | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 102.40            | 90                    | 106.33                | 84              | 88.46                 | 120.65          | 405,559.63             | 353,287.50             |
| M402A00080+78         | M402A0080+78            | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 102.50            | 90                    | 106.50                | 84              | 88.60                 | 120.12          | 549,493.54             | 478,669.93             |
| M402A00085+50         | M402A0085+50            | 808           | 54              | 32.33                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 102.64            | 90                    | 106.74                | 84              | 88.80                 | 121.03          | 642,533.69             | 559,718.24             |
| M402A00086+56         | M402A0086+56            | 151           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 102.70            | 90                    | 106.85                | 84              | 88.89                 | 124.56          | 318,085.99             | 277,088.24             |
| M402A00088+51         | M402A0088+51            | 168           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 102.75            | 90                    | 106.91                | 84              | 88.94                 | 118.20          | 120,077.46             | 104,600.81             |
| M402A00096+65         | M402A0096+65            | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 102.80            | 90                    | 106.97                | 84              | 88.99                 | 113.41          | 133,596.11             | 116,377.06             |
| M402A0103+76          | M402A0103+76            | 711           | 54              | 29.26                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 103.24            | 90                    | 107.21                | 84              | 89.19                 | 120.91          | 652,076.27             | 568,030.89             |
| M402A0105+11          | M402A0105+11            | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 103.31            | 90                    | 107.42                | 84              | 89.37                 | 111.26          | 565,387.84             | 492,524.34             |
| M402A0109+91          | M402A0109+91            | 807           | 54              | 25.06                  | 31.70                 | 89.87                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 103.55            | 90                    | 107.78                | 84              | 89.42                 | 142.89          | 92,351.28              | 81,517.42              |
| M402A0113+81          | M402A0113+81            | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 103.67            | 90                    | 107.89                | 84              | 89.67                 | 114.75          | 641,738.48             | 559,025.52             |
| M402A0117+43          | M402A0117+43            | 695           | 54              | 40.76                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 110.48            | 90                    | 108.19                | 84              | 89.76                 | 129.15          | 274,349.16             | 238,988.61             |
| M402A0120+25          | M402A0120+25            | 126           | 54              | 41.74                  | 42.22                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 110.53            | 90                    | 108.25                | 84              | 90.01                 | 130.79          | 552,674.40             | 481,440.81             |
| M402B0123+40          | M402B0123+40            | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 110.61            | 90                    | 108.38                | 84              | 90.17                 | 127.14          | 244,926.21             | 213,357.94             |
| M402B0138+74          | M402B0138+74            | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 99.61             | 72                    | 105.43                | 66              | 83.60                 | 115.00          | 590,367.59             | 496,072.77             |

DESIGN YEAR: 2015  
 DESIGN NO. 1  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 116,778.00  
 2015 Sew. Ac. = 23,826.69  
 TOTAL ESTIM. CONST. COST = \$11,279,590.65 \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5x) = \$16,919,385.98 \$14,747,213.88  
 Constant Intel Flow = 6.00

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup>(8/3)]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line.

Estim. Cost Above R.H. Meter = \$7,581,897.60 \$6,586,472.24  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 32.78% 33.01%  
 Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PAR. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------------|-----------------------|----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.82                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 94.74             | 96                          | 99.32                 | 90                   | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17         | M432A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 97.20             | 96                          | 102.85                | 90                   | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 97.21             | 96                          | 102.88                | 90                   | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0022+40         | M402A/0022+40           | 150           | 24               | 0.00                   | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 97.21             | 96                          | 102.88                | 90                   | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A/0023+09         | M402A/0023+09           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 97.24             | 96                          | 102.91                | 90                   | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0032+40         | M402A/0028+40           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 97.24             | 96                          | 102.81                | 90                   | 87.43                 | 112.47          | 78,156.79              | 69,187.02               |
| M402A/0036+78         | M402A/0032+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 97.99             | 96                          | 103.85                | 90                   | 87.43                 | 123.33          | 361,006.39             | 299,948.02              |
| M402A/0040+28         | M402A/0036+78           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 98.22             | 96                          | 104.12                | 90                   | 87.84                 | 120.23          | 344,328.08             | 250,072.13              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 98.43             | 90                          | 105.58                | 90                   | 87.96                 | 116.85          | 444,525.17             | 387,230.81              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 98.71             | 90                          | 105.86                | 90                   | 88.07                 | 121.89          | 244,131.00             | 212,665.22              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 98.79             | 90                          | 105.94                | 90                   | 88.14                 | 118.85          | 209,394.17             | 174,565.59              |
| M402A/0060+68         | M402A/0051+91           | 645           | 54               | 35.19                  | 19.06                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 98.83             | 90                          | 106.05                | 90                   | 88.19                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0065+95         | M402A/0060+68           | 255           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 98.92             | 90                          | 106.05                | 90                   | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0067+78         | M402A/0065+95           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 108.71            | 96                          | 126.14                | 94                   | 88.37                 | 120.25          | 583,581.76             | 446,804.78              |
| M402A/0072+77         | M402A/0067+78           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 108.73            | 96                          | 126.30                | 84                   | 88.46                 | 120.85          | 461,436.74             | 353,287.50              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 108.83            | 96                          | 126.50                | 84                   | 88.60                 | 120.12          | 625,201.54             | 478,669.93              |
| M402A/0086+56         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 108.96            | 96                          | 126.78                | 84                   | 88.80                 | 121.03          | 731,060.56             | 559,718.24              |
| M402A/0088+51         | M402A/0086+56           | 151           | 54               | 29.26                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 109.03            | 96                          | 126.98                | 84                   | 88.89                 | 124.56          | 361,911.17             | 277,088.24              |
| M402A/0096+65         | M402A/0088+51           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 109.07            | 96                          | 127.05                | 84                   | 88.94                 | 118.20          | 136,621.47             | 104,600.81              |
| M402A/0103+76         | M402A/0096+65           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 109.13            | 96                          | 127.34                | 84                   | 88.99                 | 113.41          | 152,002.69             | 116,377.06              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 109.40            | 96                          | 127.05                | 84                   | 89.19                 | 120.91          | 741,917.89             | 568,030.89              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 109.61            | 96                          | 127.67                | 84                   | 89.37                 | 111.26          | 643,297.10             | 492,524.34              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 109.68            | 96                          | 127.67                | 84                   | 89.67                 | 142.89          | 122,145.02             | 93,517.28               |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 109.93            | 96                          | 128.02                | 84                   | 89.76                 | 114.75          | 730,155.78             | 559,025.52              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 110.06            | 96                          | 128.51                | 84                   | 90.01                 | 130.79          | 312,148.38             | 238,988.61              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 118.37            | 96                          | 128.58                | 84                   | 90.06                 | 131.80          | 628,820.65             | 481,440.81              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 66                    | 0.000588                   | 118.46            | 78                          | 128.74                | 84                   | 90.17                 | 127.14          | 114,002.02             | 87,282.72               |
|                       |                         |               |                  | 31.40                  | 33.78                 | 93.60                 | -0.0001        | 0.0045         |                       | 0.001829                   | 106.15            | 78                          | 130.52                |                      | 105.43                | 136.83          | 692,861.97             | 590,367.59              |

F.W. Model Eq. Pop. = 57,207.50 93,287.50

F.W. Model Sew. Ac. = 9,004.81 20,981.33

2020 Eq. Pop. = 126,777.00

2020 Sew. Ac. = 25,540.00

Constant Inlet Flow = 6.00

TOTAL ESTIM. CONST. COST = \$12,184,932.56  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84  
 \$14,988,656.12

UPSTREAM MAIN/STATION: Length of Pipe Segment in Feet  
 DOWNSTREAM MAIN/STATION: Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 LENGTH: Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 EXIST DIA: Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 EXIST PIPE CAP: Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 2000 MODEL FLOW: Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Exp.: s = [ 1629.6 x n x MGD^1.54 / D^5.14 / D^3 ]^2, n = 0.0145  
 2020 MODEL FLOW: Calculated Design Flow in MGD Based on Computed Coef. "A" and "B", and Design Period Equivalent Population and Sewered Acres  
 COEF. "A", COEF. "B": Proposed Replacement Pipe Capacity in Inches  
 MODEL PROP DIA: Proposed Replacement Pipe Capacity in MGD = [ D^5.14 / 1629.6 x n ] / 1.54  
 MODEL H.G. SLOPE: Proposed Parallel Pipe Capacity in MGD = [ D^5.14 / 1629.6 x n ] / 1.54  
 DESIGN FLOW: Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 PROP. REPL. PIPE: Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 PROP. PARL. PIPE: Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 BOTH CAP: Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

DESIGN CONDITION: OPTION NO. 1  
 DESIGN YEAR: 2020

NOTES: UPSTREAM MAIN/STATION: Stations confirmed by Field Survey  
 DOWNSTREAM MAIN/STATION: Stations confirmed by Field Survey  
 LENGTH: Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 EXIST DIA: Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 EXIST PIPE CAP: Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 2000 MODEL FLOW: Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 2020 MODEL FLOW: Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Exp.: s = [ 1629.6 x n x MGD^1.54 / D^5.14 / D^3 ]^2, n = 0.0145  
 COEF. "A", COEF. "B": Proposed Replacement Pipe Capacity in Inches  
 MODEL PROP DIA: Proposed Replacement Pipe Capacity in MGD = [ D^5.14 / 1629.6 x n ] / 1.54  
 MODEL H.G. SLOPE: Proposed Parallel Pipe Capacity in MGD = [ D^5.14 / 1629.6 x n ] / 1.54  
 DESIGN FLOW: Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 PROP. REPL. PIPE: Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 PROP. PARL. PIPE: Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 BOTH CAP: Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, Year 2020  
 BFX Area, and Constant 6.0 MGD Inlet Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line.

Estim. Cost Above R.H. Meier = \$8,497,239.51  
 Estim. Cost Below R.H. Meier = \$3,697,693.06  
 Percent R.H. Cost of Total Line = 30.32%  
 Estim. Richland Hills Cost Share = \$5,546,539.58  
 \$4,867,505.52

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | REPL. P.I.P.E. (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|---------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000-50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 96.46                  | 96                    | 99.32                 | 90                  | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 98.15                  | 96                    | 102.85                | 90                  | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0022+40         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 98.16                  | 96                    | 102.88                | 90                  | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 0.00                   | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 98.18                  | 96                    | 102.91                | 90                  | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 98.86                  | 96                    | 103.85                | 90                  | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 39.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 99.07                  | 96                    | 104.12                | 90                  | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 29.03                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 99.29                  | 90                    | 105.58                | 90                  | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0045+95         | M402A/0040+28           | 361           | 54               | 33.82                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 99.46                  | 90                    | 105.73                | 84                  | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A/0049+00         | M402A/0045+95           | 559           | 54               | 28.71                  | 18.97                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 99.62                  | 90                    | 105.86                | 84                  | 87.96                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0054+21         | M402A/0049+00           | 307           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 99.71                  | 90                    | 105.94                | 84                  | 88.07                 | 121.89          | 444,525.17             | 387,230.81              |
| M402A/0060+88         | M402A/0054+21           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 99.74                  | 90                    | 106.00                | 84                  | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0065+67         | M402A/0060+88           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0091         | 84                    | 0.000564                   | 99.89                  | 90                    | 106.05                | 84                  | 88.23                 | 123.42          | 202,779.82             | 174,565.59              |
| M402A/0065+95         | M402A/0065+67           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 121.16                 | 96                    | 126.14                | 90                  | 106.20                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 121.08                 | 96                    | 126.17                | 90                  | 106.20                | 138.10          | 461,436.74             | 405,559.63              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 121.12                 | 96                    | 126.30                | 90                  | 106.33                | 138.72          | 625,201.54             | 549,493.54              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.69                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 121.17                 | 96                    | 126.50                | 90                  | 106.50                | 138.02          | 731,060.56             | 642,533.69              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 121.20                 | 96                    | 126.78                | 90                  | 106.85                | 142.52          | 361,911.17             | 318,085.09              |
| M402A/0098+65         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 121.24                 | 96                    | 127.05                | 90                  | 106.91                | 136.17          | 136,621.47             | 120,077.46              |
| M402A/0103+76         | M402A/0098+65           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 121.33                 | 96                    | 127.34                | 90                  | 106.97                | 131.39          | 152,002.69             | 133,596.11              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 121.63                 | 96                    | 127.60                | 90                  | 107.21                | 138.93          | 741,917.89             | 652,076.27              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 121.87                 | 96                    | 127.67                | 90                  | 107.42                | 129.31          | 643,297.10             | 565,397.84              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 122.20                 | 96                    | 128.02                | 90                  | 107.48                | 160.95          | 122,145.02             | 107,354.02              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 122.38                 | 96                    | 128.15                | 90                  | 107.89                | 132.86          | 730,155.78             | 641,738.48              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 140.17                 | 96                    | 128.51                | 90                  | 107.89                | 147.28          | 312,148.38             | 274,349.16              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 140.25                 | 96                    | 128.58                | 90                  | 108.19                | 148.97          | 628,820.65             | 552,674.40              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 121.45                 | 78                    | 130.52                | 90                  | 108.38                | 145.35          | 114,002.02             | 100,197.09              |

DESIGN CONDITION: 2050  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 161,728.99  
 2050 Sew. Ac. = 29,865.17  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76

UPSTREAM MAIN/STATION LENGTH EXIST DIA. EXISTING GRAVITY FLOW CAPACITY IN INCHES  
 UPSTREAM MAIN/STATION LENGTH EXIST DIA. EXISTING GRAVITY FLOW CAPACITY IN INCHES  
 2000 MODEL FLOW YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 COEF. "A", COEF. "B" CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON HYDROWORKS CALCULATIONS  
 MODEL PROP DIA. COMPUTED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 MODEL H.G. SLOPE COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQ.  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75} (\text{ft}^3)^2, n = 0.0145$   
 DESIGN FLOW CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 P.I.P.E. REPL. PIPE PROPOSED REPLACEMENT PIPE IN INCHES  
 REPL. PIPE CAP. PROPOSED REPLACEMENT PIPE CAPACITY IN MGD  
 PARL. PIPE CAP. PROPOSED PARALLEL PIPE IN INCHES  
 PARL. PIPE CAP. PROPOSED PARALLEL PIPE CAPACITY IN MGD  
 BOTH CAP. COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIM. REPL. PIPE COST ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) X \$0.125/SQ. IN. X LENGTH (FT.)  
 ESTIM. PARL. PIPE COST ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) X \$0.125/SQ. IN. X LENGTH (FT.)

**OPTION 1**  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Hallom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BF X Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Hallom City  
 to this line.

Estim. Cost Above R.H. Meter = \$8,497,239.51 \$7,441,172.82  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 30.32% 30.37%  
 Est. n. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

| UPSTREAM MAINSTATION | DOWNSTREAM MAINSTATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PRO. PAR. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|----------------------|------------------------|---------------|------------------|------------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|---------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50        | M280A/0304+97          | 102           | 54               | 222.11                 | 18.94                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 98.27                  | 96                    | 99.32                 | 90                  | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17        | M402A/0000+50          | 1726          | 54               | 34.03                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.60                  | 96                    | 102.85                | 90                  | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90        | M402A/0020+17          | 73            | 24               | -70.57                 | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.61                  | 96                    | 102.88                | 90                  | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0022+40        | M402A/0020+90          | 150           | 24               | 0.00                   | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.61                  | 96                    | 102.88                | 90                  | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A/0023+09        | M402A/0022+40          | 69            | 24               | 74.31                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 99.63                  | 96                    | 102.91                | 90                  | 86.64                 | 86.64           | 62,429.68              | 54,869.83               |
| M402A/0028+40        | M402A/0023+09          | 870           | 54               | 25.04                  | 18.78                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 100.27                 | 96                    | 103.85                | 90                  | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A/0032+40        | M402A/0028+40          | 399           | 54               | 35.67                  | 18.81                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 100.48                 | 96                    | 104.12                | 90                  | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0036+79        | M402A/0032+40          | 433           | 54               | 32.39                  | 18.87                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 100.72                 | 90                    | 105.58                | 94                  | 87.84                 | 344,328.08      | 299,948.02             |                         |
| M402A/0040+28        | M402A/0036+79          | 361           | 54               | 29.03                  | 18.92                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 101.07                 | 90                    | 105.86                | 84                  | 88.07                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0045+95        | M402A/0040+28          | 559           | 54               | 33.82                  | 18.97                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 101.19                 | 90                    | 106.00                | 94                  | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0049+00        | M402A/0045+95          | 307           | 54               | 28.71                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 101.19                 | 90                    | 106.00                | 94                  | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0051+91        | M402A/0049+00          | 252           | 54               | 31.72                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 101.37                 | 90                    | 106.05                | 94                  | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0054+21        | M402A/0051+91          | 255           | 54               | 35.19                  | 19.06                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 101.37                 | 90                    | 106.05                | 94                  | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0060+68        | M402A/0054+21          | 645           | 54               | 29.72                  | 31.63                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 128.57                 | 96                    | 126.14                | 90                  | 106.21                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0061+67        | M402A/0060+68          | 99            | 54               | 31.88                  | 31.61                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 128.57                 | 96                    | 126.14                | 90                  | 106.21                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0065+95        | M402A/0061+67          | 510           | 54               | 32.39                  | 31.54                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 128.44                 | 96                    | 126.30                | 90                  | 106.33                | 138.10          | 86,573.01              | 78,726.28               |
| M402A/0072+77        | M402A/0065+95          | 891           | 54               | 31.52                  | 31.50                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 128.46                 | 96                    | 126.78                | 90                  | 106.42                | 138.97          | 731,060.56             | 642,533.69              |
| M402A/0080+78        | M402A/0072+77          | 400           | 54               | 35.67                  | 31.43                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 128.47                 | 96                    | 126.91                | 90                  | 106.45                | 142.52          | 361,911.17             | 318,085.99              |
| M402A/0085+50        | M402A/0080+78          | 151           | 54               | 29.26                  | 31.43                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 128.50                 | 96                    | 127.05                | 90                  | 106.91                | 136.17          | 138,621.47             | 120,077.46              |
| M402A/0088+56        | M402A/0085+50          | 168           | 54               | 24.42                  | 31.45                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 128.57                 | 96                    | 127.05                | 90                  | 106.91                | 136.17          | 138,621.47             | 120,077.46              |
| M402A/0088+51        | M402A/0088+56          | 820           | 54               | 31.72                  | 31.56                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 128.93                 | 96                    | 127.34                | 90                  | 107.21                | 138.93          | 741,917.89             | 652,076.27              |
| M402A/0103+76        | M402A/0088+51          | 711           | 54               | 21.89                  | 31.63                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 129.19                 | 96                    | 127.67                | 90                  | 107.42                | 129.31          | 643,297.10             | 565,397.84              |
| M402A/0105+11        | M402A/0103+76          | 135           | 54               | 53.47                  | 31.66                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 129.29                 | 96                    | 127.67                | 90                  | 107.42                | 129.31          | 643,297.10             | 565,397.84              |
| M402A/0117+43        | M402A/0105+11          | 807           | 54               | 25.08                  | 31.70                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 129.53                 | 96                    | 128.02                | 90                  | 107.78                | 132.86          | 730,155.78             | 641,738.48              |
| M402A/0113+81        | M402A/0117+43          | 345           | 54               | 40.78                  | 31.77                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 129.74                 | 96                    | 128.15                | 90                  | 107.89                | 147.28          | 312,148.38             | 274,349.16              |
| M402A/0120+25        | M402A/0113+81          | 695           | 54               | 41.74                  | 42.22                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 152.44                 | 96                    | 128.58                | 90                  | 108.19                | 148.97          | 628,820.65             | 552,674.40              |
| M402B/0123+40        | M402A/0120+25          | 308           | 54               | 36.97                  | 42.20                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 152.50                 | 96                    | 128.74                | 90                  | 108.25                | 149.99          | 114,002.02             | 100,197.09              |
| M402B/0136+74        | M402B/0123+40          | 1160          | 48               | 31.40                  | 33.78                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 130.29                 | 78                    | 130.52                | 72                  | 105.43                | 145.35          | 278,671.60             | 244,926.21              |
|                      |                        | 14135         |                  |                        |                       |                |                |                       |                            |                        |                       |                       |                     |                       |                 |                        |                         |

DESIGN CONDITION: 2070  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 180,801.77  
 2070 Sew. Ac. = 32,329.98  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76  
 Avg. Estimated Per Foot Cost = \$1,294.12 \$1,134.01

UPSTREAM MAINSTATION  
 UPSTREAM MAINSTATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2070 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL PIPE  
 REPL PIPE CAP  
 PARL PIPE CAP  
 BOTH CAP  
 ESTIM. REPL PIPE COST

DOWNSTREAM MAINSTATION  
 DOWNSTREAM MAINSTATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2070 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL PIPE  
 REPL PIPE CAP  
 PARL PIPE CAP  
 BOTH CAP  
 ESTIM. REPL PIPE COST

Notes:  
 Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2070 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2070 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft)

OPTION 1  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Hallom City,  
 Richland Hills, Marne Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Inlet Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Hallom City  
 to this line.

Estim. Cost Above R.H. Meter = \$8,497,239.51 \$7,441,172.82  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 30.32% 30.37%  
 Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

**OPTION 2**

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                   | 0.000350                   | 46.23                  | 72                    | 48.12                 | 60              | 28.36                 | 250.47          | \$51,911.63            | \$36,049.75            |
| M402A/0020+17         | M1402A/0000+50          | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 46.52                  | 72                    | 47.76                 | 60              | 29.37                 | 63.40           | 878,426.26             | 610,018.24             |
| M402A/0020+90         | M402A/0020+17           | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 46.52                  | 72                    | 47.77                 | 60              | 29.38                 | -41.19          | 37,152.44              | 25,800.31              |
| M402A/0022+09         | M402A/0020+90           | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 46.52                  | 72                    | 47.77                 | 60              | 29.38                 | 29.38           | 76,340.64              | 53,014.33              |
| M402A/0023+09         | M402A/0022+09           | 69            | 24              | 74.31                  | 18.71                 | 87.43                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 46.53                  | 72                    | 47.79                 | 60              | 29.38                 | 103.70          | 35,116.69              | 24,386.59              |
| M402A/0032+40         | M402A/0023+09           | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 46.77                  | 72                    | 48.22                 | 60              | 29.65                 | 54.69           | 442,775.69             | 307,483.12             |
| M402A/0036+79         | M402A/0032+40           | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                   | 0.000385                   | 46.85                  | 72                    | 48.35                 | 60              | 29.73                 | 65.40           | 203,066.09             | 141,018.12             |
| M402A/0040+28         | M402A/0036+79           | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 46.96                  | 72                    | 58.23                 | 60              | 35.81                 | 68.20           | 220,369.97             | 153,034.70             |
| M402A/0045+95         | M402A/0040+28           | 361           | 54              | 33.82                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 47.05                  | 72                    | 58.31                 | 60              | 35.86                 | 64.89           | 183,726.47             | 127,587.82             |
| M402A/0049+00         | M402A/0045+95           | 559           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 47.14                  | 72                    | 58.39                 | 60              | 35.90                 | 69.72           | 284,496.11             | 197,566.74             |
| M402A/0051+91         | M402A/0049+00           | 307           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 47.18                  | 72                    | 58.43                 | 60              | 35.93                 | 64.64           | 156,243.84             | 108,502.66             |
| M402A/0054+21         | M402A/0051+91           | 252           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 47.28                  | 72                    | 58.46                 | 60              | 35.95                 | 67.67           | 128,252.27             | 89,064.08              |
| M402A/0060+68         | M402A/0054+21           | 255           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 47.28                  | 72                    | 58.49                 | 60              | 35.97                 | 71.16           | 129,779.08             | 90,124.36              |
| M402A/0061+67         | M402A/0060+68           | 645           | 54              | 31.88                  | 31.63                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 63.20                  | 78                    | 72.51                 | 66              | 46.44                 | 76.16           | 385,255.15             | 275,833.57             |
| M402A/0065+95         | M402A/0061+67           | 99            | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 63.18                  | 78                    | 72.52                 | 66              | 46.45                 | 78.33           | 59,132.19              | 42,337.24              |
| M402A/0072+77         | M402A/0065+95           | 510           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 63.11                  | 78                    | 72.60                 | 66              | 46.50                 | 78.89           | 304,620.35             | 218,100.96             |
| M402A/0080+78         | M402A/0072+77           | 691           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 63.09                  | 78                    | 72.71                 | 66              | 46.57                 | 78.09           | 412,730.71             | 295,505.42             |
| M402A/0085+50         | M402A/0080+78           | 808           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 63.06                  | 78                    | 72.88                 | 66              | 46.68                 | 78.91           | 482,614.20             | 345,540.34             |
| M402A/0086+56         | M402A/0085+50           | 400           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                   | 0.000572                   | 63.06                  | 78                    | 72.95                 | 66              | 46.73                 | 82.40           | 238,917.92             | 171,654.98             |
| M402A/0088+51         | M402A/0086+56           | 151           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 63.07                  | 78                    | 73.03                 | 66              | 46.78                 | 76.01           | 90,191.51              | 64,574.98              |
| M402A/0103+76         | M402A/0088+51           | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                   | 0.000573                   | 63.10                  | 78                    | 73.20                 | 66              | 46.88                 | 71.20           | 100,345.53             | 71,845.02              |
| M402A/0105+11         | M402A/0103+76           | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 63.28                  | 78                    | 73.34                 | 66              | 46.98                 | 78.60           | 489,781.73             | 350,672.13             |
| M402A/0109+91         | M402A/0105+11           | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 63.45                  | 78                    | 73.39                 | 66              | 47.00                 | 100.47          | 424,676.60             | 304,058.40             |
| M402A/0113+81         | M402A/0109+91           | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 63.55                  | 78                    | 73.59                 | 66              | 47.14                 | 72.22           | 482,016.90             | 345,112.69             |
| M402A/0117+43         | M402A/0113+81           | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 63.66                  | 78                    | 73.66                 | 66              | 47.18                 | 86.57           | 206,066.71             | 147,538.88             |
| M402A/0120+25         | M402A/0117+43           | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 76.92                  | 78                    | 73.87                 | 66              | 47.31                 | 89.09           | 415,119.89             | 297,216.01             |
| M402B/0123+40         | M402A/0120+25           | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 76.93                  | 78                    | 73.91                 | 66              | 47.34                 | 89.08           | 75,259.14              | 53,883.77              |
| M402B/0136+74         | M402B/0123+40           | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                   | 0.000588                   | 76.93                  | 78                    | 74.00                 | 66              | 47.40                 | 84.37           | 183,966.80             | 131,715.87             |
|                       |                         | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001829                   | 65.00                  | 78                    | 130.52                | 66              | 83.60                 | 115.00          | 692,861.97             | 496,072.77             |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 90,518.25  
 2000 Sew. Ac. = 15,473.77  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$7,951,849.27 \$5,632,451.08  
 + Engr., ROW, Financ., Conting. (1.5x) = \$1,927,773.91 \$8,448,676.61

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP.  
 PROP. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^2$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^4(8/3) \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BFx Area, and Constant  
 6.0 MGD Intel Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marne Creek Area is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$5,822,963.38 \$4,154,058.09  
 Estim. Cost Below R.H. Meter = \$2,128,885.90 \$1,478,392.98  
 Percent R.H. Cost of Total Line = 26.77% 26.25%  
 Estim. Richland Hills Cost Share = \$3,193,328.85 \$2,217,569.48

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 CFWW Option 2.xls  
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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 51.68                  | 78                    | 57.09                 | 66              | 36.57                 | 258.68          | \$60,924.07            | \$43,620.19             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.15                  | 78                    | 59.12                 | 66              | 37.87                 | 71.90           | 1,030,930.82           | 738,122.07              |
| M402A/0020+40         | M402A/0020+17           | 73            | 24               | 70.57                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.16                  | 78                    | 59.13                 | 66              | 37.88                 | 32.69           | 43,602.52              | 31,218.37               |
| M402A/0022+09         | M402A/0022+40           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.16                  | 78                    | 59.13                 | 66              | 37.88                 | 37.88           | 89,594.22              | 64,147.34               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 24.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 52.17                  | 78                    | 59.15                 | 66              | 37.89                 | 112.20          | 41,213.34              | 29,507.78               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 52.46                  | 78                    | 59.69                 | 66              | 38.24                 | 63.28           | 519,946.47             | 372,054.58              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 52.56                  | 78                    | 59.85                 | 66              | 38.34                 | 74.01           | 238,320.62             | 170,631.93              |
| M402A/0045+95         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 52.68                  | 78                    | 72.09                 | 66              | 46.17                 | 78.56           | 258,628.65             | 185,171.99              |
| M402A/0049+00         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 52.77                  | 78                    | 72.19                 | 66              | 46.24                 | 75.27           | 215,623.42             | 154,381.27              |
| M402A/0051+91         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 52.87                  | 78                    | 72.28                 | 66              | 46.29                 | 80.11           | 333,887.79             | 239,055.76              |
| M402A/0054+21         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 52.91                  | 78                    | 72.33                 | 66              | 46.33                 | 75.04           | 183,369.50             | 131,288.22              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 53.02                  | 78                    | 72.38                 | 66              | 46.36                 | 78.08           | 150,518.29             | 107,767.53              |
| M402A/0065+95         | M402A/0060+68           | 99            | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 69.07                  | 78                    | 72.51                 | 66              | 46.44                 | 76.16           | 385,255.15             | 275,833.57              |
| M402A/0072+77         | M402A/0065+95           | 510           | 54               | 32.39                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 69.05                  | 78                    | 72.52                 | 66              | 46.45                 | 78.33           | 59,132.19              | 42,337.24               |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 69.05                  | 78                    | 72.60                 | 66              | 46.50                 | 78.89           | 304,620.35             | 218,100.96              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000568                   | 68.97                  | 78                    | 72.71                 | 66              | 46.57                 | 78.09           | 412,730.71             | 295,505.42              |
| M402A/0088+56         | M402A/0085+50           | 151           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 68.96                  | 78                    | 72.88                 | 66              | 46.68                 | 78.91           | 482,614.20             | 345,540.34              |
| M402A/0096+65         | M402A/0088+56           | 168           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 68.96                  | 78                    | 72.95                 | 66              | 46.73                 | 82.40           | 238,917.92             | 171,059.58              |
| M402A/0103+76         | M402A/0096+65           | 820           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 68.97                  | 78                    | 72.99                 | 66              | 46.75                 | 76.01           | 90,191.51              | 64,574.99               |
| M402A/0105+11         | M402A/0103+76           | 711           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 69.01                  | 78                    | 73.03                 | 66              | 46.78                 | 71.20           | 100,345.53             | 71,845.02               |
| M402A/0109+91         | M402A/0105+11           | 135           | 54               | 53.47                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 69.20                  | 78                    | 73.20                 | 66              | 46.88                 | 78.60           | 489,781.73             | 350,672.13              |
| M402A/0113+81         | M402A/0109+91           | 807           | 54               | 25.08                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 69.34                  | 78                    | 73.34                 | 66              | 46.98                 | 88.87           | 424,676.60             | 304,058.40              |
| M402A/0117+43         | M402A/0113+81           | 345           | 54               | 39.39                  | 31.77                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 69.39                  | 78                    | 73.39                 | 66              | 47.00                 | 100.47          | 80,634.80              | 57,732.61               |
| M402A/0120+25         | M402A/0117+43           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000582                   | 69.62                  | 78                    | 73.66                 | 66              | 47.14                 | 72.22           | 482,016.90             | 345,112.69              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 83.00                  | 78                    | 73.87                 | 66              | 47.31                 | 88.09           | 208,066.71             | 147,538.88              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 93.60                 | -0.0001        | 0.0045         | 66                    | 0.000588                   | 70.59                  | 78                    | 74.00                 | 66              | 47.40                 | 84.37           | 183,966.80             | 131,715.87              |
|                       |                         |               |                  |                        |                       |                       |                |                |                       |                            |                        |                       |                       |                 |                       | 115.00          | 692,861.97             | 496,072.77              |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 96,946.88  
 2005 Sew. Ac. = 16,882.20  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$8,442,761.98 \$6,044,817.75  
 + Engr., ROW, Financ., Conting. (1.5x) = \$12,664,142.97 \$9,067,226.62

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{5.48}]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Parallel Pipe Capacity in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{5.48} / 1629.6 \times n]^{1/1.54}$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{5.48} / 1629.6 \times n]^{1/1.54}$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, year 2020 BFX Area, and Constant  
 6.0 MGD Intel Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$5,944,277.84 \$4,255,962.24  
 Estim. Cost Below R.H. Meter = \$2,498,484.14 \$1,788,855.51  
 Percent R.H. Cost of Total Line = 29.59% 29.59%  
 Estim. Richland Hills Cost Share = \$3,747,726.21 \$2,683,283.27

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA. (in) | MODEL SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350              | 54.68                  | 78                    | 57.09                       | 66                    | 36.57                 | 258.68                | \$60,924.07     | \$43,620.19            |                        |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375              | 55.19                  | 78                    | 59.12                       | 66                    | 37.87                 | 71.90                 | 1,030,930.82    | 738,122.07             |                        |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375              | 55.19                  | 78                    | 59.13                       | 66                    | 37.88                 | -32.69                | 43,602.52       | 31,218.37              |                        |
| M402A/0022+40         | M402A/0022+40           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375              | 55.19                  | 78                    | 59.13                       | 66                    | 37.88                 | 89,594.22             | 89,594.22       | 64,147.34              |                        |
| M402A/0023+09         | M402A/0023+09           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0090         | 90                    | 0.000376              | 55.20                  | 78                    | 59.15                       | 66                    | 37.89                 | 112.20                | 41,213.34       | 29,507.78              |                        |
| M402A/0028+40         | M402A/0028+40           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383              | 55.51                  | 78                    | 59.69                       | 66                    | 38.24                 | 63.28                 | 519,646.47      | 372,054.58             |                        |
| M402A/0036+79         | M402A/0036+79           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0091         | 90                    | 0.000385              | 55.61                  | 78                    | 59.85                       | 66                    | 38.34                 | 74.01                 | 238,320.62      | 170,631.93             |                        |
| M402A/0040+28         | M402A/0040+28           | 361           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558              | 55.75                  | 78                    | 72.09                       | 66                    | 46.17                 | 78.56                 | 258,628.65      | 185,171.99             |                        |
| M402A/0045+95         | M402A/0045+95           | 559           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559              | 55.85                  | 78                    | 72.19                       | 66                    | 46.24                 | 75.27                 | 215,623.42      | 154,381.27             |                        |
| M402A/0049+00         | M402A/0049+00           | 307           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000562              | 55.99                  | 78                    | 72.33                       | 66                    | 46.29                 | 80.11                 | 333,887.79      | 239,055.76             |                        |
| M402A/0051+91         | M402A/0051+91           | 252           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562              | 56.00                  | 78                    | 72.38                       | 66                    | 46.33                 | 75.04                 | 183,369.50      | 131,288.22             |                        |
| M402A/0054+21         | M402A/0054+21           | 645           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562              | 56.00                  | 78                    | 72.38                       | 66                    | 46.33                 | 75.04                 | 183,369.50      | 131,288.22             |                        |
| M402A/0060+68         | M402A/0060+68           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563              | 56.11                  | 78                    | 72.41                       | 66                    | 46.36                 | 78.08                 | 152,310.17      | 109,050.48             |                        |
| M402A/0061+67         | M402A/0061+67           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564              | 73.24                  | 84                    | 88.35                       | 78                    | 72.52                 | 104.40                | 446,804.76      | 385,255.15             |                        |
| M402A/0065+95         | M402A/0065+95           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566              | 73.22                  | 84                    | 88.37                       | 78                    | 72.51                 | 104.40                | 446,804.76      | 385,255.15             |                        |
| M402A/0072+77         | M402A/0072+77           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566              | 73.15                  | 84                    | 88.46                       | 78                    | 72.60                 | 104.99                | 68,579.34       | 59,132.19              |                        |
| M402A/0080+78         | M402A/0080+78           | 808           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000566              | 73.15                  | 84                    | 88.60                       | 78                    | 72.61                 | 104.99                | 68,579.34       | 59,132.19              |                        |
| M402A/0085+50         | M402A/0085+50           | 400           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0060         | 84                    | 0.000570              | 73.12                  | 84                    | 88.60                       | 78                    | 72.71                 | 104.23                | 478,669.93      | 304,620.35             |                        |
| M402A/0088+51         | M402A/0088+51           | 151           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571              | 73.11                  | 84                    | 88.89                       | 78                    | 72.88                 | 105.11                | 559,718.24      | 482,614.20             |                        |
| M402A/0096+65         | M402A/0096+65           | 168           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000571              | 73.11                  | 84                    | 88.89                       | 78                    | 72.95                 | 108.62                | 277,088.24      | 238,917.92             |                        |
| M402A/0103+76         | M402A/0103+76           | 820           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573              | 73.13                  | 84                    | 88.99                       | 78                    | 72.99                 | 102.25                | 104,600.81      | 90,191.51              |                        |
| M402A/0105+11         | M402A/0105+11           | 711           | 54               | 21.89                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573              | 73.17                  | 84                    | 88.99                       | 78                    | 73.03                 | 97.45                 | 116,377.06      | 100,345.53             |                        |
| M402A/0109+91         | M402A/0109+91           | 135           | 54               | 53.47                  | 31.66                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577              | 73.52                  | 84                    | 89.19                       | 78                    | 73.20                 | 104.92                | 568,030.89      | 489,781.73             |                        |
| M402A/0113+81         | M402A/0113+81           | 807           | 54               | 25.08                  | 31.70                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578              | 73.57                  | 84                    | 89.37                       | 78                    | 73.34                 | 95.23                 | 492,524.34      | 424,676.60             |                        |
| M402A/0117+43         | M402A/0117+43           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000581              | 73.70                  | 84                    | 89.42                       | 78                    | 73.39                 | 126.86                | 93,517.28       | 80,634.80              |                        |
| M402A/0120+25         | M402A/0120+25           | 126           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000582              | 73.82                  | 84                    | 89.67                       | 78                    | 73.59                 | 113.05                | 559,025.52      | 482,016.90             |                        |
| M402B/0123+40         | M402B/0123+40           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000586              | 88.09                  | 84                    | 90.01                       | 78                    | 73.66                 | 238,988.61            | 206,066.71      |                        |                        |
| M402B/0136+74         | M402B/0136+74           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829              | 74.86                  | 64                    | 90.06                       | 78                    | 73.87                 | 114.65                | 481,440.81      | 415,119.89             |                        |
|                       |                         |               |                  |                        |                       |                       |                |                |                       |                       |                        |                       | 90.17                       | 78                    | 73.91                 | 115.65                | 287,282.79      | 75,259.14              |                        |
|                       |                         |               |                  |                        |                       |                       |                |                |                       |                       |                        |                       | 77.01                       | 78                    | 74.00                 | 110.97                | 213,357.94      | 183,968.80             |                        |
|                       |                         |               |                  |                        |                       |                       |                |                |                       |                       |                        |                       |                             |                       | 130.52                | 161.92                | 466,463.28      | 692,861.97             |                        |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 103,375.50  
 2010 Sew. Ac. = 17,998.52  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$8,924,327.28  
 + Engr., ROW, Finance, Conting. (1.5x) = \$13,386,490.92 \$11,250,314.37

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 DOWNSTREAM MAIN/STATION  
 DOWNSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 LENGTH  
 Length of Pipe Segment in Feet  
 EXIST DIA.  
 Existing Pipe Diameter in Inches  
 EXIST PIPE CAP  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 2000 MODEL FLOW  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 2020 MODEL FLOW  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 COEF. "A", COEF. "B"  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 MODEL PROP DIA.  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 MODEL H.G. SLOPE  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.: s = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup>(8/3) ]<sup>2</sup>, n = 0.0145  
 DESIGN FLOW  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 PROP. REPL. PIPE  
 Proposed Replacement Pipe in Inches  
 REPL. PIPE CAP.  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 PROP. PARL. PIPE  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 PARL. PIPE CAP.  
 Proposed Parallel Pipe Capacity in MGD  
 BOTH CAP.  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 ESTIM. REPL. PIPE COST  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 ESTIM. PARL. PIPE COST  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BEF, Area, and Constant  
 6.0 MGD Intel Facility Flow This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model.  
 Estim. Cost Above R.H. Meter = \$6,425,843.14 \$5,711,354.07  
 Estim. Cost Below R.H. Meter = \$2,498,484.14 \$1,788,855.51  
 Percent R.H. Cost of Total Line = 28.00% 23.85%  
 Estim. Richland Hills Cost Share = \$3,747,726.21 \$2,683,283.27



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/ft) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. P/ARL PIPE (n) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|--------------------------|------------------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                 | 68.08                  | 84                    | 69.57                 | 84                   | 69.57                 | 291.68          | \$70,657.50            | \$70,657.50             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 69.19                  | 84                    | 72.04                 | 84                   | 72.04                 | 106.07          | 1,195,635.75           | 1,195,635.75            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 69.20                  | 84                    | 72.06                 | 84                   | 72.06                 | 1.49            | 50,568.60              | 50,568.60               |
| M402A/0022+40         | M402A/0022+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 69.20                  | 84                    | 72.06                 | 84                   | 72.06                 | 146.39          | 103,908.09             | 103,908.09              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                 | 69.21                  | 84                    | 72.08                 | 84                   | 72.08                 | 47,797.72       | 47,797.72              | 47,797.72               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                 | 69.67                  | 84                    | 72.74                 | 84                   | 72.74                 | 59,696.47       | 59,696.47              | 59,696.47               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.65                 | -0.0011        | 0.0090         | 90                    | 0.000385                 | 69.81                  | 84                    | 72.93                 | 84                   | 72.93                 | 276,395.52      | 276,395.52             | 276,395.52              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000358                 | 69.81                  | 84                    | 72.84                 | 84                   | 72.84                 | 95.52           | 299,948.02             | 299,948.02              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000358                 | 69.97                  | 84                    | 72.84                 | 84                   | 72.84                 | 104.48          | 299,948.02             | 299,948.02              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000359                 | 70.08                  | 84                    | 87.96                 | 84                   | 87.96                 | 101.22          | 250,072.13             | 250,072.13              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000361                 | 70.20                  | 84                    | 88.07                 | 84                   | 88.07                 | 106.10          | 387,230.81             | 387,230.81              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000362                 | 70.25                  | 84                    | 88.07                 | 84                   | 88.07                 | 101.04          | 212,665.22             | 212,665.22              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000362                 | 70.28                  | 84                    | 88.19                 | 84                   | 88.19                 | 104.10          | 174,565.59             | 174,565.59              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000363                 | 70.38                  | 84                    | 88.23                 | 84                   | 88.23                 | 107.60          | 333,887.79             | 333,887.79              |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000364                 | 85.67                  | 84                    | 88.37                 | 84                   | 88.37                 | 102.23          | 446,804.78             | 446,804.78              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000366                 | 85.66                  | 84                    | 88.46                 | 84                   | 88.46                 | 104.40          | 68,579.34              | 68,579.34               |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000368                 | 85.61                  | 84                    | 88.46                 | 84                   | 88.46                 | 104.99          | 352,287.50             | 352,287.50              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000370                 | 85.63                  | 84                    | 88.60                 | 84                   | 88.60                 | 104.23          | 478,669.93             | 478,669.93              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000370                 | 85.66                  | 84                    | 88.80                 | 84                   | 88.80                 | 105.11          | 559,718.24             | 559,718.24              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000371                 | 85.68                  | 84                    | 88.89                 | 84                   | 88.89                 | 108.62          | 277,088.24             | 277,088.24              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000372                 | 85.70                  | 84                    | 88.94                 | 84                   | 88.94                 | 102.25          | 104,600.81             | 104,600.81              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000373                 | 85.75                  | 84                    | 88.99                 | 84                   | 88.99                 | 97.45           | 116,377.06             | 116,377.06              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000377                 | 86.15                  | 84                    | 89.19                 | 84                   | 89.19                 | 104.92          | 568,030.89             | 568,030.89              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000378                 | 86.21                  | 84                    | 89.37                 | 84                   | 89.37                 | 95.23           | 492,524.34             | 492,524.34              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000381                 | 86.37                  | 84                    | 89.67                 | 84                   | 89.67                 | 126.86          | 93,517.28              | 93,517.28               |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000382                 | 86.50                  | 84                    | 89.76                 | 84                   | 89.76                 | 98.67           | 559,025.52             | 559,025.52              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000386                 | 99.28                  | 84                    | 90.01                 | 84                   | 90.01                 | 114.65          | 238,988.61             | 238,988.61              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000386                 | 99.31                  | 84                    | 90.06                 | 84                   | 90.06                 | 115.65          | 481,440.81             | 481,440.81              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                 | 86.05                  | 84                    | 159.04                | 84                   | 159.04                | 110.97          | 213,357.94             | 213,357.94              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                 | 86.05                  | 84                    | 159.04                | 84                   | 159.04                | 161.92          | 803,555.89             | 803,555.89              |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 112,980.75  
 2015 Sew. Ac. = 20,730.07  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,791,605.61 \$8,645,064.67  
 + Engr. ROW, financ., Conting. (1.5x) = \$14,687,408.42 \$12,967,597.00

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROF. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(8/3)]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [D<sup>4.75</sup>(8/3) x s<sup>0.5</sup>(1/2) / 1629.6 x n] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [D<sup>4.75</sup>(8/3) x s<sup>0.5</sup>(1/2) / 1629.6 x n] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BFx Area, and Constant  
 6.0 MGD Intel Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$6,893,955.36 \$5,944,277.84  
 Estim. Cost Below R.H. Meter = \$2,897,650.25 \$2,700,786.83  
 Percent R.H. Cost of Total Line = 29.50% 31.24%  
 Estim. Richland Hills Cost Share = \$4,346,475.37 \$4,051,180.25

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OPTION 2 - YEAR 2020

BIG FOSSIL SEWER STUDY

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 68.26                  | 84                    | 69.57                 | 78                    | 57.09                 | 279.20          | \$70,657.50            | \$80,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 69.15                  | 84                    | 72.04                 | 78                    | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 69.15                  | 84                    | 72.06                 | 78                    | 59.13                 | -11.44          | 50,568.60              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 69.15                  | 84                    | 72.06                 | 78                    | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 69.15                  | 84                    | 72.04                 | 78                    | 59.13                 | 133.46          | 47,977.72              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 69.59                  | 84                    | 72.74                 | 78                    | 59.89                 | 84.73           | 602,666.92             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 69.73                  | 84                    | 72.93                 | 78                    | 59.85                 | 95.52           | 276,395.52             | 238,320.62             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 69.89                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 298,948.02             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 70.02                  | 84                    | 87.96                 | 78                    | 72.19                 | 101.22          | 250,072.13             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 70.14                  | 84                    | 88.07                 | 78                    | 72.28                 | 106.10          | 387,230.81             | 333,887.79             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 70.19                  | 84                    | 88.14                 | 78                    | 72.33                 | 101.04          | 212,665.22             | 183,369.50             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 70.22                  | 84                    | 88.19                 | 78                    | 72.38                 | 104.10          | 174,565.59             | 150,518.29             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000564                   | 70.33                  | 84                    | 88.23                 | 78                    | 72.41                 | 107.60          | 176,643.75             | 152,310.17             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 88.89                  | 90                    | 106.20                | 84                    | 88.35                 | 120.25          | 512,913.65             | 446,604.78             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 88.87                  | 90                    | 106.22                | 84                    | 88.35                 | 120.25          | 405,559.63             | 353,287.50             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 88.81                  | 90                    | 106.33                | 84                    | 88.46                 | 120.12          | 549,493.54             | 478,669.93             |
| M402A/0072+77         | M402A/0065+95           | 808           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000570                   | 88.81                  | 90                    | 106.74                | 84                    | 88.60                 | 121.03          | 642,533.69             | 559,718.24             |
| M402A/0080+78         | M402A/0072+77           | 400           | 54               | 32.23                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 88.82                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.99             | 277,088.24             |
| M402A/0085+50         | M402A/0080+78           | 151           | 54               | 29.26                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 88.84                  | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81             |
| M402A/0086+56         | M402A/0085+50           | 168           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 88.84                  | 90                    | 106.97                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06             |
| M402A/0088+51         | M402A/0086+56           | 820           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 88.89                  | 90                    | 107.21                | 84                    | 88.99                 | 120.91          | 652,076.27             | 568,030.89             |
| M402A/0086+65         | M402A/0088+51           | 711           | 54               | 21.89                  | 31.72                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 89.14                  | 90                    | 107.42                | 84                    | 89.37                 | 111.26          | 565,397.84             | 492,524.34             |
| M402A/0103+76         | M402A/0086+65           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 89.31                  | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28              |
| M402A/0105+11         | M402A/0103+76           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 89.54                  | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52             |
| M402A/0109+91         | M402A/0105+11           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 89.68                  | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61             |
| M402A/0113+81         | M402A/0109+91           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 105.17                 | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 552,674.40             | 481,440.81             |
| M402A/0117+43         | M402A/0113+81           | 126           | 54               | 41.74                  | 42.20                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 105.19                 | 90                    | 108.25                | 84                    | 90.06                 | 131.80          | 100,197.09             | 87,282.79              |
| M402A/0120+25         | M402A/0117+43           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 105.21                 | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 213,357.94             |
| M402B/0123+40         | M402A/0120+25           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 90.11                  | 90                    | 191.16                | 64                    | 159.04                | 190.44          | 922,449.36             | 803,555.89             |
| M402B/0136+74         | M402B/0123+40           |               |                  |                        |                       |                       |                |                |                       |                            |                        |                       |                       |                       |                       |                 |                        |                        |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2020 Eq. Pop. = 122,586.00  
 2020 Sew. Ac. = 21,884.42  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$10,670,904.84 \$9,261,419.89  
 + Engr., ROW, F.H.I., Conting. (1.5x) = \$16,006,357.26 \$13,892,129.83

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

NOTES:  
 UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING PIPE DIAMETER IN INCHES  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FL. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FL. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FL. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN FL. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQUATION: S = [1629.6 x n x MGD^1.54 / D^4.75] ^ (1/2), n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGD = [D^4.75 / 1629.6 x n] / 1.54  
 PROPOSED REPLACEMENT PIPE CAPACITY IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [D^4.75 / 1629.6 x n] / 1.54  
 PROPOSED PARALLEL PIPE CAPACITY IN INCHES  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Year 2020 BFX Area, and Constant  
 6.0 MGD Intel Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$7,773,254.59 \$6,762,935.74  
 Estim. Cost Below R.H. Meter = \$2,897,650.25 \$2,498,484.14  
 Percent R.H. Cost of Total Line = 27.15% 26.98%  
 Estim. Richland Hills Cost Share = \$4,346,475.37 \$3,747,726.21

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. P/R.L. P/E (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 59.29                  | 84                    | 69.57                 | 84                    | 69.57                 | 291.68          | \$70,657.50            | \$70,657.50             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 58.75                  | 84                    | 72.04                 | 84                    | 72.04                 | 106.07          | 1,195,635.75           | 1,195,635.75            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 58.75                  | 84                    | 72.06                 | 84                    | 72.06                 | 1.49            | 50,568.60              | 50,568.60               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 58.75                  | 84                    | 72.06                 | 84                    | 72.06                 | 72.06           | 103,908.09             | 103,908.09              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 58.75                  | 84                    | 72.08                 | 84                    | 72.08                 | 146.39          | 47,797.72              | 47,797.72               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 58.96                  | 84                    | 72.74                 | 84                    | 72.74                 | 97.78           | 602,666.92             | 602,666.92              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.65                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 59.05                  | 84                    | 72.93                 | 84                    | 72.93                 | 108.60          | 276,395.52             | 276,395.52              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 59.22                  | 84                    | 87.84                 | 84                    | 87.84                 | 120.23          | 299,948.02             | 299,948.02              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 59.36                  | 84                    | 87.96                 | 84                    | 87.96                 | 116.99          | 250,072.13             | 250,072.13              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.92                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 59.49                  | 84                    | 88.07                 | 84                    | 88.07                 | 121.89          | 387,230.81             | 387,230.81              |
| M402A/0051+91         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 59.55                  | 84                    | 88.14                 | 84                    | 88.14                 | 116.85          | 212,665.22             | 212,665.22              |
| M402A/0054+21         | M402A/0051+91           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 59.55                  | 84                    | 88.19                 | 84                    | 88.19                 | 119.91          | 174,565.59             | 174,565.59              |
| M402A/0060+68         | M402A/0054+21           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 59.74                  | 84                    | 88.23                 | 84                    | 88.23                 | 123.42          | 176,643.75             | 176,643.75              |
| M402A/0061+67         | M402A/0060+68           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 93.63                  | 90                    | 106.20                | 84                    | 88.35                 | 118.07          | 512,913.65             | 446,804.78              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.61                 | 88.37                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 93.39                  | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,559.63             | 353,287.50              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 93.28                  | 90                    | 106.50                | 84                    | 88.60                 | 120.12          | 549,493.54             | 478,669.93              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 93.15                  | 90                    | 106.74                | 84                    | 88.80                 | 121.03          | 642,533.69             | 559,718.24              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 93.10                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.99             | 277,088.24              |
| M402A/0088+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 93.10                  | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81              |
| M402A/0096+65         | M402A/0088+56           | 168           | 54               | 24.42                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 93.16                  | 90                    | 107.21                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 93.66                  | 90                    | 107.42                | 84                    | 89.42                 | 142.89          | 565,397.84             | 492,524.34              |
| M402A/0109+91         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 93.74                  | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28               |
| M402A/0113+81         | M402A/0109+91           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 93.85                  | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52              |
| M402A/0120+25         | M402A/0113+81           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 94.04                  | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61              |
| M402A/0120+25         | M402A/0120+25           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 122.22                 | 90                    | 108.19                | 84                    | 90.06                 | 130.79          | 552,674.40             | 481,440.81              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 122.17                 | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 87,282.79               |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 86                    | 0.001829                   | 99.30                  | 90                    | 191.16                | 84                    | 159.04                | 190.44          | 922,449.36             | 803,555.89              |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 156,708.49  
 2050 Sew. Ac. = 24,835.40  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$10,670,904.84 \$9,791,605.61  
 + Engr., ROW, -manc., Conting. (1.5x) = \$16,006,357.26 \$14,687,408.42

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 LENGTH  
 Length of Pipe Segment in Feet  
 EXIST DIA.  
 Existing Pipe Diameter in Inches  
 EXIST PIPE CAP  
 Existing Gravity Flow Capacity of Pipe in MGD based on FL Worth Master Plan Data using Colbrook-White equations  
 2000 MODEL FLOW  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 2020 MODEL FLOW  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 COEF. "A", COEF. "B"  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 MODEL PROP DIA.  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 DESIGN FLOW  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [ (1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}) ]^{1/2}$ ,  $n = 0.0145$   
 PROP. REPL. PIPE  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 REPL. PIPE CAP.  
 Proposed Replacement Pipe Capacity in Inches  
 PARL. PIPE CAP.  
 Proposed Parallel Pipe Capacity in MGD =  $[ D^{4.75} / (1629.6 \times n \times \text{MGD}^{1.54}) ]^{1/2}$ ,  $n = 0.0145$   
 BOTH CAP.  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 ESTIM. REPL. PIPE COST  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 ESTIM. PARL. PIPE COST  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BFV Area, and Constant  
 6.0 MGD Inlet Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Haltom City  
 to this line. The Marine Creek Area is not included in  
 this model

Estim. Cost Above R.H. Meter = \$7,773,254.59 \$6,893,955.36  
 Estim. Cost Below R.H. Meter = \$2,897,650.25 \$2,897,650.25  
 Percent R.H. Cost of Total Line = 27.15% 29.59%  
 Estim. Richland Hills Cost Share = \$4,346,475.37 \$4,346,475.37

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A0000+50          | M280A00304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 54.38                  | 90                    | 83.62                 | 84                    | 69.57                 | 291.68          | \$81,111.93            | \$70,657.50             |
| M402A0020+17          | M402A0000+50            | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 53.07                  | 90                    | 86.59                 | 84                    | 72.04                 | 106.07          | 1,372,541.04           | 1,195,635.75            |
| M402A0020+90          | M402A0020+17            | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 53.06                  | 90                    | 86.61                 | 84                    | 72.06                 | 1.49            | 58,050.89              | 50,568.60               |
| M402A0022+40          | M402A0020+90            | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 53.06                  | 90                    | 86.61                 | 84                    | 72.06                 | 146.39          | 119,289.23             | 103,908.09              |
| M402A0023+09          | M402A0022+40            | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 53.06                  | 90                    | 86.64                 | 84                    | 72.08                 | 97.78           | 54,869.83              | 47,797.72               |
| M402A0028+40          | M402A0023+09            | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 53.15                  | 90                    | 87.43                 | 84                    | 72.74                 | 108.60          | 691,637.02             | 602,666.92              |
| M402A0032+40          | M402A0028+40            | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 53.21                  | 90                    | 87.66                 | 84                    | 72.93                 | 317,290.77      | 276,395.52             |                         |
| M402A0036+79          | M402A0032+40            | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 53.38                  | 90                    | 105.58                | 84                    | 87.84                 | 344,328.08      | 299,948.02             |                         |
| M402A0040+28          | M402A0036+79            | 381           | 54               | 29.03                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 53.52                  | 90                    | 105.73                | 84                    | 87.96                 | 287,072.60      | 250,072.13             |                         |
| M402A0045+95          | M402A0040+28            | 559           | 54               | 33.82                  | 18.97                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 53.67                  | 90                    | 105.86                | 84                    | 88.07                 | 444,525.17      | 387,230.81             |                         |
| M402A0049+00          | M402A0045+95            | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 53.73                  | 90                    | 105.94                | 84                    | 88.14                 | 200,394.17      | 174,565.59             |                         |
| M402A0051+91          | M402A0049+00            | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 53.72                  | 90                    | 106.00                | 84                    | 88.19                 | 116.85          | 212,665.22             |                         |
| M402A0054+21          | M402A0051+91            | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 53.94                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             |                         |
| M402A0060+68          | M402A0054+21            | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 96.17                  | 90                    | 106.22                | 84                    | 88.35                 | 118.07          | 512,913.65             |                         |
| M402A0061+67          | M402A0060+68            | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 96.10                  | 90                    | 106.22                | 84                    | 88.37                 | 120.25          | 68,578.34              |                         |
| M402A0065+95          | M402A0061+67            | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 95.85                  | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,559.63             |                         |
| M402A0072+77          | M402A0065+95            | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 95.48                  | 90                    | 106.74                | 84                    | 88.60                 | 120.12          | 549,493.54             |                         |
| M402A0080+78          | M402A0072+77            | 808           | 54               | 32.23                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 95.40                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 642,533.69             |                         |
| M402A0085+50          | M402A0080+78            | 400           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 95.39                  | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             |                         |
| M402A0086+56          | M402A0085+50            | 151           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 95.45                  | 90                    | 106.97                | 84                    | 88.99                 | 113.41          | 133,596.11             |                         |
| M402A0088+51          | M402A0086+56            | 168           | 54               | 31.72                  | 31.56                 | 89.17                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 95.78                  | 90                    | 107.21                | 84                    | 89.17                 | 120.91          | 652,076.27             |                         |
| M402A0096+65          | M402A0088+51            | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 95.98                  | 90                    | 107.42                | 84                    | 89.37                 | 111.26          | 565,397.84             |                         |
| M402A0103+76          | M402A0096+65            | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 96.16                  | 90                    | 107.78                | 84                    | 89.42                 | 142.89          | 107,354.02             |                         |
| M402A0105+11          | M402A0103+76            | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 96.38                  | 90                    | 107.89                | 84                    | 89.67                 | 114.75          | 641,738.48             |                         |
| M402A0109+91          | M402A0105+11            | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000586                   | 131.46                 | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 274,349.16             |                         |
| M402A0113+81          | M402A0109+91            | 625           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 131.45                 | 90                    | 108.25                | 84                    | 90.01                 | 130.79          | 552,674.40             |                         |
| M402A0117+43          | M402A0113+81            | 195           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 131.45                 | 90                    | 108.25                | 84                    | 90.17                 | 127.14          | 244,926.21             |                         |
| M402A0120+25          | M402A0117+43            | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 131.36                 | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             |                         |
| M402B0123+40          | M402A0120+25            | 1180          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 104.26                 | 90                    | 191.16                | 84                    | 159.04                | 190.44          | 922,449.36             |                         |

DESIGN CONDITION: OPTION NO. 2  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 175,228.27  
 2070 Sew. Ac. = 26,431.99  
 + Engr., ROW, Fin. inc., Conting. (1.5x) = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,240,363.58 \$9,791,605.61  
 \$16,860,545.37 \$14,687,408.42

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows. Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan Using Manning's Eq. s = [ 1629.6 x n x MGD<sup>0.33</sup> / D<sup>2.48</sup> ]<sup>1/2</sup>, n = 0.0145  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq. s = [ 1629.6 x n x MGD<sup>0.33</sup> / D<sup>2.48</sup> ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>2.48</sup> / (1629.6 x n) ]<sup>1/2</sup>  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>2.48</sup> / (1629.6 x n) ]<sup>1/2</sup>  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 2  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Hallom City,  
 Richland Hills, year 2020 BFX Area, and Constant  
 6.0 MGD Inlet Facility Flow. This Option also includes  
 diversion of Little Fossil Creek Area in Hallom City  
 to this line. The Marine Creek Area is not included in  
 this model  
 Estim. Cost Above R.H. Meter = \$7,913,979.37 \$6,893,955.36  
 Estim. Cost Below R.H. Meter = \$3,326,384.21 \$2,897,650.25  
 Percent R.H. Cost of Total Line = 29.59% 29.59%  
 Estim. Richland Hills Cost Share = \$4,989,576.32 \$4,346,475.37

**OPTION 3**

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+10         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 40.23                  | 72                    | 46.12                 | 54                    | 21.41                 | 243.52          | \$51,911.63            | \$29,200.29            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 40.52                  | 72                    | 47.76                 | 54                    | 22.18                 | 56.21           | 878,426.26             | 494,114.77             |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 40.52                  | 72                    | 47.77                 | 54                    | 22.18                 | -48.39          | 37,152.44              | 20,898.25              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 40.52                  | 72                    | 47.77                 | 54                    | 22.18                 | 22.18           | 76,340.64              | 42,941.61              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 40.53                  | 72                    | 47.79                 | 54                    | 22.19                 | 96.50           | 35,116.69              | 19,753.14              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 40.77                  | 72                    | 48.22                 | 54                    | 22.39                 | 47.43           | 442,775.69             | 249,061.33             |
| M402A/0032+40         | M402A/0028+40           | 389           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0091         | 90                    | 0.000385                   | 40.85                  | 72                    | 48.25                 | 54                    | 22.45                 | 58.12           | 203,066.09             | 114,224.68             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 40.96                  | 66                    | 46.17                 | 54                    | 27.04                 | 59.43           | 185,171.99             | 123,958.11             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 41.14                  | 66                    | 46.24                 | 54                    | 27.08                 | 56.11           | 154,381.27             | 103,346.14             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 31.88                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 41.18                  | 66                    | 46.33                 | 54                    | 27.11                 | 55.84           | 131,288.22             | 87,887.16              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 31.72                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 41.18                  | 66                    | 46.33                 | 54                    | 27.11                 | 55.84           | 131,288.22             | 87,887.16              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 31.72                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000564                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 41.18                  | 66                    | 46.36                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 41.18                  | 66                    | 46.36                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000567                   | 41.18                  | 66                    | 46.36                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.72                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0103+76         | M402A/0096+65           | 135           | 54               | 21.89                  | 31.63                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0105+11         | M402A/0103+76           | 807           | 54               | 35.47                  | 31.77                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0109+91         | M402A/0105+11           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0113+81         | M402A/0109+91           | 695           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000586                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0117+43         | M402A/0113+81           | 126           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402A/0120+25         | M402A/0117+43           | 308           | 54               | 41.74                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 41.28                  | 66                    | 46.38                 | 54                    | 27.15                 | 58.87           | 107,675.53             | 72,141.90              |
| M402B/0123+40         | M402A/0120+25           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 59.00                  | 78                    | 130.52                | 60                    | 64.84                 | 96.24           | 692,861.97             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 90,518.25  
 2000 Sew. Ac. = 15,473.77  
 Constant Intel Flow = 0.00  
 TOTAL ESTIM. CONST. COST = \$7,219,929.88  
 + Engr., RO V, Financ., Conting. (1.5%) = \$10,929,894.82 \$8,616,342.28

NOTES:  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BF X Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Haltom City. The Marine Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model

Estim. Cost Above R.H. Meter = \$4,916,531.41 \$3,053,367.48  
 Estim. Cost Below R.H. Meter = \$2,251,486.84 \$1,328,327.08  
 Percent R.H. Cost of Total Line = 20.79% 20.08%  
 Estim. Richland Hills Cost Share = \$0.00 \$0.00

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. P.A.R.L. (m) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|--------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 45.68                  | 72                    | 46.12                 | 60                 | 28.36                 | 250.47          | \$51,911.63            | \$36,049.75             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 46.15                  | 72                    | 47.76                 | 60                 | 29.37                 | 63.40           | 878,426.26             | 610,018.24              |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 46.16                  | 72                    | 47.77                 | 60                 | 29.38                 | -41.19          | 37,152.44              | 25,800.31               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.62                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 46.16                  | 72                    | 47.77                 | 60                 | 29.38                 | 29.38           | 76,340.64              | 53,014.33               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 46.17                  | 72                    | 47.79                 | 60                 | 29.39                 | 103.70          | 35,116.69              | 24,386.59               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 46.46                  | 72                    | 48.22                 | 60                 | 29.65                 | 54.69           | 442,775.69             | 307,483.12              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 46.46                  | 72                    | 48.22                 | 60                 | 29.65                 | 54.69           | 442,775.69             | 307,483.12              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 46.68                  | 72                    | 58.23                 | 54                 | 27.04                 | 59.43           | 220,369.97             | 123,958.11              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 46.77                  | 72                    | 58.31                 | 54                 | 27.08                 | 56.11           | 183,726.47             | 103,346.14              |
| M402A/0045+95         | M402A/0040+28           | 359           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 46.87                  | 72                    | 58.39                 | 54                 | 27.11                 | 60.93           | 284,496.11             | 160,029.06              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 46.91                  | 72                    | 58.43                 | 54                 | 27.13                 | 55.84           | 156,243.84             | 87,887.16               |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 46.92                  | 72                    | 58.46                 | 54                 | 27.15                 | 58.87           | 128,252.27             | 72,141.90               |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 47.02                  | 72                    | 58.49                 | 54                 | 27.16                 | 62.35           | 129,779.08             | 73,000.73               |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 63.07                  | 78                    | 72.51                 | 66                 | 46.44                 | 76.16           | 385,255.15             | 275,833.57              |
| M402A/0060+68         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 63.05                  | 78                    | 72.52                 | 66                 | 46.45                 | 78.33           | 59,132.19              | 42,337.24               |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 62.99                  | 78                    | 72.60                 | 66                 | 46.50                 | 78.89           | 304,620.35             | 218,100.96              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 62.97                  | 78                    | 72.71                 | 66                 | 46.57                 | 78.09           | 412,730.71             | 295,505.42              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 62.96                  | 78                    | 72.88                 | 66                 | 46.68                 | 78.91           | 482,614.20             | 345,540.34              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 62.96                  | 78                    | 72.95                 | 66                 | 46.73                 | 82.40           | 238,917.92             | 171,059.58              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 62.97                  | 78                    | 72.99                 | 66                 | 46.75                 | 76.01           | 90,191.51              | 64,574.99               |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 63.01                  | 78                    | 73.03                 | 66                 | 46.78                 | 71.20           | 100,345.53             | 71,845.02               |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 63.20                  | 78                    | 73.20                 | 66                 | 46.88                 | 78.60           | 489,781.73             | 350,672.13              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 63.34                  | 78                    | 73.34                 | 66                 | 46.98                 | 88.87           | 424,676.60             | 304,058.40              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 63.39                  | 78                    | 73.39                 | 66                 | 47.00                 | 100.47          | 80,634.80              | 57,732.61               |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 63.50                  | 78                    | 73.59                 | 66                 | 47.14                 | 72.22           | 482,016.90             | 345,112.69              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 63.62                  | 78                    | 73.66                 | 66                 | 47.18                 | 86.57           | 206,066.71             | 147,538.88              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 77.00                  | 78                    | 73.87                 | 66                 | 47.31                 | 88.09           | 415,119.89             | 297,216.01              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 77.01                  | 78                    | 73.91                 | 66                 | 47.34                 | 89.08           | 75,259.14              | 53,883.77               |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 77.02                  | 78                    | 74.00                 | 66                 | 47.40                 | 84.37           | 183,966.80             | 131,715.87              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 64.59                  | 78                    | 130.52                | 66                 | 83.60                 | 115.00          | 692,861.97             | 496,072.77              |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 96,946.88  
 2005 Sew. Ac. = 16,882.20  
 + Engr., ROW, Financ., Conting. (1.5x) = \$11,927,773.91  
 TOTAL ESTIM. CONST. COST = \$7,951,849.27  
 \$5,460,140.36  
 \$8,190,215.64

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP REPL PIPE  
 REPL PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter, Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient, Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{16/3}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{16/3} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{16/3} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, year 2020 BF-X Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Haltom City. The Marine Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$5,822,963.38 \$4,061,859.10  
 Estim. Cost Below R.H. Meter = \$2,128,885.90 \$1,398,281.26  
 Percent R.H. Cost of Total Line = 26.77% 25.61%  
 Estim. Richland Hills Cost Share = \$3,193,328.85 \$2,097,421.89

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PRC (P. PAR. L. (ft.) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 48.68                  | 76                    | 57.09                 | 60                    | 28.36                 | 250.47          | \$60,924.07            | \$36,049.75             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 49.19                  | 78                    | 59.12                 | 60                    | 29.37                 | 63.40           | 1,030,930.82           | 610,018.24              |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 49.19                  | 78                    | 59.13                 | 60                    | 29.38                 | -41.19          | 43,602.52              | 25,800.31               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 49.19                  | 78                    | 59.13                 | 60                    | 29.38                 | 29.38           | 89,594.22              | 53,014.33               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 49.51                  | 78                    | 59.15                 | 60                    | 29.39                 | 103.70          | 41,213.34              | 24,386.59               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 49.51                  | 78                    | 59.69                 | 60                    | 29.85                 | 54.69           | 519,646.47             | 307,483.12              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 49.75                  | 78                    | 59.85                 | 60                    | 29.85                 | 65.40           | 238,320.62             | 141,018.12              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 49.75                  | 72                    | 58.23                 | 60                    | 35.81                 | 68.20           | 220,369.97             | 153,034.70              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 49.85                  | 72                    | 58.31                 | 60                    | 35.86                 | 64.89           | 183,726.47             | 127,587.82              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 49.94                  | 72                    | 58.39                 | 60                    | 35.90                 | 69.72           | 284,486.11             | 187,566.74              |
| M402A/0051+91         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 49.99                  | 72                    | 58.43                 | 60                    | 35.93                 | 64.64           | 156,243.84             | 108,502.66              |
| M402A/0055+21         | M402A/0051+91           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 50.00                  | 72                    | 58.46                 | 60                    | 35.95                 | 67.67           | 128,252.27             | 89,084.08               |
| M402A/0060+68         | M402A/0055+21           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 50.11                  | 72                    | 58.49                 | 60                    | 35.97                 | 71.16           | 129,779.08             | 90,124.36               |
| M402A/0061+67         | M402A/0060+68           | 64.5          | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 67.24                  | 78                    | 72.51                 | 66                    | 46.44                 | 76.16           | 385,255.15             | 275,833.57              |
| M402A/0063+95         | M402A/0061+67           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 67.22                  | 78                    | 72.52                 | 66                    | 46.45                 | 78.33           | 59,132.19              | 42,337.24               |
| M402A/0072+77         | M402A/0063+95           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 67.15                  | 78                    | 72.60                 | 66                    | 46.50                 | 78.89           | 304,620.35             | 218,100.96              |
| M402A/0085+56         | M402A/0072+77           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000570                   | 67.13                  | 78                    | 72.71                 | 66                    | 46.57                 | 78.09           | 412,730.71             | 295,505.42              |
| M402A/0088+50         | M402A/0085+56           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 67.12                  | 78                    | 72.88                 | 66                    | 46.68                 | 78.91           | 482,614.20             | 345,540.34              |
| M402A/0088+51         | M402A/0088+50           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 67.13                  | 78                    | 72.95                 | 66                    | 46.73                 | 82.40           | 238,917.92             | 171,059.58              |
| M402A/0086+56         | M402A/0088+51           | 168           | 54               | 29.26                  | 31.45                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 67.13                  | 78                    | 72.99                 | 66                    | 46.75                 | 76.01           | 90,191.51              | 64,574.99               |
| M402A/0096+85         | M402A/0086+56           | 820           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 67.17                  | 78                    | 73.03                 | 66                    | 46.78                 | 71.20           | 100,345.53             | 71,845.02               |
| M402A/0103+76         | M402A/0096+85           | 711           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 67.37                  | 78                    | 73.20                 | 66                    | 46.88                 | 78.60           | 489,781.73             | 350,672.13              |
| M402A/0109+91         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 67.52                  | 78                    | 73.34                 | 72                    | 59.25                 | 81.14           | 424,676.60             | 361,854.62              |
| M402A/0113+81         | M402A/0109+91           | 807           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 67.57                  | 78                    | 73.39                 | 72                    | 59.28                 | 112.75          | 80,634.80              | 68,706.57               |
| M402A/0117+43         | M402A/0113+81           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 67.70                  | 78                    | 73.59                 | 72                    | 59.45                 | 84.53           | 482,016.90             | 410,712.63              |
| M402A/0120+25         | M402A/0117+43           | 695           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 67.82                  | 78                    | 73.66                 | 72                    | 59.51                 | 98.90           | 206,066.71             | 175,563.47              |
| M402B/0123+40         | M402A/0120+25           | 126           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 82.09                  | 84                    | 90.01                 | 72                    | 59.67                 | 100.45          | 481,440.81             | 353,711.62              |
| M402B/0136+74         | M402B/0123+40           | 308           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 82.11                  | 84                    | 90.06                 | 72                    | 59.70                 | 101.44          | 87,282.79              | 64,126.14               |
|                       |                         | 1160          | 48               | 36.97                  | 42.20                 | 90.17                 | -0.0001        | 0.0045         | 84                    | 0.000588                   | 82.11                  | 84                    | 90.17                 | 72                    | 59.78                 | 96.75           | 213,357.94             | 156,752.77              |
|                       |                         |               |                  | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 68.86                  | 72                    | 105.43                | 66                    | 83.60                 | 115.00          | 590,367.59             | 495,072.77              |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 103,375.50  
 2010 Sew. Ac. = 17,998.52  
 Constant Intel Flow = 0.00  
 TOTAL ESTIM. CONST. COST = \$8,256,533.24  
 + Engr., ROW, Financ., Conting. (1.5x) = \$12,384,799.86  
 \$5,886,640.66  
 \$8,829,960.98

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A" COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup> ]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D\*(8/3) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D\*(8/3) x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (ft.)

Estim. Cost Above R.H. Meter = \$5,828,204.73  
 Estim. Cost Below R.H. Meter = \$2,428,328.51  
 Percent R.H. Cost of Total Line = 29.41%  
 Estim. Richland Hills Cost Share = \$3,642,492.77  
 \$2,217,569.48

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BF Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Haltom City. The Marine Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model.



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 62.08                  | 84                    | 69.57                 | 78                    | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 63.19                  | 84                    | 72.04                 | 78                    | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 63.20                  | 84                    | 72.06                 | 78                    | 59.13                 | -11.44          | 50,568.60              | 43,602.52              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 0.00                   | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 63.21                  | 84                    | 72.06                 | 78                    | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A/0023+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 63.67                  | 84                    | 72.74                 | 72                    | 47.79                 | 122.10          | 47,797.72              | 35,116.69              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 63.81                  | 84                    | 72.74                 | 72                    | 48.22                 | 73.26           | 60,266.92              | 44,275.69              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | -0.0011        | 0.0091         | 84                    | 0.000358                   | 63.81                  | 78                    | 72.93                 | 72                    | 48.35                 | 84.02           | 276,395.52             | 203,066.09             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 18.92                  | 18.92                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 64.08                  | 78                    | 72.19                 | 72                    | 58.23                 | 90.62           | 298,628.65             | 220,369.97             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 64.20                  | 78                    | 72.28                 | 72                    | 58.31                 | 87.34           | 215,623.42             | 183,726.47             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 64.25                  | 78                    | 72.33                 | 72                    | 58.39                 | 92.21           | 333,887.79             | 284,496.11             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 64.25                  | 78                    | 72.33                 | 72                    | 58.46                 | 87.14           | 183,369.50             | 156,243.84             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 64.28                  | 78                    | 72.38                 | 72                    | 58.46                 | 90.18           | 150,518.29             | 128,252.27             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | -0.0004        | 0.0058         | 84                    | 0.000563                   | 64.38                  | 84                    | 88.35                 | 72                    | 58.57                 | 88.29           | 446,804.78             | 328,264.74             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 79.67                  | 84                    | 88.37                 | 72                    | 58.58                 | 90.46           | 66,579.34              | 50,384.82              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | -0.0004        | 0.0059         | 84                    | 0.000565                   | 79.66                  | 84                    | 88.46                 | 72                    | 58.58                 | 90.26           | 478,669.93             | 351,675.87             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 79.66                  | 84                    | 88.80                 | 72                    | 58.74                 | 91.10           | 559,718.24             | 411,221.56             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 35.67                  | 31.45                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 79.68                  | 84                    | 88.89                 | 72                    | 58.87                 | 94.60           | 277,088.24             | 203,575.03             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 29.26                  | 31.43                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 79.70                  | 84                    | 88.94                 | 72                    | 58.96                 | 88.22           | 104,600.81             | 76,849.57              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 24.42                  | 31.45                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 79.75                  | 84                    | 88.99                 | 72                    | 59.00                 | 83.42           | 116,377.06             | 85,501.51              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 31.72                  | 31.56                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 79.98                  | 84                    | 89.19                 | 78                    | 59.13                 | 90.85           | 568,030.89             | 417,328.82             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 21.89                  | 31.63                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 80.15                  | 84                    | 89.37                 | 78                    | 73.34                 | 95.23           | 492,524.34             | 424,676.60             |
| M402A/0105+11         | M402A/0096+65           | 711           | 54               | 53.47                  | 31.66                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 80.21                  | 84                    | 89.42                 | 78                    | 73.39                 | 92.86           | 93,517.28              | 80,634.80              |
| M402A/0109+91         | M402A/0105+11           | 135           | 54               | 25.08                  | 31.70                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 80.37                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0113+81         | M402A/0109+91           | 807           | 54               | 39.39                  | 31.77                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 80.50                  | 84                    | 89.76                 | 78                    | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0117+43         | M402A/0113+81           | 345           | 54               | 40.78                  | 42.22                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 93.28                  | 84                    | 90.01                 | 78                    | 73.87                 | 114.65          | 481,440.81             | 415,119.89             |
| M402A/0120+25         | M402A/0117+43           | 695           | 54               | 41.74                  | 42.22                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 93.31                  | 84                    | 90.06                 | 78                    | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 93.33                  | 84                    | 90.17                 | 78                    | 74.00                 | 110.97          | 213,357.94             | 183,966.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 80.05                  | 84                    | 159.04                | 78                    | 130.52                | 161.92          | 803,555.89             | 692,861.97             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 112,980.75  
 2015 Sew. Ac. = 20,730.07  
 Constant Intel Flow = 0.00  
 TOTAL ESTIM CONST. COST = \$9,584,817.91 \$7,753,840.75  
 + Engr., ROW, Financ., Conting. (1.5x) = \$14,377,226.86 \$11,630,761.12

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(8/3) ]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.12</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.12</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Hallom City,  
 Richland Hills, year 2020 BFX Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Hallom City. The Marine Creek Area is included, but  
 the 6 MGD Intel Facility flow is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$6,762,935.74 \$5,443,734.19  
 Estim. Cost Below R.H. Meter = \$2,821,882.17 \$2,310,106.55  
 Percent R.H. Cost of Total Line = 29.44%  
 Estirn., Richland Hills Cost Share = \$4,232,823.25 \$3,465,159.83

01/13/2000, 3:23 PM  
 COFW Option 3.xls  
 Page 1 of 1

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROF. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                   | 0.000350                   | 62.26                  | 84                    | 69.57                 | 72                    | 46.12                 | 268.23          | \$70,657.50            | \$51,911.63            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 63.15                  | 84                    | 72.04                 | 72                    | 47.76                 | 81.79           | 1,195,635.75           | 878,426.26             |
| M402A/0020+90         | M402A/0020+17           | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 63.15                  | 84                    | 72.06                 | 72                    | 47.77                 | -22.80          | 50,968.60              | 37,152.44              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 63.15                  | 84                    | 72.06                 | 72                    | 47.77                 | 47.77           | 103,908.09             | 76,340.64              |
| M402A/0023+09         | M402A/0022+40           | 68            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 63.17                  | 84                    | 72.08                 | 72                    | 47.79                 | 122.10          | 47,797.72              | 35,116.69              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 63.59                  | 84                    | 72.74                 | 72                    | 48.22                 | 73.26           | 602,666.92             | 442,775.69             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0091         | 90                   | 0.000385                   | 63.73                  | 84                    | 72.93                 | 72                    | 48.35                 | 84.02           | 276,395.52             | 203,066.09             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 63.89                  | 84                    | 87.94                 | 72                    | 58.23                 | 90.62           | 299,948.02             | 220,369.97             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 64.02                  | 84                    | 87.96                 | 72                    | 58.31                 | 87.34           | 250,072.13             | 183,726.47             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 64.14                  | 84                    | 88.07                 | 72                    | 58.39                 | 92.21           | 387,230.81             | 284,496.11             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 64.19                  | 84                    | 88.14                 | 72                    | 58.43                 | 87.14           | 212,665.22             | 156,243.84             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 64.22                  | 84                    | 88.19                 | 72                    | 58.46                 | 90.18           | 174,565.59             | 128,252.27             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000563                   | 64.33                  | 84                    | 88.23                 | 72                    | 58.49                 | 93.68           | 176,643.75             | 129,779.08             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 82.89                  | 84                    | 88.35                 | 72                    | 58.57                 | 88.29           | 446,804.78             | 328,264.74             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000565                   | 82.87                  | 84                    | 88.37                 | 72                    | 58.58                 | 90.46           | 68,579.34              | 50,384.82              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 82.81                  | 84                    | 88.46                 | 72                    | 58.64                 | 91.03           | 353,287.50             | 259,558.17             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 82.80                  | 84                    | 88.60                 | 72                    | 58.74                 | 90.26           | 478,669.93             | 351,675.87             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 82.81                  | 84                    | 88.80                 | 72                    | 58.87                 | 91.10           | 559,718.24             | 411,221.56             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 82.82                  | 84                    | 88.89                 | 72                    | 58.93                 | 94.60           | 277,088.24             | 203,575.03             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                   | 0.000572                   | 82.84                  | 84                    | 88.94                 | 72                    | 58.96                 | 88.22           | 104,600.81             | 76,849.57              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                   | 0.000573                   | 82.89                  | 84                    | 88.99                 | 72                    | 58.99                 | 113.41          | 116,377.06             | 86,377.06              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 83.14                  | 84                    | 89.19                 | 72                    | 59.01                 | 120.91          | 568,030.89             | 568,030.89             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000577                   | 83.31                  | 84                    | 89.37                 | 72                    | 59.06                 | 111.26          | 492,524.34             | 492,524.34             |
| M402A/0109+11         | M402A/0103+76           | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 83.38                  | 84                    | 89.42                 | 72                    | 59.07                 | 142.89          | 93,517.28              | 93,517.28              |
| M402A/0113+81         | M402A/0109+11           | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 83.54                  | 84                    | 89.67                 | 72                    | 59.14                 | 114.75          | 559,025.52             | 559,025.52             |
| M402A/0117+43         | M402A/0113+81           | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 83.68                  | 84                    | 89.76                 | 72                    | 59.15                 | 129.15          | 238,988.61             | 238,988.61             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 99.19                  | 84                    | 90.01                 | 72                    | 60.01                 | 130.79          | 481,440.81             | 481,440.81             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 99.19                  | 84                    | 90.06                 | 72                    | 60.01                 | 131.80          | 87,282.79              | 87,282.79              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001829                   | 84.21                  | 84                    | 159.04                | 78                    | 130.52                | 161.92          | 213,357.94             | 213,357.94             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2020 Eq. Pop. = 122,586.00  
 2020 Sew. Ac. = 21,884.42  
 Constant Intel Flow = 0.00  
 TOTAL ESTIM. CONST. COST = \$9,791,605.61 \$8,052,584.17  
 + Engr., ROW, Financ., Conting. (1.5x) = \$14,687,408.42 \$12,078,891.26

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 LENGTH  
 Length of Pipe Segment in Feet  
 EXIST DIA.  
 Existing Pipe Diameter in Inches  
 EXIST PIPE CAP  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 2000 MODEL FLOW  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 2020 MODEL FLOW  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 COEF. "A", COEF. "B"  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 MODEL PROP. DIA.  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 MODEL H.G. SLOPE  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 DESIGN FLOW  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 PROP. REPL. PIPE  
 Proposed Replacement Pipe Capacity in Inches  
 REPL. PIPE CAP.  
 Proposed Replacement Pipe Capacity in MGD  
 PARL. PIPE CAP.  
 Proposed Parallel Pipe Capacity in Inches  
 PARL. PIPE CAP.  
 Proposed Parallel Pipe Capacity in MGD  
 BOTH CAP.  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 ESTIM. REPL. PIPE COST  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 ESTIM. PARL. PIPE COST  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Year 2020 BFX Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Haltom City. The Marine Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model.  
 Estim. Cost Above R.H. Meter = \$6,893,955.36 \$5,923,708.28  
 Estim. Cost Below R.H. Meter = \$2,897,650.25 \$2,128,885.90  
 Percent R.H. Cost of Total Line = 29.59% 26.44%  
 Estim. Richland Hills Cost Share = \$4,346,475.37 \$3,193,328.85

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. PIPE CAP. (MGD) | PROF. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 53.29                  | 90                    | 83.62                 | 78                    | 57.09                 | 279.20          | \$81,111.93            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.75                  | 90                    | 86.59                 | 78                    | 59.12                 | 93.15           | 1,372,541.04           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | 70.57                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.75                  | 90                    | 86.61                 | 78                    | 59.13                 | -11.44          | 58,050.69              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 52.75                  | 90                    | 86.61                 | 78                    | 59.13                 | 59.13           | 119,282.25             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 52.75                  | 90                    | 86.61                 | 78                    | 59.15                 | 133.46          | 54,869.83              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 52.96                  | 90                    | 87.43                 | 72                    | 48.35                 | 73.26           | 602,666.92             | 442,775.69             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 53.05                  | 90                    | 87.66                 | 72                    | 48.35                 | 84.02           | 276,395.52             | 203,066.09             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.82                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 53.22                  | 84                    | 87.84                 | 72                    | 58.23                 | 90.62           | 299,948.02             | 220,369.97             |
| M402A/0040+28         | M402A/0036+79           | 559           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 53.36                  | 84                    | 87.96                 | 72                    | 58.31                 | 87.34           | 250,072.13             | 183,726.47             |
| M402A/0045+95         | M402A/0040+28           | 307           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 53.49                  | 84                    | 88.07                 | 72                    | 58.39                 | 92.21           | 387,230.81             | 284,496.11             |
| M402A/0049+00         | M402A/0045+95           | 252           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 53.55                  | 84                    | 88.14                 | 72                    | 58.43                 | 87.14           | 212,665.22             | 156,243.84             |
| M402A/0051+91         | M402A/0049+00           | 361           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 53.55                  | 84                    | 88.19                 | 72                    | 58.46                 | 90.18           | 174,565.59             | 128,252.27             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 53.74                  | 84                    | 88.23                 | 72                    | 58.49                 | 93.68           | 176,643.75             | 129,779.08             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 87.63                  | 84                    | 88.35                 | 72                    | 58.57                 | 88.29           | 446,804.78             | 328,264.74             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 87.75                  | 84                    | 88.37                 | 72                    | 58.58                 | 90.46           | 68,579.34              | 50,384.82              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 87.39                  | 84                    | 88.46                 | 72                    | 58.64                 | 91.03           | 353,287.50             | 259,558.17             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 87.28                  | 84                    | 88.60                 | 72                    | 58.74                 | 90.26           | 478,669.93             | 351,675.87             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 87.15                  | 84                    | 88.80                 | 72                    | 58.87                 | 91.10           | 559,718.24             | 411,221.56             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 87.10                  | 84                    | 88.89                 | 72                    | 58.93                 | 94.60           | 277,088.24             | 203,575.03             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 87.16                  | 84                    | 88.94                 | 72                    | 58.96                 | 88.22           | 104,600.81             | 76,849.57              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 87.46                  | 84                    | 89.19                 | 72                    | 58.99                 | 113.41          | 116,377.06             | 86,377.06              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 87.66                  | 84                    | 89.19                 | 72                    | 58.96                 | 120.91          | 568,030.89             | 568,030.89             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 87.66                  | 84                    | 89.37                 | 72                    | 58.96                 | 111.26          | 492,524.34             | 492,524.34             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 87.74                  | 84                    | 89.42                 | 72                    | 58.96                 | 112.69          | 93,517.28              | 55,517.28              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 87.85                  | 84                    | 89.67                 | 72                    | 58.96                 | 114.75          | 559,025.52             | 559,025.52             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.61                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 88.04                  | 84                    | 89.67                 | 72                    | 58.96                 | 129.15          | 238,988.61             | 238,988.61             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 116.22                 | 84                    | 90.01                 | 72                    | 58.96                 | 130.79          | 481,440.81             | 481,440.81             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 116.22                 | 84                    | 90.06                 | 72                    | 58.96                 | 131.80          | 87,282.79              | 87,282.79              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0001        | 0.0034         | 84                    | 0.000588                   | 116.17                 | 84                    | 90.17                 | 72                    | 58.96                 | 127.14          | 213,357.94             | 213,357.94             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 93.30                  | 84                    | 159.04                | 78                    | 130.52                | 161.92          | 803,555.89             | 692,861.97             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 156,708.49  
 2050 Sew. Ac. = 24,835.40  
 Constant Inlet Flow = 0.00  
 TOTAL ESTIM. CONST. COST = \$10,008,893.68  
 + Engr., ROW, Financ., Conting. (1.5x) = \$15,013,340.52  
 \$12,359,867.22

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn. s = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>0.83</sup> ]<sup>0.2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe Capacity in Inches  
 Proposed Parallel Pipe Capacity in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>0.83</sup> x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>0.83</sup> x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, year 2020 BF-A Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Haltom City. The Marime Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model.

Estim. Cost Above R H Meter = \$6,893,955.36  
 Estim. Cost Below R H Meter = \$3,114,938.32  
 Percent R H. Cost of Total Line = 31.12%  
 Estim. Richland Hills Cost Share = \$4,672,407.48  
 \$5,923,708.28  
 \$2,316,203.20  
 28.11%  
 \$3,474,304.80

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL DIA. (in) | MODEL SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PAR. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------|-----------------------|------------------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90              | 0.000350              | 48.38                  | 90                    | 83.62                 | 78                   | 57.09                 | 279.20          | \$81,111.93            | \$60,924.07            |
| M402A/0000+17         | M402A/0000+17           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90              | 0.000375              | 47.07                  | 90                    | 86.59                 | 78                   | 58.12                 | 93.15           | 1,372,541.04           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+10           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90              | 0.000375              | 47.06                  | 90                    | 86.61                 | 78                   | 59.13                 | -11.44          | 58,050.69              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90              | 0.000375              | 47.06                  | 90                    | 86.61                 | 78                   | 59.13                 | 119,282.25      | 89,594.22              |                        |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90              | 0.000376              | 47.06                  | 90                    | 86.64                 | 78                   | 59.15                 | 133.46          | 54,869.83              | 41,213.34              |
| M402A/0028+40         | M402A/0028+40           | 399           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90              | 0.000383              | 47.15                  | 90                    | 87.43                 | 78                   | 59.69                 | 84.73           | 691,837.02             | 519,646.47             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90              | 0.000385              | 47.21                  | 90                    | 87.66                 | 78                   | 59.85                 | 95.52           | 317,290.77             | 238,320.62             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 90              | 0.000558              | 47.38                  | 90                    | 105.58                | 78                   | 72.09                 | 104.48          | 344,328.08             | 258,628.65             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 90              | 0.000561              | 47.67                  | 90                    | 105.73                | 78                   | 72.19                 | 101.22          | 287,072.60             | 215,623.42             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 90              | 0.000562              | 47.73                  | 90                    | 105.86                | 78                   | 72.28                 | 106.10          | 444,525.17             | 333,887.79             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84              | 0.000562              | 47.73                  | 84                    | 105.86                | 78                   | 72.33                 | 101.04          | 212,665.22             | 183,369.50             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84              | 0.000563              | 47.72                  | 84                    | 88.19                 | 78                   | 72.38                 | 104.10          | 174,565.59             | 150,518.29             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84              | 0.000564              | 90.17                  | 84                    | 88.23                 | 78                   | 72.41                 | 107.60          | 152,310.17             | 121,730.71             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84              | 0.000565              | 90.10                  | 84                    | 88.37                 | 78                   | 72.52                 | 104.40          | 446,804.78             | 385,255.15             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84              | 0.000566              | 89.85                  | 84                    | 88.46                 | 78                   | 72.50                 | 104.89          | 68,579.34              | 59,132.19              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84              | 0.000568              | 89.69                  | 84                    | 88.60                 | 78                   | 72.71                 | 104.23          | 353,287.50             | 304,620.35             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84              | 0.000570              | 89.48                  | 84                    | 88.80                 | 78                   | 72.85                 | 105.11          | 478,669.93             | 412,730.71             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84              | 0.000571              | 89.48                  | 84                    | 88.89                 | 78                   | 72.95                 | 108.62          | 559,718.24             | 482,614.20             |
| M402A/0088+51         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84              | 0.000572              | 89.39                  | 84                    | 88.94                 | 78                   | 72.99                 | 102.25          | 277,088.24             | 238,917.92             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84              | 0.000573              | 89.45                  | 84                    | 88.99                 | 78                   | 72.99                 | 102.25          | 104,600.81             | 90,191.51              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84              | 0.000578              | 89.88                  | 84                    | 89.19                 | 78                   | 72.99                 | 116,377.06      | 116,377.06             | 116,377.06             |
| M402A/0109+91         | M402A/0103+76           | 135           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84              | 0.000577              | 89.98                  | 84                    | 89.37                 | 78                   | 72.99                 | 120.91          | 568,030.89             | 568,030.89             |
| M402A/0113+81         | M402A/0109+91           | 807           | 54               | 53.47                  | 31.68                 | 89.42                 | -0.0004        | 0.0060         | 84              | 0.000577              | 89.98                  | 84                    | 89.37                 | 78                   | 72.99                 | 111.26          | 482,524.34             | 482,524.34             |
| M402A/0117+43         | M402A/0113+81           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84              | 0.000581              | 90.07                  | 84                    | 89.42                 | 78                   | 72.99                 | 142.89          | 93,517.28              | 93,517.28              |
| M402A/0120+25         | M402A/0117+43           | 695           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84              | 0.000581              | 90.16                  | 84                    | 89.67                 | 78                   | 72.99                 | 142.89          | 559,025.52             | 559,025.52             |
| M402B/0123+40         | M402A/0120+25           | 126           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84              | 0.000586              | 125.46                 | 84                    | 90.01                 | 78                   | 72.99                 | 129.15          | 238,988.61             | 238,988.61             |
|                       |                         | 308           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84              | 0.000586              | 125.45                 | 84                    | 90.06                 | 78                   | 72.99                 | 130.79          | 481,440.81             | 481,440.81             |
|                       |                         | 1160          | 48               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84              | 0.000588              | 125.36                 | 84                    | 90.17                 | 78                   | 72.99                 | 127.14          | 213,357.94             | 213,357.94             |
|                       |                         |               |                  | 33.78                  | 83.60                 | 83.60                 | -0.0001        | 0.0045         | 66              | 0.001828              | 98.26                  | 84                    | 159.04                | 78                   | 130.52                | 161.92          | 803,555.89             | 692,861.97             |

DESIGN CONDITION: OPTION NO. 3  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 175,228.27  
 2070 Sew. Ac. = 26,431.99  
 Constant Intel Flow = 0.00  
 TOTAL ESTIM. CONST. COST = \$10,277,633.93 \$8,835,439.13  
 + Engr. ROW, Financ. Conting. (1.5%) = \$15,416,450.90 \$13,253,158.70

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{2.63} \times s^{1.48} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{2.63} \times s^{1.48} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (ft.)

OPTION 3  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Hallom City,  
 Richland Hills, year 2020 BFV Area. This option also  
 includes diversion of Little Fossil Creek Area in  
 Hallom City. The Marine Creek Area is included, but  
 the 6.0 MGD Intel Facility flow is not included in  
 this model.

Estim. Cost Above R.H. Meter = \$6,951,249.72 \$6,336,954.99  
 Estim. Cost Below R.H. Meter = \$3,326,384.21 \$2,498,484.14  
 Percent R.H. Cost of Total Line = 32.37% 28.28%  
 Estim. Richland Hills Cost Share = \$4,989,576.32 \$3,747,726.21

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***OPTION 4***

BIG FOSSIL SEWER STUDY

OPTION 4 - YEAR 2000

TABLE F-1

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 60.87                  | 84                    | 69.57                 | 78                    | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A0020+17          | M402A0000+50            | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.32                  | 84                    | 72.04                 | 78                    | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A0020+90          | M402A0020+17            | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.33                  | 84                    | 72.06                 | 78                    | 59.13                 | -11.44          | 50,568.60              | 43,602.52              |
| M402A0022+40          | M402A0022+40            | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 62.33                  | 84                    | 72.06                 | 78                    | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A0023+09          | M402A0023+09            | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 62.81                  | 84                    | 72.08                 | 72                    | 47.79                 | 122.10          | 47,797.72              | 35,116.69              |
| M402A0028+40          | M402A0028+40            | 870           | 54              | 25.07                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 62.81                  | 84                    | 72.74                 | 72                    | 48.27                 | 73.26           | 602,666.92             | 442,775.69             |
| M402A0036+79          | M402A0032+40            | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 84                    | 0.000558                   | 62.95                  | 84                    | 72.93                 | 72                    | 48.35                 | 84.02           | 276,395.52             | 203,066.09             |
| M402A0045+95          | M402A0036+79            | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 63.17                  | 84                    | 72.09                 | 72                    | 48.35                 | 78.56           | 258,628.65             | 185,171.99             |
| M402A0049+00          | M402A0040+28            | 361           | 54              | 29.03                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 63.25                  | 78                    | 72.19                 | 66                    | 46.24                 | 75.27           | 215,623.42             | 154,381.27             |
| M402A0051+81          | M402A0045+95            | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 63.30                  | 78                    | 72.28                 | 66                    | 46.24                 | 80.11           | 333,887.79             | 239,055.76             |
| M402A0054+21          | M402A0051+81            | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 63.30                  | 78                    | 72.33                 | 66                    | 46.33                 | 75.04           | 183,369.50             | 131,288.22             |
| M402A0060+68          | M402A0054+21            | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 63.33                  | 78                    | 72.38                 | 66                    | 46.36                 | 78.08           | 150,518.29             | 107,875.53             |
| M402A0066+88          | M402A0060+68            | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 63.33                  | 78                    | 72.41                 | 66                    | 46.38                 | 81.57           | 152,310.17             | 109,050.48             |
| M402A0068+68          | M402A0066+88            | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 70.32                  | 78                    | 72.51                 | 66                    | 46.44                 | 76.16           | 385,255.15             | 275,833.57             |
| M402A0068+95          | M402A0068+68            | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 70.32                  | 78                    | 72.52                 | 66                    | 46.45                 | 78.33           | 59,132.19              | 42,337.24              |
| M402A0072+77          | M402A0068+95            | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 70.33                  | 78                    | 72.60                 | 66                    | 46.50                 | 78.89           | 304,620.35             | 218,100.96             |
| M402A0080+78          | M402A0072+77            | 808           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 70.33                  | 78                    | 72.71                 | 66                    | 46.57                 | 78.09           | 412,730.71             | 295,505.42             |
| M402A0085+50          | M402A0080+78            | 400           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 70.46                  | 78                    | 72.88                 | 66                    | 46.68                 | 78.91           | 482,614.20             | 345,540.34             |
| M402A0086+56          | M402A0085+50            | 151           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 70.50                  | 78                    | 72.95                 | 66                    | 46.73                 | 82.40           | 238,917.92             | 171,059.58             |
| M402A0088+51          | M402A0086+56            | 168           | 54              | 29.26                  | 31.43                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 70.53                  | 78                    | 72.99                 | 66                    | 46.75                 | 76.01           | 90,191.51              | 64,574.99              |
| M402A0096+65          | M402A0088+51            | 820           | 54              | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 70.56                  | 78                    | 73.03                 | 66                    | 46.78                 | 71.20           | 100,345.53             | 71,845.02              |
| M402A0103+76          | M402A0096+65            | 711           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 70.73                  | 78                    | 73.20                 | 66                    | 46.88                 | 78.60           | 489,781.73             | 350,672.13             |
| M402A0105+11          | M402A0103+76            | 135           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 70.86                  | 78                    | 73.34                 | 66                    | 46.98                 | 88.87           | 424,676.60             | 304,058.40             |
| M402A0109+91          | M402A0105+11            | 807           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 70.91                  | 78                    | 73.39                 | 66                    | 47.14                 | 100.47          | 80,634.80              | 57,732.61              |
| M402A0113+81          | M402A0109+91            | 345           | 54              | 29.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 71.06                  | 78                    | 73.59                 | 66                    | 47.14                 | 72.22           | 482,018.90             | 345,112.69             |
| M402A0117+43          | M402A0113+81            | 695           | 54              | 35.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 71.15                  | 78                    | 73.66                 | 66                    | 47.18                 | 86.57           | 206,066.71             | 147,538.88             |
| M402A0120+25          | M402A0117+43            | 126           | 54              | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 76.99                  | 78                    | 73.87                 | 66                    | 47.31                 | 88.09           | 415,119.89             | 297,216.01             |
| M402B0123+40          | M402A0120+25            | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 77.02                  | 78                    | 73.81                 | 66                    | 47.34                 | 89.08           | 75,259.14              | 53,883.77              |
| M402B0136+74          | M402B0123+40            | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 68.97                  | 66                    | 83.60                 | 66                    | 83.60                 | 115.00          | 496,072.77             | 496,072.77             |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 80,931.25  
 2000 Sew. Ac. = 16,091.36  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$8,569,370.81 \$9,501,525.61  
 + Engr., ROW, Financ., Conting. (1.5x) = \$12,854,056.21 \$9,752,288.42

UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP.  
 PROP. REPL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq. s = [1629.6 x n x MGD<sup>1.54</sup> / (D<sup>4.75</sup>)(83)]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [D<sup>4.75</sup>(83) x s<sup>1/2</sup>] / (1629.6 x n) / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [D<sup>4.75</sup>(83) x s<sup>1/2</sup>] / (1629.6 x n) / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City, Richland Hills, Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Intel Facility Flow. This Option does not include diversion of Little Creek Area in Haltom City to this line -- this area is omitted.

Estim. Cost Above R.H. Meter = \$5,747,488.64 \$4,255,962.24  
 Estim. Cost Below R.H. Meter = \$2,821,882.17 \$2,245,563.37  
 Percent R.H. Cost of Total Line = 32.93% 34.54%  
 Estim. Richland Hills Cost Share = \$4,232,823.25 \$3,368,345.06

TABLE F-2

OPTION 4 - YEAR 2005

BIG FOSSIL SEWER STUDY

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PIPE (ft) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350              | 66.85                  | 84                    | 69.57                 | 69.57                 | 57.09           | 279.20                | 279.20          | \$70,657.50            | \$60,924.07             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375              | 68.52                  | 84                    | 72.04                 | 72.04                 | 59.12           | 93.15                 | 93.15           | 1,195,635.75           | 1,030,930.82            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375              | 68.53                  | 84                    | 72.06                 | 72.06                 | 59.13           | -11.44                | -11.44          | 50,568.60              | 43,602.52               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375              | 68.53                  | 84                    | 72.06                 | 72.06                 | 59.13           | 59.13                 | 59.13           | 103,908.09             | 89,594.22               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376              | 68.55                  | 84                    | 72.08                 | 72.08                 | 59.15           | 133.46                | 133.46          | 47,797.72              | 41,213.34               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383              | 69.06                  | 84                    | 72.74                 | 72.74                 | 59.69           | 59.69                 | 59.69           | 602,666.92             | 519,646.47              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385              | 69.22                  | 84                    | 72.93                 | 72.93                 | 59.85           | 59.85                 | 59.85           | 276,395.52             | 238,320.62              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558              | 69.36                  | 78                    | 72.09                 | 72.09                 | 58.56           | 46.17                 | 78.56           | 258,628.65             | 185,171.99              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559              | 69.46                  | 78                    | 72.19                 | 72.19                 | 58.66           | 46.24                 | 75.27           | 215,623.42             | 154,381.27              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561              | 69.55                  | 78                    | 72.33                 | 72.33                 | 58.77           | 46.29                 | 80.11           | 333,887.79             | 239,055.76              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562              | 69.61                  | 78                    | 72.38                 | 72.38                 | 58.80           | 46.33                 | 75.04           | 183,369.50             | 131,288.22              |
| M402A/0054+21         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562              | 69.64                  | 78                    | 72.38                 | 72.38                 | 58.80           | 46.36                 | 78.08           | 150,518.29             | 107,767.53              |
| M402A/0055+95         | M402A/0054+21           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563              | 69.70                  | 78                    | 72.41                 | 72.41                 | 58.89           | 46.38                 | 81.57           | 152,310.17             | 109,050.48              |
| M402A/0060+68         | M402A/0055+95           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564              | 76.58                  | 84                    | 88.35                 | 88.35                 | 72.51           | 102.23                | 104.40          | 446,804.78             | 385,255.15              |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565              | 76.58                  | 84                    | 88.37                 | 88.37                 | 72.51           | 104.40                | 104.40          | 353,287.50             | 304,620.35              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566              | 76.60                  | 84                    | 88.46                 | 88.46                 | 72.60           | 104.99                | 104.99          | 353,287.50             | 304,620.35              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568              | 76.66                  | 84                    | 88.60                 | 88.60                 | 72.71           | 104.23                | 104.23          | 478,669.93             | 412,730.71              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570              | 76.76                  | 84                    | 88.80                 | 88.80                 | 72.88           | 105.11                | 105.11          | 559,718.24             | 482,814.20              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571              | 76.80                  | 84                    | 88.89                 | 88.89                 | 72.95           | 108.62                | 108.62          | 277,088.24             | 238,917.92              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572              | 76.83                  | 84                    | 88.94                 | 88.94                 | 72.99           | 102.25                | 102.25          | 446,804.78             | 385,255.15              |
| M402A/0088+51         | M402A/0086+56           | 188           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573              | 76.87                  | 84                    | 88.99                 | 88.99                 | 73.03           | 97.45                 | 97.45           | 116,377.06             | 100,345.53              |
| M402A/0098+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575              | 77.05                  | 84                    | 89.19                 | 89.19                 | 73.20           | 104.92                | 104.92          | 568,030.89             | 489,781.73              |
| M402A/0103+76         | M402A/0098+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577              | 77.20                  | 84                    | 89.37                 | 89.37                 | 73.34           | 95.23                 | 95.23           | 116,377.06             | 100,345.53              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578              | 77.25                  | 84                    | 89.42                 | 89.42                 | 73.39           | 126.86                | 126.86          | 492,524.34             | 424,676.60              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581              | 77.42                  | 84                    | 89.67                 | 89.67                 | 73.59           | 98.67                 | 98.67           | 559,025.52             | 482,016.90              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582              | 77.51                  | 84                    | 89.76                 | 89.76                 | 73.66           | 113.05                | 113.05          | 238,988.61             | 206,066.71              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586              | 83.33                  | 84                    | 90.01                 | 90.01                 | 73.87           | 114.65                | 114.65          | 481,440.81             | 415,119.89              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586              | 83.36                  | 84                    | 90.06                 | 90.06                 | 73.91           | 115.65                | 115.65          | 87,282.79              | 75,259.14               |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588              | 83.41                  | 84                    | 90.17                 | 90.17                 | 74.00           | 110.97                | 110.97          | 213,357.94             | 183,966.80              |
| M402B/0136+74         | M402B/0123+40           | 1,160         | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829              | 74.88                  | 78                    | 130.52                | 130.52                | 105.43          | 136.83                | 136.83          | 692,861.97             | 590,367.59              |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 87,431.63  
 2005 Sew. Ac. = 17,571.46  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,474,123.99  
 + Engr., ROW, Finance, Conting. (1.5x) = \$14,211,185.98  
 \$7,972,645.03  
 \$11,958,967.54

NOTES:

- UPSTREAM MAIN/STATION
- DOWNSTREAM MAIN/STATION
- LENGTH
- EXIST DIA.
- EXIST PIPE CAP
- 2000 MODEL FLOW
- 2020 MODEL FLOW
- Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations
- Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations
- Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres
- Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design
- Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^2$ ,  $n = 0.0145$
- Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres
- Proposed Replacement Pipe in Inches
- Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$
- Proposed Parallel Pipe in Inches
- Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$
- Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD
- Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)
- Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, Year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option does NOT include diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line -- this area is omitted.

Estim. Cost Above R.H. Meter = \$6,652,241.82  
 Estim. Cost Below R.H. Meter = \$2,821,882.17  
 Percent R.H. Cost of Total Line = 29.79%  
 Estim. Richland Hills Cost Share = \$4,232,823.25  
 \$5,608,859.70  
 \$2,363,785.33  
 29.65%  
 \$3,545,678.00

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PAHL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                   | 0.000350                   | 70.38                  | 90                    | 83.62                 | 84                    | 69.57                 | 291.68          | \$81,111.93            | \$70,657.50            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 72.11                  | 90                    | 86.59                 | 84                    | 72.04                 | 106.07          | 1,372,541.04           | 1,195,635.75           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 72.12                  | 90                    | 86.61                 | 84                    | 72.06                 | 106.07          | 58,050.69              | 50,568.60              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 72.12                  | 90                    | 86.61                 | 84                    | 72.06                 | 106.07          | 119,282.25             | 103,908.09             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 72.14                  | 90                    | 86.64                 | 84                    | 72.08                 | 146.39          | 54,869.83              | 47,797.72              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54              | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 72.68                  | 90                    | 87.43                 | 84                    | 72.74                 | 97.78           | 691,837.02             | 602,666.92             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                   | 0.000385                   | 72.85                  | 90                    | 87.66                 | 84                    | 72.93                 | 108.60          | 317,290.77             | 276,335.52             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 73.00                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 299,948.02             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 73.10                  | 84                    | 87.96                 | 78                    | 72.19                 | 101.22          | 250,072.13             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 73.20                  | 84                    | 88.07                 | 78                    | 72.28                 | 106.10          | 387,230.81             | 333,887.79             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 73.26                  | 84                    | 88.14                 | 78                    | 72.33                 | 101.04          | 212,665.22             | 183,369.50             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 73.29                  | 84                    | 88.19                 | 78                    | 72.38                 | 104.10          | 174,565.59             | 150,518.29             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000563                   | 73.36                  | 84                    | 88.23                 | 78                    | 72.41                 | 107.60          | 176,643.75             | 152,310.17             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 81.14                  | 84                    | 88.35                 | 78                    | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000565                   | 81.14                  | 84                    | 88.37                 | 78                    | 72.52                 | 104.40          | 66,579.34              | 59,132.19              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 81.15                  | 84                    | 88.46                 | 78                    | 72.60                 | 104.99          | 353,287.50             | 304,620.35             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 81.22                  | 84                    | 88.60                 | 78                    | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 81.31                  | 84                    | 88.80                 | 78                    | 72.88                 | 105.11          | 559,716.24             | 482,614.20             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 81.36                  | 84                    | 88.89                 | 78                    | 72.95                 | 108.62          | 277,088.24             | 238,917.92             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                   | 0.000572                   | 81.39                  | 84                    | 88.94                 | 78                    | 72.99                 | 102.25          | 104,600.81             | 90,191.51              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54              | 24.42                  | 31.45                 | 88.98                 | -0.0004        | 0.0060         | 84                   | 0.000573                   | 81.43                  | 84                    | 88.98                 | 78                    | 73.03                 | 97.45           | 116,377.06             | 100,345.53             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54              | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 81.63                  | 84                    | 89.19                 | 78                    | 73.20                 | 104.92          | 568,030.89             | 489,781.73             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000577                   | 81.78                  | 84                    | 89.37                 | 78                    | 73.34                 | 95.23           | 492,524.34             | 424,676.60             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 81.83                  | 84                    | 89.42                 | 78                    | 73.39                 | 128.86          | 93,517.28              | 80,634.80              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 82.02                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 82.12                  | 84                    | 89.76                 | 78                    | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 88.68                  | 84                    | 90.01                 | 78                    | 73.87                 | 114.65          | 481,440.81             | 415,119.89             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54              | 41.74                  | 42.22                 | 90.17                 | 0.0002         | 0.0034         | 84                   | 0.000586                   | 88.71                  | 84                    | 90.17                 | 78                    | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                   | 0.000588                   | 88.77                  | 84                    | 90.17                 | 78                    | 74.00                 | 110.97          | 213,357.94             | 183,966.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001829                   | 79.46                  | 66                    | 83.60                 | 60                    | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 93,932.00  
 2010 Sew. Ac. = 18,759.44  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5x) = \$14,747,213.88  
 \$12,724,913.30

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn: s = [ 1629.6 x n x MGD<sup>0.54</sup> / D<sup>4.87</sup> ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.87</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.87</sup> x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe Capacity in MGD  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 of Little Fossil Creek Area in Haltom City  
 to this line -- this area is omitted

Estim. Cost Above R.H. Meter = \$5,586,472.24  
 Estim. Cost Below R.H. Meter = \$3,245,003.68  
 Percent R.H. Cost of Total Line = 33.01%  
 Estim. Richland Hills Cost Share = \$4,867,505.52  
 \$4,232,823.25



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/ft) | 2015 DESIGN FLOW (MGD) | PROP. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|--------------------------|------------------------|-----------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                 | 87.91                  | 96              | 99.32                 | 90              | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 90.50                  | 96              | 102.85                | 90              | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 90.52                  | 96              | 102.88                | 90              | 86.61                 | 16.04           | 86,048.79              | 58,050.89              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                 | 90.52                  | 96              | 102.88                | 90              | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000376                 | 90.55                  | 96              | 102.91                | 90              | 86.61                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                 | 91.28                  | 96              | 103.85                | 90              | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                 | 91.50                  | 96              | 104.12                | 90              | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000358                 | 91.68                  | 90              | 105.58                | 84              | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000359                 | 91.81                  | 90              | 105.86                | 84              | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000362                 | 91.99                  | 90              | 105.94                | 84              | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 31.72                  | 18.98                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000363                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000363                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 29.72                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 31.88                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 29.72                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0066+55         | M402A/0065+95           | 691           | 54               | 31.52                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0072+77         | M402A/0066+55           | 808           | 54               | 32.23                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0080+78         | M402A/0072+77           | 400           | 54               | 35.67                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0085+50         | M402A/0080+78           | 151           | 54               | 29.26                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0086+56         | M402A/0085+50           | 168           | 54               | 24.42                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0088+51         | M402A/0086+56           | 820           | 54               | 31.72                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0086+65         | M402A/0088+51           | 711           | 54               | 21.89                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0103+76         | M402A/0086+65           | 135           | 54               | 53.47                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0105+11         | M402A/0103+76           | 807           | 54               | 31.72                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0109+91         | M402A/0105+11           | 345           | 54               | 39.39                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0113+81         | M402A/0109+91           | 695           | 54               | 40.78                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0117+43         | M402A/0113+81           | 126           | 54               | 41.74                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0120+25         | M402A/0117+43           | 308           | 54               | 36.97                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000364                 | 92.10                  | 90              | 106.05                | 84              | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402B/0123+40         | M402A/0120+25           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 68                    | 0.001829                 | 93.06                  | 78              | 130.52                | 72              | 105.43                | 136.83          | 682,861.97             | 590,367.59             |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50 2015 Eq. Pop. = 103,938.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33 2015 Sew. Ac. = 22,032.13  
 Constant Inlet Flow = 6.00  
 TOT-AL ESTIM. CONST. COST = \$11,382,085.03 \$9,925,770.75  
 + Engr., ROW, I manc., Conting. (1.5x) = \$17,073,127.54 \$14,888,656.12

**OPTION 4**  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, including NRH, Haltom City,  
 Richland Hills, Maric Creek Area, year 2020  
 BFx Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option does not include diversion  
 of Little Fossil Creek Area in Haltom City  
 (to this line --- this area is omitted)

**UPSTREAM MAIN/STATION**  
 Length of Pipe Segment in Feet  
**EXIST DIA.**  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
**2000 MODEL FLOW**  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
**2020 MODEL FLOW**  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
**COEF. "A", COEF. "B"**  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
**MODEL PROP DIA.**  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
**MODEL H.G. SLOPE**  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
**DESIGN FLOW**  
 Calculated Design Flow in MGD based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
**PROP. REPL. PIPE**  
 Proposed Replacement Pipe Capacity in Inches  
**REPL. PIPE CAP.**  
 Proposed Parallel Pipe Capacity in Inches  
**PARL. PIPE CAP.**  
 Proposed Parallel Pipe Capacity in MGD  
**BOTH CAP.**  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
**ESTIM. REPL. PIPE COST**  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
**ESTIM. PARL. PIPE COST**  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000-50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 92.38                  | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020-17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 95.00                  | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020-90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 95.02                  | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0022-40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 95.02                  | 96                    | 102.88                | 90                    | 86.61                 | 160.95          | 135,716.69             | 119,282.25              |
| M402A/0023-09         | M402A/0022+40           | 89            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 95.05                  | 96                    | 102.91                | 90                    | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0028+40         | M402A/0023+09           | 870           | 24               | 25.04                  | 18.71                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 95.81                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 78,156.79              | 69,183.07               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 96.04                  | 96                    | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 96.24                  | 90                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 96.37                  | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 96.50                  | 90                    | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 96.57                  | 90                    | 105.94                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.59              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 96.62                  | 90                    | 106.00                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.29              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 96.69                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 102.92                 | 90                    | 106.20                | 84                    | 88.35                 | 118.07          | 512,913.65             | 446,804.78              |
| M402A/0065+95         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 102.93                 | 90                    | 106.22                | 84                    | 88.37                 | 120.25          | 78,726.28              | 68,579.34               |
| M402A/0072+77         | M402A/0065+95           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 102.98                 | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,599.63             | 353,287.50              |
| M402A/0080+78         | M402A/0072+77           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 103.09                 | 90                    | 106.50                | 84                    | 88.60                 | 120.12          | 549,493.54             | 476,669.93              |
| M402A/0085+50         | M402A/0080+78           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 103.25                 | 90                    | 106.74                | 84                    | 88.80                 | 121.03          | 642,533.69             | 559,718.24              |
| M402A/0086+56         | M402A/0085+50           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 103.33                 | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.99             | 277,088.24              |
| M402A/0096+65         | M402A/0086+56           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 103.37                 | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81              |
| M402A/0103+76         | M402A/0096+65           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 103.43                 | 90                    | 106.97                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06              |
| M402A/0105+11         | M402A/0103+76           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 103.67                 | 90                    | 107.21                | 84                    | 89.19                 | 120.91          | 652,076.27             | 568,030.89              |
| M402A/0109+91         | M402A/0105+11           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 103.87                 | 90                    | 107.42                | 84                    | 89.37                 | 111.26          | 565,397.84             | 492,524.34              |
| M402A/0113+81         | M402A/0109+91           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 103.93                 | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28               |
| M402A/0117+43         | M402A/0113+81           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 104.18                 | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52              |
| M402A/0120+25         | M402A/0117+43           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 104.29                 | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61              |
| M402B/0123+40         | M402A/0120+25           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 109.62                 | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 552,674.40             | 481,440.81              |
| M402B/0136+74         | M402B/0123+40           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 109.66                 | 90                    | 108.25                | 84                    | 90.06                 | 131.80          | 100,197.09             | 87,282.79               |
|                       |                         | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 109.76                 | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 213,357.94              |
|                       |                         | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 99.59                  | 78                    | 130.52                | 72                    | 105.43                | 136.83          | 692,861.97             | 590,367.59              |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2020 Eq. Pop. = 113,945.00  
 2020 Sew. Ac. = 23,745.44  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,382,085.03 \$9,925,770.75  
 + Engr., ROW, Fin. inc., Conting. (1.5x) = \$17,073,127.54 \$14,888,656.12

NOTES:  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BF, Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option does not include diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line -- this area is omitted

Estim. Cost Above R.H. Meter = \$7,684,391.97 \$6,680,767.06  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 32.49% 32.69%  
 Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000-50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62          | -0.0010        | 0.0084                | 0.000350                   | 93.84             | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0000-17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59          | -0.0011        | 0.0089                | 0.000375                   | 95.68             | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+10         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61          | -0.0011        | 0.0089                | 0.000375                   | 95.68             | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.69              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61          | -0.0011        | 0.0089                | 0.000375                   | 95.68             | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.69              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64          | -0.0011        | 0.0089                | 0.000376                   | 95.72             | 96                    | 102.91                | 90                    | 86.64                 | 160.95          | 135,716.69             | 119,282.25             |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43          | -0.0011        | 0.0090                | 0.000383                   | 96.39             | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.86          | -0.0011        | 0.0090                | 0.000385                   | 96.60             | 96                    | 104.12                | 90                    | 87.86                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84          | -0.0011        | 0.0091                | 0.000558                   | 96.82             | 90                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96          | -0.0011        | 0.0091                | 0.000559                   | 96.88             | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07          | -0.0011        | 0.0091                | 0.000561                   | 97.13             | 90                    | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.19          | -0.0011        | 0.0091                | 0.000562                   | 97.24             | 90                    | 105.94                | 84                    | 88.19                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19          | -0.0011        | 0.0091                | 0.000562                   | 97.24             | 90                    | 105.94                | 84                    | 88.19                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0054+21         | M402A/0051+91           | 285           | 54               | 35.19                  | 19.06                 | 88.23          | -0.0011        | 0.0091                | 0.000563                   | 97.37             | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35          | -0.0004        | 0.0058                | 0.000564                   | 115.28            | 96                    | 126.14                | 90                    | 106.20                | 135.92          | 583,581.76             | 512,913.65             |
| M402A/0061+67         | M402A/0060+68           | 98            | 54               | 31.88                  | 31.61                 | 88.37          | -0.0004        | 0.0058                | 0.000565                   | 115.27            | 96                    | 126.17                | 90                    | 106.22                | 136.10          | 89,573.01              | 78,726.28              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46          | -0.0004        | 0.0059                | 0.000568                   | 115.26            | 96                    | 126.30                | 90                    | 106.33                | 138.72          | 461,436.74             | 405,559.63             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.50          | -0.0004        | 0.0059                | 0.000570                   | 115.36            | 96                    | 126.78                | 90                    | 106.54                | 138.02          | 625,201.54             | 549,493.54             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60          | -0.0004        | 0.0060                | 0.000571                   | 115.39            | 96                    | 126.78                | 90                    | 106.74                | 138.97          | 731,060.56             | 642,533.69             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89          | -0.0004        | 0.0060                | 0.000572                   | 115.39            | 96                    | 126.91                | 90                    | 106.85                | 142.52          | 361,911.17             | 318,085.99             |
| M402A/0088+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94          | -0.0004        | 0.0060                | 0.000573                   | 115.50            | 96                    | 127.05                | 90                    | 106.91                | 136.17          | 136,621.47             | 120,077.46             |
| M402A/0088+51         | M402A/0088+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99          | -0.0004        | 0.0060                | 0.000573                   | 115.50            | 96                    | 127.05                | 90                    | 106.97                | 131.39          | 152,002.69             | 133,596.11             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19          | -0.0004        | 0.0060                | 0.000575                   | 115.80            | 96                    | 127.34                | 90                    | 107.21                | 138.93          | 741,917.89             | 652,076.27             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37          | -0.0004        | 0.0060                | 0.000577                   | 116.03            | 96                    | 127.67                | 90                    | 107.31                | 129.31          | 643,297.10             | 565,397.84             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42          | -0.0004        | 0.0060                | 0.000578                   | 116.11            | 96                    | 127.67                | 90                    | 107.48                | 160.95          | 122,145.02             | 107,354.02             |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67          | -0.0004        | 0.0060                | 0.000581                   | 116.35            | 96                    | 128.02                | 90                    | 107.78                | 132.86          | 730,155.78             | 641,738.48             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76          | -0.0004        | 0.0060                | 0.000582                   | 116.51            | 96                    | 128.15                | 90                    | 107.89                | 147.28          | 312,148.38             | 274,349.16             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.06          | -0.0002        | 0.0034                | 0.000586                   | 131.51            | 96                    | 128.51                | 90                    | 108.19                | 148.97          | 628,820.65             | 552,674.40             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06          | -0.0002        | 0.0034                | 0.000586                   | 131.55            | 96                    | 128.58                | 90                    | 108.25                | 149.99          | 114,002.02             | 100,197.09             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17          | -0.0002        | 0.0034                | 0.000588                   | 131.60            | 96                    | 128.74                | 90                    | 108.38                | 145.35          | 278,671.60             | 244,926.21             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60          | -0.0001        | 0.0045                | 0.001829                   | 114.87            | 78                    | 130.52                | 72                    | 105.43                | 136.83          | 692,861.97             | 590,367.59             |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 149,156.99  
 2050 Sew. Ac. = 28,070.61  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ, Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76  
 Constant Intel Flow = 6.00

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2050 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2050 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2050 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [ 1629.6 x n x MGD<sup>0.154</sup> / D<sup>4.75</sup> ]<sup>0.2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.154</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, year 2020  
 BFx Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option does not include diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line -- this area is omitted

Estim. Cost Above R.H. Meter = \$8,497,239.51  
 Estim. Cost Below R.H. Meter = \$3,697,693.06  
 Percent R.H. Cost of Total Line = 30.32%  
 Estim. Richland Hills Cost Share = \$5,546,539.58  
 \$4,867,505.52

01/13/2000, 3:26 PM  
 COFW Option 4.xls  
 Page 1 of 1

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 95.48                  | 96                          | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.95                  | 96                          | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.96                  | 96                          | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.69              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.96                  | 96                          | 102.88                | 90                    | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 96.98                  | 96                          | 102.91                | 90                    | 86.64                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 97.62                  | 96                          | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 97.82                  | 96                          | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 98.05                  | 90                          | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 98.22                  | 90                          | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 98.39                  | 90                          | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 98.47                  | 90                          | 105.94                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 98.50                  | 90                          | 106.00                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.59             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 98.66                  | 90                          | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 122.63                 | 96                          | 126.14                | 90                    | 106.20                | 135.92          | 583,581.76             | 512,913.65             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 122.60                 | 96                          | 126.17                | 90                    | 106.22                | 138.10          | 89,573.01              | 78,726.28              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 122.53                 | 96                          | 126.30                | 90                    | 106.33                | 138.72          | 461,436.74             | 405,559.63             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 122.54                 | 96                          | 126.50                | 90                    | 106.50                | 138.02          | 625,201.54             | 549,483.54             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 122.57                 | 96                          | 126.78                | 90                    | 106.74                | 138.97          | 731,060.56             | 642,533.69             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 122.59                 | 96                          | 126.91                | 90                    | 106.85                | 142.52          | 361,911.17             | 318,085.99             |
| M402A/0088+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 122.63                 | 96                          | 126.98                | 90                    | 106.91                | 136.17          | 136,621.47             | 120,077.46             |
| M402A/0091+91         | M402A/0088+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 122.70                 | 96                          | 127.05                | 90                    | 106.97                | 131.39          | 152,002.69             | 133,596.11             |
| M402A/0096+65         | M402A/0091+91           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 123.03                 | 96                          | 127.34                | 90                    | 107.21                | 138.93          | 741,917.89             | 652,076.27             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 123.28                 | 96                          | 127.60                | 90                    | 107.42                | 129.31          | 643,297.10             | 565,397.84             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 123.37                 | 96                          | 127.67                | 90                    | 107.48                | 160.95          | 122,145.02             | 107,354.02             |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 123.61                 | 96                          | 128.02                | 90                    | 107.78                | 132.86          | 730,155.78             | 641,738.48             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 123.80                 | 96                          | 128.15                | 90                    | 107.89                | 147.28          | 312,148.38             | 274,349.16             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 143.82                 | 96                          | 128.51                | 90                    | 108.19                | 148.97          | 628,820.65             | 552,674.40             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 143.85                 | 96                          | 128.58                | 90                    | 108.25                | 149.99          | 114,002.02             | 100,197.09             |
| M402A/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 143.88                 | 96                          | 128.74                | 90                    | 108.38                | 145.35          | 278,671.60             | 244,926.21             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 123.68                 | 78                          | 130.52                | 72                    | 105.43                | 136.83          | 692,861.97             | 590,367.59             |

DESIGN CONDITION: OPTION NO. 4  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 168,403.10  
 2070 Sew. Ac. = 30,535.42  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING PIPE DIAMETER IN INCHES  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING CALIBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNING'S EQN.: S = [1629.6 x n x MGD^1.54 / D^5(8/3)]^2, n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGD = [D^5(8/3) x S^1/2] / 1629.6 x n / 1.54  
 PROPOSED PARALLEL PIPE IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [D^5(8/3) x S^1/2] / 1629.6 x n / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 4  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, Including NRH, Haltom City,  
 Richland Hills, Marine Creek Area, Year 2020  
 BFx Area, and Constant 6.0 MGD Inlet Facility  
 Flow. This Option does not include diversion  
 of Little Fossil Creek Area in Haltom City  
 (to this line -- this area is omitted)

Estim. Cost Above R.H. Meter = \$8,497,239.51 \$7,441,172.82  
 Estim. Cost Below R.H. Meter = \$3,697,693.06 \$3,245,003.68  
 Percent R.H. Cost of Total Line = 30.32% 30.37%  
 Estim. Richland Hills Cost Share = \$5,546,539.58 \$4,867,505.52

***OPTION 5a***

OPTION 5A YEAR 2000

BIG FOL SEWER STUDY

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0004+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 61.21                  | 84                          | 69.57                 | 78              | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.56                  | 84                          | 72.04                 | 78              | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.57                  | 84                          | 72.06                 | 84              | 72.06                 | 1.49            | 50,568.60              | 50,568.60              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 62.58                  | 84                          | 72.08                 | 84              | 72.08                 | 146.39          | 103,908.09             | 103,908.09             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000383                   | 63.03                  | 84                          | 72.74                 | 84              | 59.69                 | 84.73           | 602,669.92             | 519,646.47             |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 63.03                  | 84                          | 72.74                 | 78              | 59.69                 | 84.73           | 276,395.52             | 238,320.62             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 63.17                  | 84                          | 72.93                 | 78              | 46.17                 | 78.56           | 258,628.65             | 185,171.99             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.86                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 63.30                  | 78                          | 72.09                 | 66              | 46.24                 | 75.27           | 333,887.79             | 154,381.27             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 63.39                  | 78                          | 72.28                 | 66              | 46.24                 | 80.11           | 183,369.50             | 131,288.22             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 63.48                  | 78                          | 72.33                 | 66              | 46.33                 | 75.04           | 150,518.29             | 107,675.53             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 63.56                  | 78                          | 72.38                 | 66              | 46.36                 | 78.08           | 152,310.17             | 109,050.48             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 63.66                  | 78                          | 72.41                 | 66              | 46.38                 | 81.57           | 152,310.17             | 109,050.48             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000564                   | 72.19                  | 84                          | 88.35                 | 78              | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 72.19                  | 84                          | 88.35                 | 78              | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 72.18                  | 84                          | 88.37                 | 78              | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 72.18                  | 84                          | 88.37                 | 78              | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 72.23                  | 84                          | 88.60                 | 78              | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 72.29                  | 84                          | 88.80                 | 78              | 72.88                 | 105.11          | 559,718.24             | 482,614.20             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 72.33                  | 84                          | 88.89                 | 78              | 72.99                 | 102.25          | 568,030.89             | 489,781.73             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 72.39                  | 84                          | 88.99                 | 78              | 73.03                 | 97.45           | 116,377.06             | 90,191.51              |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 72.57                  | 84                          | 89.19                 | 78              | 73.20                 | 104.92          | 568,030.89             | 489,781.73             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 72.71                  | 84                          | 89.37                 | 78              | 73.34                 | 95.23           | 492,524.34             | 424,676.60             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 29.26                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 72.75                  | 84                          | 89.42                 | 78              | 73.39                 | 126.86          | 93,517.28              | 80,634.80              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 72.90                  | 84                          | 89.67                 | 78              | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 73.00                  | 84                          | 89.76                 | 78              | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 80.19                  | 84                          | 90.01                 | 78              | 73.87                 | 114.65          | 481,440.81             | 415,119.89             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 80.22                  | 84                          | 90.06                 | 78              | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 80.26                  | 84                          | 90.17                 | 78              | 74.00                 | 110.97          | 213,357.94             | 183,966.80             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 71.23                  | 66                          | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |
| M402B/0136+74         | M402B/0123+40           | 1,160         | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 71.23                  | 66                          | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2000 Eq. Pop. = 85,990.79  
 2000 Sew. Ac. = 16,728.36  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,277,334.79 \$7,820,119.26  
 + Engr., ROW, Financ., Conting. (1.5x) = \$13,916,002.18 \$11,730,178.89

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>5.49</sup>(8/3) ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>2.63</sup>(8/3) x s<sup>1/2</sup> / 1629.6 x n ]<sup>1/1.54</sup>  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>2.63</sup>(8/3) x s<sup>1/2</sup> / 1629.6 x n ]<sup>1/1.54</sup>  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5a  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marne Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

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COFW Option 5a.xls

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 67.13                  | 84              | 69.57                 | 78              | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 68.71                  | 84              | 72.04                 | 78              | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 68.72                  | 84              | 72.06                 | 84              | 72.06                 | 1.49            | 50,568.60              | 50,568.60               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 68.72                  | 84              | 72.06                 | 84              | 72.06                 | 72.06           | 103,908.09             | 103,908.09              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 68.73                  | 84              | 72.08                 | 84              | 72.08                 | 146.39          | 47,797.72              | 47,797.72               |
| M402A/0023+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 69.24                  | 84              | 72.74                 | 78              | 59.69                 | 84.73           | 276,395.52             | 519,646.47              |
| M402A/0032+40         | M402A/0023+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 69.39                  | 84              | 72.93                 | 78              | 59.85                 | 95.52           | 206,666.92             | 238,320.62              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 69.54                  | 78              | 72.09                 | 66              | 46.17                 | 78.56           | 258,628.65             | 185,171.99              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 69.64                  | 78              | 72.19                 | 66              | 46.24                 | 75.27           | 215,623.42             | 154,381.27              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 69.74                  | 78              | 72.28                 | 66              | 46.29                 | 80.11           | 333,887.79             | 239,055.76              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 69.82                  | 78              | 72.33                 | 66              | 46.33                 | 75.04           | 183,369.50             | 131,288.22              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 69.89                  | 78              | 72.41                 | 66              | 46.38                 | 81.57           | 152,310.17             | 109,050.48              |
| M402A/0054+21         | M402A/0051+91           | 645           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 69.99                  | 78              | 72.48                 | 66              | 46.38                 | 81.57           | 152,310.17             | 109,050.48              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 78.23                  | 84              | 88.35                 | 78              | 72.51                 | 102.23          | 446,804.78             | 385,255.15              |
| M402A/0061+87         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 78.23                  | 84              | 88.37                 | 78              | 72.52                 | 104.40          | 68,579.34              | 59,132.19               |
| M402A/0065+95         | M402A/0061+87           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 78.24                  | 84              | 88.46                 | 78              | 72.60                 | 104.99          | 353,287.50             | 304,620.35              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 78.29                  | 84              | 88.60                 | 78              | 72.71                 | 104.23          | 478,669.93             | 412,730.71              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 78.38                  | 84              | 88.80                 | 78              | 72.88                 | 105.11          | 559,718.24             | 482,614.20              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 78.41                  | 84              | 88.89                 | 78              | 72.95                 | 108.62          | 277,088.24             | 238,917.92              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 78.49                  | 84              | 88.94                 | 78              | 72.99                 | 102.25          | 104,600.81             | 90,191.51               |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 78.49                  | 84              | 88.99                 | 78              | 73.03                 | 97.45           | 116,377.06             | 100,345.53              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 78.87                  | 84              | 89.19                 | 78              | 73.20                 | 104.92          | 568,030.89             | 489,781.73              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 78.83                  | 84              | 89.37                 | 78              | 73.34                 | 95.23           | 492,524.34             | 424,876.60              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 78.87                  | 84              | 89.42                 | 78              | 73.39                 | 126.86          | 93,517.28              | 80,634.80               |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 79.05                  | 84              | 89.67                 | 78              | 73.59                 | 98.67           | 559,025.52             | 482,016.90              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 79.14                  | 84              | 89.76                 | 78              | 73.66                 | 113.05          | 238,988.61             | 206,066.71              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 86.17                  | 84              | 90.01                 | 78              | 73.87                 | 114.65          | 481,440.81             | 415,119.89              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 86.20                  | 84              | 90.06                 | 78              | 73.91                 | 115.65          | 87,282.79              | 75,259.14               |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 86.25                  | 84              | 90.17                 | 78              | 74.00                 | 110.97          | 213,357.94             | 183,966.80              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 76.88                  | 66              | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50              |

DESIGN CONDITION: 2005  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 91,937.31  
 2005 Sew. Ac. = 18,136.37  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,277,334.79 \$7,820,119.26  
 + Engr., ROW, Financ., Conting. (1.5x) = \$13,916,002.18 \$11,730,178.89

NOTES:

- UPSTREAM MAIN/STATION
- LENGTH
- EXIST DIA.
- EXIST PIPE CAP
- 2000 MODEL FLOW
- 2020 MODEL FLOW
- COEF. "A", COEF. "B"
- MODEL PROP DIA.
- MODEL H.G. SLOPE
- DESIGN FLOW
- PROP. REPL. PIPE
- PROP. PIPE CAP.
- PROP. PARL. PIPE
- PARL. PIPE CAP.
- BOTH CAP.
- ESTIM. REPL. PIPE COST
- ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.73</sup> ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>2.63</sup> x s<sup>0.112</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>2.63</sup> x s<sup>0.112</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 5a**  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 71.00                  | 90                    | 83.62                 | 84                    | 69.57                 | 291.68          | \$81,111.93            | \$70,657.50             |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 72.67                  | 90                    | 86.59                 | 84                    | 72.04                 | 106.07          | 1,372,541.04           | 1,195,635.75            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 72.69                  | 90                    | 86.61                 | 90                    | 86.61                 | 16.04           | 58,050.69              | 58,050.69               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 72.71                  | 90                    | 86.61                 | 90                    | 86.61                 | 16.04           | 58,050.69              | 58,050.69               |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 72.71                  | 90                    | 86.61                 | 90                    | 86.61                 | 16.04           | 58,050.69              | 58,050.69               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 73.24                  | 90                    | 87.43                 | 84                    | 72.74                 | 97.78           | 54,869.83              | 54,869.83               |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | -0.0011        | 0.0091         | 90                    | 0.000558                   | 73.41                  | 90                    | 87.66                 | 84                    | 72.93                 | 104.60          | 691,837.02             | 602,666.92              |
| M402A/0038+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 73.56                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 317,290.77             | 276,395.52              |
| M402A/0040+28         | M402A/0038+79           | 361           | 54               | 29.03                  | 18.92                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 73.67                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 299,948.02             | 258,628.65              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 73.77                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 250,072.13             | 215,623.42              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 73.83                  | 84                    | 88.07                 | 78                    | 72.28                 | 106.10          | 387,230.81             | 333,887.79              |
| M402A/0054+21         | M402A/0051+91           | 252           | 54               | 31.72                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 73.86                  | 84                    | 88.14                 | 78                    | 72.28                 | 106.10          | 212,665.22             | 183,369.50              |
| M402A/0060+68         | M402A/0054+21           | 255           | 54               | 35.19                  | 19.06                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 73.93                  | 84                    | 88.19                 | 78                    | 72.38                 | 104.10          | 174,585.59             | 150,518.29              |
| M402A/0061+67         | M402A/0060+68           | 645           | 54               | 29.72                  | 31.63                 | -0.0004        | 0.0088         | 84                    | 0.000564                   | 82.85                  | 84                    | 88.23                 | 78                    | 72.41                 | 107.60          | 176,643.75             | 152,310.17              |
| M402A/0065+95         | M402A/0061+67           | 99            | 54               | 31.88                  | 31.61                 | -0.0004        | 0.0088         | 84                    | 0.000566                   | 82.85                  | 84                    | 88.35                 | 78                    | 72.51                 | 102.23          | 446,804.78             | 385,255.15              |
| M402A/0072+77         | M402A/0065+95           | 510           | 54               | 32.39                  | 31.54                 | -0.0004        | 0.0088         | 84                    | 0.000566                   | 82.85                  | 84                    | 88.37                 | 78                    | 72.52                 | 102.23          | 446,804.78             | 385,255.15              |
| M402A/0080+78         | M402A/0072+77           | 691           | 54               | 31.52                  | 31.50                 | -0.0004        | 0.0088         | 84                    | 0.000568                   | 82.91                  | 84                    | 88.46                 | 78                    | 72.60                 | 104.99          | 353,287.50             | 304,620.35              |
| M402A/0085+50         | M402A/0080+78           | 808           | 54               | 32.23                  | 31.45                 | -0.0004        | 0.0088         | 84                    | 0.000570                   | 83.00                  | 84                    | 88.60                 | 78                    | 72.71                 | 104.23          | 478,669.93             | 412,730.71              |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 35.67                  | 31.43                 | -0.0004        | 0.0088         | 84                    | 0.000571                   | 83.04                  | 84                    | 88.80                 | 78                    | 72.88                 | 105.11          | 559,718.24             | 482,614.20              |
| M402A/0096+85         | M402A/0086+56           | 168           | 54               | 29.26                  | 31.43                 | -0.0004        | 0.0088         | 84                    | 0.000572                   | 83.07                  | 84                    | 88.89                 | 78                    | 72.99                 | 108.62          | 277,088.24             | 238,917.92              |
| M402A/0103+76         | M402A/0096+85           | 820           | 54               | 24.42                  | 31.45                 | -0.0004        | 0.0088         | 84                    | 0.000575                   | 83.12                  | 84                    | 88.99                 | 78                    | 73.03                 | 102.25          | 104,600.81             | 90,191.51               |
| M402A/0109+91         | M402A/0103+76           | 711           | 54               | 21.89                  | 31.63                 | -0.0004        | 0.0088         | 84                    | 0.000577                   | 83.32                  | 84                    | 89.19                 | 78                    | 73.20                 | 104.92          | 568,030.89             | 489,781.73              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | -0.0004        | 0.0088         | 84                    | 0.000578                   | 83.53                  | 84                    | 89.19                 | 78                    | 73.34                 | 95.23           | 492,524.34             | 424,676.60              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 39.39                  | 31.77                 | -0.0004        | 0.0088         | 84                    | 0.000581                   | 83.71                  | 84                    | 89.42                 | 78                    | 73.39                 | 126.86          | 92,517.28              | 80,634.80               |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 40.78                  | 42.22                 | -0.0002        | 0.0034         | 84                    | 0.000582                   | 83.82                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 91.35                  | 84                    | 90.01                 | 78                    | 73.87                 | 114.65          | 481,440.81             | 415,119.89              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 81.42                  | 66                    | 83.60                 | 60                    | 64.84                 | 110.97          | 213,357.94             | 183,967.80              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 81.42                  | 66                    | 83.60                 | 60                    | 64.84                 | 110.97          | 496,072.77             | 409,977.50              |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 97,883.84  
 2010 Sew. Ac. = 19,299.64  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5x) = \$14,747,213.88 \$12,769,805.83

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5a  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BFH Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000-50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 88.77                  | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.33                  | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.35                  | 96                    | 102.88                | 96                    | 102.88                | 32.31           | 66,048.79              | 66,048.79              |
| M402A/0022+40         | M402A/0022+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.35                  | 96                    | 102.88                | 96                    | 102.88                | 177.22          | 135,716.69             | 135,716.69             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 91.37                  | 96                    | 102.91                | 96                    | 102.91                | 177.22          | 62,429.68              | 62,429.68              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 92.11                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 92.11                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 92.52                  | 90                    | 105.58                | 84                    | 87.84                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 92.64                  | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 92.76                  | 90                    | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 92.83                  | 90                    | 105.94                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 92.88                  | 90                    | 106.00                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.59             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.35                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 92.94                  | 90                    | 106.05                | 84                    | 88.35                 | 118.07          | 512,913.65             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 98.38                  | 90                    | 106.20                | 84                    | 88.35                 | 120.25          | 78,726.28              | 446,804.78             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 98.39                  | 90                    | 106.22                | 84                    | 88.37                 | 120.25          | 78,726.28              | 446,804.78             |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 98.44                  | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,559.63             | 353,287.50             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 98.55                  | 90                    | 106.50                | 84                    | 88.60                 | 120.12          | 549,493.54             | 478,669.93             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 98.71                  | 90                    | 106.74                | 84                    | 88.80                 | 121.03          | 642,533.69             | 559,718.24             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 98.78                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.99             | 277,088.24             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 98.88                  | 90                    | 106.97                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 98.88                  | 90                    | 106.97                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81             |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 99.10                  | 90                    | 107.21                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 99.29                  | 90                    | 107.42                | 84                    | 89.19                 | 120.91          | 652,076.27             | 568,030.89             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 99.35                  | 90                    | 107.48                | 84                    | 89.37                 | 111.26          | 585,397.84             | 492,524.34             |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 99.59                  | 90                    | 107.78                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 99.70                  | 90                    | 107.89                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 104.36                 | 90                    | 108.19                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 104.36                 | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 552,674.40             | 481,440.81             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 104.49                 | 90                    | 108.25                | 84                    | 90.06                 | 131.80          | 100,197.09             | 87,282.79              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 95.05                  | 72                    | 105.43                | 66                    | 83.60                 | 115.00          | 590,367.59             | 496,072.77             |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 107,643.23  
 2015 Sew. Ac. = 22,572.33  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,279,590.65 \$9,863,468.30  
 + Engr., ROW, Financ., Conting. (1.5x) = \$16,919,385.98 \$14,795,202.46

NOTES:  
 UPSTREAM MAIN/STATION Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 LENGTH Length of Pipe Segment in Feet  
 EXIST DIA. Existing Pipe Diameter in Inches  
 EXIST PIPE CAP Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 2000 MODEL FLOW Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 2020 MODEL FLOW Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 COEF. "A", COEF. "B" Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 MODEL PROP DIA. Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 MODEL H.G. SLOPE Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq. n = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(8/3) ]<sup>0.2</sup>, n = 0.0145  
 DESIGN FLOW Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 PROP. REPL. PIPE Proposed Replacement Pipe in Inches  
 PROP. PARL. PIPE Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>1.48</sup> / 1629.6 x n ] / 1.54  
 PARL. PIPE CAP. Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>1.48</sup> / 1629.6 x n ] / 1.54  
 BOTH CAP. Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 ESTIM. REPL. PIPE COST Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 ESTIM. PARL. PIPE COST Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 5a**  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills; but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2020 COEF. "A" | 2020 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. CAP. (MGD) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|------------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 93.49                  | 96                    | 99.32            | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17         | M402A/0000+50           | 1728          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.10                  | 96                    | 102.85           | 86.59                 | 120.82          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.12                  | 96                    | 102.88           | 86.61                 | 16.04           | 66,048.79              | 58,050.89               |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 96.12                  | 96                    | 102.88           | 86.61                 | 86.61           | 135,716.69             | 119,262.25              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 96.15                  | 96                    | 102.91           | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 96.91                  | 96                    | 103.85           | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 97.14                  | 96                    | 104.12           | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 97.34                  | 90                    | 105.58           | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 97.48                  | 90                    | 105.73           | 87.96                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 97.61                  | 90                    | 105.86           | 88.07                 | 121.89          | 444,525.17             | 387,230.81              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 97.73                  | 90                    | 106.00           | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 97.80                  | 90                    | 106.05           | 88.19                 | 119.91          | 200,394.17             | 174,565.59              |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000565                   | 104.81                 | 96                    | 126.17           | 88.23                 | 123.42          | 583,581.76             | 512,913.65              |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 104.82                 | 96                    | 126.30           | 106.20                | 138.10          | 89,573.01              | 78,726.28               |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 104.87                 | 96                    | 126.30           | 106.20                | 138.72          | 461,436.74             | 405,559.63              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000570                   | 104.97                 | 96                    | 126.50           | 106.50                | 138.02          | 625,201.54             | 549,493.54              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000571                   | 105.20                 | 90                    | 106.85           | 106.50                | 124.56          | 318,085.99             | 277,088.24              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 105.30                 | 90                    | 106.91           | 106.50                | 113.41          | 133,596.11             | 116,377.06              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.69                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 105.55                 | 90                    | 107.21           | 106.91                | 120.91          | 652,076.27             | 568,030.89              |
| M402A/0085+56         | M402A/0085+50           | 151           | 54               | 24.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 105.75                 | 90                    | 107.48           | 107.21                | 111.26          | 565,397.84             | 492,524.34              |
| M402A/0088+51         | M402A/0085+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 105.82                 | 90                    | 107.78           | 107.48                | 142.89          | 107,354.02             | 93,517.28               |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 106.07                 | 90                    | 107.89           | 107.78                | 114.75          | 641,738.46             | 559,025.52              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 106.19                 | 90                    | 107.89           | 107.89                | 129.15          | 274,349.16             | 238,988.61              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000586                   | 112.16                 | 90                    | 108.19           | 108.19                | 131.80          | 552,674.40             | 481,440.81              |
| M402A/0109+11         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000588                   | 112.29                 | 90                    | 108.38           | 108.25                | 127.14          | 244,926.21             | 213,357.94              |
| M402A/0113+81         | M402A/0109+11           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000588                   | 112.29                 | 90                    | 108.38           | 108.38                | 115.00          | 590,367.59             | 496,072.77              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.76                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 112.16                 | 90                    | 108.25           | 90.06                 | 131.80          | 100,197.09             | 87,282.79               |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 112.29                 | 90                    | 108.38           | 90.17                 | 127.14          | 244,926.21             | 213,357.94              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 112.29                 | 90                    | 108.38           | 90.17                 | 127.14          | 244,926.21             | 213,357.94              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 101.61                 | 72                    | 105.43           | 83.60                 | 115.00          | 590,367.59             | 496,072.77              |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2020  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2020 Eq. Pop. = 117,402.63  
 2020 Sew. Ac. = 24,285.65  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,482,690.59 \$10,030,827.48  
 + Engr., ROW, Financ., Conting. (1.5x) = \$17,239,035.89 \$15,046,241.22

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP  
 ESTIM REPL. PIPE COST  
 ESTIM PARL. PIPE COST

Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(8/3) ]<sup>2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.125</sup> / 1629.6 x n ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(8/3) x s<sup>0.125</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 5a**  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marine Creek Area, Year 2020  
 BF X Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 97.10                  | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.11                  | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.13                  | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.89              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.13                  | 96                    | 102.88                | 90                    | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 99.15                  | 96                    | 102.91                | 90                    | 86.64                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 99.88                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 100.08                 | 96                    | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 100.31                 | 90                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 100.62                 | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 100.70                 | 90                    | 105.84                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 100.74                 | 90                    | 105.84                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0051+91         | M402A/0049+00           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 100.87                 | 90                    | 106.05                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.59             |
| M402A/0060+68         | M402A/0051+91           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 117.97                 | 96                    | 126.14                | 84                    | 88.19                 | 135.92          | 583,581.76             | 512,913.65             |
| M402A/0065+95         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.63                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 117.96                 | 96                    | 126.17                | 84                    | 88.35                 | 138.10          | 89,573.01              | 78,726.28              |
| M402A/0072+77         | M402A/0065+95           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 117.93                 | 96                    | 126.30                | 84                    | 88.37                 | 138.72          | 461,436.74             | 405,559.63             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 117.99                 | 96                    | 126.50                | 84                    | 88.46                 | 138.02          | 625,201.54             | 549,493.54             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 118.12                 | 96                    | 126.91                | 84                    | 88.60                 | 139.97          | 731,060.56             | 642,533.69             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 118.16                 | 96                    | 126.98                | 84                    | 88.89                 | 142.52          | 361,911.17             | 318,085.99             |
| M402A/0088+51         | M402A/0086+56           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 118.23                 | 96                    | 127.05                | 84                    | 88.94                 | 136.17          | 136,621.47             | 120,077.46             |
| M402A/0103+76         | M402A/0088+51           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 118.53                 | 96                    | 127.34                | 84                    | 89.19                 | 131.39          | 152,002.69             | 133,596.11             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 118.77                 | 96                    | 127.60                | 84                    | 89.37                 | 138.93          | 741,917.89             | 652,076.27             |
| M402A/0113+81         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 118.85                 | 96                    | 127.87                | 84                    | 89.42                 | 129.31          | 643,297.10             | 565,397.84             |
| M402A/0117+43         | M402A/0113+81           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 119.10                 | 96                    | 128.02                | 84                    | 89.67                 | 160.95          | 122,145.02             | 107,354.02             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000582                   | 119.26                 | 96                    | 128.15                | 84                    | 89.76                 | 132.88          | 312,148.38             | 274,349.16             |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 133.64                 | 96                    | 128.51                | 84                    | 89.76                 | 148.97          | 628,820.65             | 552,674.40             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.000588                   | 133.69                 | 78                    | 130.52                | 72                    | 108.38                | 145.35          | 278,671.60             | 244,926.21             |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2050  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2050 Eq. Pop. = 150,439.81  
 2050 Sew. Ac. = 28,610.82  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,292,398.84 \$16,029,264.76

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5a  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BFX Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 98.91             | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 100.56            | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 100.58            | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,050.69              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 100.58            | 96                    | 102.88                | 90                    | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 100.60            | 96                    | 102.91                | 90                    | 86.64                 | 160.95          | 62,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 101.28            | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 101.49            | 96                    | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 101.73            | 84                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 559           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 101.90            | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 307           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 102.07            | 90                    | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 102.16            | 90                    | 105.94                | 84                    | 88.19                 | 116.85          | 244,131.00             | 212,685.22             |
| M402A/0051+91         | M402A/0049+00           | 551           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 102.35            | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0054+21         | M402A/0051+91           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 125.38            | 96                    | 126.14                | 90                    | 106.20                | 135.92          | 583,581.76             | 512,913.65             |
| M402A/0060+68         | M402A/0054+21           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 125.39            | 96                    | 126.30                | 90                    | 106.33                | 138.10          | 89,573.01              | 78,726.28              |
| M402A/0061+67         | M402A/0060+68           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 125.38            | 96                    | 126.78                | 90                    | 106.50                | 138.02          | 625,201.54             | 549,493.54             |
| M402A/0065+95         | M402A/0061+67           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 125.36            | 96                    | 126.98                | 90                    | 106.85                | 142.52          | 731,060.56             | 642,533.69             |
| M402A/0072+77         | M402A/0065+95           | 400           | 54               | 29.26                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 125.42            | 96                    | 127.05                | 90                    | 106.97                | 131.39          | 152,002.69             | 133,596.11             |
| M402A/0080+78         | M402A/0072+77           | 151           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 125.49            | 96                    | 127.34                | 90                    | 107.21                | 138.93          | 361,911.17             | 318,085.99             |
| M402A/0085+50         | M402A/0080+78           | 168           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 125.84            | 96                    | 127.60                | 90                    | 107.42                | 129.31          | 643,297.10             | 565,397.84             |
| M402A/0088+51         | M402A/0085+50           | 820           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 126.09            | 96                    | 127.67                | 90                    | 107.48                | 160.95          | 122,145.02             | 107,354.02             |
| M402A/0096+65         | M402A/0088+51           | 711           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 126.18            | 96                    | 128.02                | 90                    | 107.78                | 132.86          | 730,155.78             | 647,739.48             |
| M402A/0103+76         | M402A/0096+65           | 135           | 54               | 25.08                  | 31.70                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 126.62            | 96                    | 128.15                | 90                    | 107.89                | 147.28          | 312,148.38             | 274,349.16             |
| M402A/0105+11         | M402A/0103+76           | 807           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 126.62            | 96                    | 128.51                | 90                    | 108.19                | 148.97          | 628,820.65             | 552,674.40             |
| M402A/0109+91         | M402A/0105+11           | 345           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 145.87            | 96                    | 128.58                | 90                    | 108.25                | 149.99          | 114,002.02             | 100,197.09             |
| M402A/0113+81         | M402A/0109+91           | 695           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 145.94            | 96                    | 128.74                | 90                    | 108.38                | 145.35          | 278,671.60             | 244,926.21             |
| M402A/0117+43         | M402A/0113+81           | 126           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 145.94            | 96                    | 128.74                | 90                    | 108.38                | 145.35          | 114,002.02             | 100,197.09             |
| M402A/0120+25         | M402A/0117+43           | 308           | 54               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 125.99            | 78                    | 130.52                | 72                    | 105.43                | 136.83          | 692,861.97             | 590,367.59             |
| M402A/0120+25         | M402A/0120+25           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 125.99            | 78                    | 130.52                | 72                    | 105.43                | 136.83          | 692,861.97             | 590,367.59             |
| M402B/0123+40         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 125.99            | 78                    | 130.52                | 72                    | 105.43                | 136.83          | 692,861.97             | 590,367.59             |

DESIGN CONDITION: OPTION NO. 5a  
 DESIGN YEAR: 2070  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2070 Eq. Pop. = 169,512.59  
 2070 Sew. Ac. = 31,075.63  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50  
 + Engr., ROW, Financ., Conting (1.5%) = \$18,292,398.84 \$16,029,264.76

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM MAIN/STATION  
 LENGTH  
 EXIST. DIA.  
 EXIST. PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP  
 ESTIM. REPL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Cobrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5a  
 All Cities Served by City of Fort Worth  
 Big Fossil Outfall, except Richland Hills, but including  
 NRH, Haltom City, Marine Creek Area, year 2020  
 BF-X Area, and Constant 6.0 MGD Intel Facility  
 Flow. This Option also includes diversion  
 of Little Fossil Creek Area in Haltom City  
 to this line. Richland Hills omitted from this model.

**OPTION 5b**

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 4.92                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 4.93                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 4.95                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,605.65              | 0.00                   |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 4.97                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 4.98                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0038    | -0.0206   | 54                    | 0.000257                   | 4.98                   | 36                    | 10.00                 | 0                     | 0.00                  | 10.00           | 24,047.30              | 0.00                   |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 4.99                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,778.07              | 0.00                   |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 4.99                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 68,197.64              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 4.99                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 80,921.08              | 0.00                   |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 5.00                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 5.00                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 5.01                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 5.02                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 5.03                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 5.04                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 5.15                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC-A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 5.06                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC-A/0006+17       | TCWSC-A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 5.07                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC-A/0007+96       | TCWSC-A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 5.07                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC-A/0015+30       | TCWSC-A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 5.09                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC-A/0017+50       | TCWSC-A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 5.10                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC-A/0039+61       | TCWSC-A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 5.14                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 158,239.83             | 0.00                   |
| TCWSC-B/0001+14.8     | TCWSC-A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.10                   | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 715.69                 | 0.00                   |
| TCWSC-B/0001+28.94    | TCWSC-B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.10                   | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC-B/0001+34.94    | TCWSC-B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.10                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC-B/0001+46.94    | TCWSC-B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | 0.10                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | 0.10                   | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 5.16                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 5.17                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 26,065.38              | 0.00                   |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | -0.01                  | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.19                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.21                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: **OPTION NO. 5b**  
 2000 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2000 Eq. Pop. = 7,909.96 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2000 Sew. Ac. = 1,157.56 + Engr., ROW, Financ., Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{*(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5b  
 Includes Flow only from  
 Richland Hills, North  
 Richland Hills flow is assumed  
 to be diverted to the proposed  
 City of Fort Worth Outfall Sewer.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC0000+20          | TCWSC0001+32            | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 5.23                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC0001+00          | TCWSC0000+20            | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 5.24                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC0004+27          | TCWSC0001+00            | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 5.26                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,605.65              | 0.00                   |
| TCWSC0009+33          | TCWSC0004+27            | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 5.28                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC0017+56          | TCWSC0009+33            | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 5.29                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC0019+45          | TCWSC0017+56            | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 5.29                   | 36                    | 10.00                 | 0                     | 0.00                  | 10.00           | 24,047.30              | 0.00                   |
| TCWSC0025+17          | TCWSC0019+45            | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 5.30                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,778.07              | 0.00                   |
| TCWSC0030+53          | TCWSC0025+17            | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 5.30                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 68,197.64              | 0.00                   |
| TCWSC0036+89          | TCWSC0030+53            | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 5.31                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 80,921.08              | 0.00                   |
| TCWSC0044+92          | TCWSC0036+89            | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 5.31                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC0053+70          | TCWSC0044+92            | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 5.31                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC0059+40          | TCWSC0053+70            | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 5.33                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC0059+99          | TCWSC0059+40            | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 5.34                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC0068+65          | TCWSC0059+99            | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 5.35                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC0076+00          | TCWSC0068+65            | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 5.36                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/A-B0000+00      | TCWSC0076+00            | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 5.47                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC-A0003+40        | TCWSC/A-B0000+00        | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 5.38                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC-A0006+17        | TCWSC-A0003+40          | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 5.39                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC-A0007+96        | TCWSC-A0006+17          | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 5.39                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC-A0015+30        | TCWSC-A0007+96          | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 5.40                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC-A0017+50        | TCWSC-A0015+30          | 220           | 27               | 21.09                  | 11.37                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 5.41                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC-A0039+61        | TCWSC-A0017+50          | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 5.46                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 158,239.83             | 0.00                   |
| TCWSC-B0001+14.8      | TCWSC-A0039+61          | 10            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.11                   | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 715.69                 | 0.00                   |
| TCWSC-B0001+28.94     | TCWSC-B0001+14.8        | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.11                   | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC-B0001+34.94     | TCWSC-B0001+28.94       | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.11                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC-B0001+46.94     | TCWSC-B0001+34.94       | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | 0.10                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC-B0001+73.07     | TCWSC-B0001+46.94       | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | 0.10                   | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC-B0003+02        | TCWSC-B0001+73.07       | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 5.48                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC-B0005+96        | TCWSC-B0003+02          | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 5.49                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 26,065.38              | 0.00                   |
| TCWSC-B0008+15        | TCWSC-B0005+96          | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | -0.01                  | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC-B0011+93        | TCWSC-B0008+15          | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.45                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC-B0012+35        | TCWSC-B0011+93          | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.47                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION NO. 5b  
 2005 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2005 Eq. Pop. = 8,402.56  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2005 Sew. Ac. = 1,229.65  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr., ROW, Financ., Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PARL. PIPE PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.8(3)</sup> ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.8(3)</sup> x s<sup>1/2</sup> / 1629.6 x n ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

| UPSTREAM MAINSTATION | DOWNSTREAM MAINSTATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|----------------------|------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20        | L9957/0001+32          | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 6.27                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00        | TCWSC/0000+20          | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 6.29                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC/0004+27        | TCWSC/0001+00          | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0189   | 54                    | 0.000228                   | 6.37                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,805.65              | 0.00                   |
| TCWSC/0009+33        | TCWSC/0004+27          | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 6.46                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC/0017+56        | TCWSC/0009+33          | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 6.56                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC/0019+45        | TCWSC/0017+56          | 189           | 36               | 10.20                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 6.58                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 24,047.30              | 0.00                   |
| TCWSC/0025+17        | TCWSC/0019+45          | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 6.63                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,778.07              | 0.00                   |
| TCWSC/0030+53        | TCWSC/0025+17          | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 6.67                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 80,197.64              | 0.00                   |
| TCWSC/0036+89        | TCWSC/0030+53          | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 6.70                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 68,921.08              | 0.00                   |
| TCWSC/0044+92        | TCWSC/0036+89          | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 6.74                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC/0053+70        | TCWSC/0044+92          | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 6.76                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC/0059+40        | TCWSC/0053+70          | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 6.78                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC/0059+99        | TCWSC/0059+40          | 59            | 36               | 9.95                   | 11.07                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 6.79                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC/0068+65        | TCWSC/0059+99          | 866           | 36               | 10.22                  | 11.09                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 6.80                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC/0076+00        | TCWSC/0068+65          | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 6.81                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/A-B/0000+00    | TCWSC/0076+00          | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 6.88                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC-A/0003+40      | TCWSC/A-B/0000+00      | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 6.82                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC-A/0006+17      | TCWSC-A/0003+40        | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 6.83                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC-A/0007+96      | TCWSC-A/0006+17        | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 6.83                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC-A/0015+30      | TCWSC-A/0007+96        | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 6.84                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC-A/0017+50      | TCWSC-A/0015+30        | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 6.85                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC-A/0039+61      | TCWSC-A/0017+50        | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 6.87                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 158,239.83             | 0.00                   |
| TCWSC-B/0001+14 B    | TCWSC-A/0039+61        | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.04                   | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 715.69                 | 0.00                   |
| TCWSC-B/0001+28.94   | TCWSC-B/0001+14 B      | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.04                   | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC-B/0001+34.94   | TCWSC-B/0001+28.94     | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | 0.03                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC-B/0001+46.94   | TCWSC-B/0001+34.94     | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | 0.03                   | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC-B/0001+73.07   | TCWSC-B/0001+46.94     | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | 0.04                   | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC-B/0003+02      | TCWSC-B/0001+73.07     | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 6.89                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC-B/0005+96      | TCWSC-B/0003+02        | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 6.90                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 26,065.38              | 0.00                   |
| TCWSC-B/0008+15      | TCWSC-B/0005+96        | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | -0.01                  | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC-B/0011+93      | TCWSC-B/0008+15        | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.96                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC-B/0012+35      | TCWSC-B/0011+93        | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.97                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION NO. 5b  
 2010 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2010 Eq. Pop. = 8,895.16  
 2010 Sew. Ac. = 1,254.35  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr., ROW, Financ., Conting (1.5%) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn. s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(ft<sup>3</sup>) ]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup>(ft<sup>3</sup>) x s<sup>2</sup>(1/2) / 1629.6 x n ]<sup>1/2</sup>  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5b  
 Includes Flow only from  
 Richland Hills, North  
 Richland Hills flow is assumed  
 to be diverted to the proposed  
 City of Fort Worth Outfall Sewer.



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST DIA (in) | EXIST PIPE CAP (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL PIPE (in) | REPL PIPE CAP (MGD) | PROP. PARL PIPE (in) | PARL PIPE CAP (MGD) | BOTH CAP (MGD) | ESTIM. PIPE COST | ESTIM. PARL PIPE COST |
|-----------------------|-------------------------|---------------|----------------|----------------------|-----------------------|-----------------------|-----------|-----------|----------------------|----------------------------|------------------------|----------------------|---------------------|----------------------|---------------------|----------------|------------------|-----------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36             | 142.07               | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                   | 0.000217                   | 6.96                   | 36                   | 142.07              | 0                    | 0.00                | 142.07         | \$2,544.69       | \$0.00                |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36             | 44.89                | 10.86                 | 16.86                 | 0.0029    | -0.0158   | 54                   | 0.000219                   | 6.99                   | 36                   | 44.89               | 0                    | 0.00                | 44.89          | 10,178.75        | 0.00                  |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36             | 13.97                | 10.91                 | 17.30                 | 0.0033    | -0.0169   | 54                   | 0.000228                   | 7.11                   | 36                   | 13.97               | 0                    | 0.00                | 13.97          | 41,605.65        | 0.00                  |
| TCWSC/0009+33         | TCWSC/0004+27           | 508           | 36             | 10.16                | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                   | 0.000241                   | 7.26                   | 36                   | 10.16               | 0                    | 0.00                | 10.16          | 64,380.60        | 0.00                  |
| TCWSC/0017+58         | TCWSC/0009+33           | 823           | 36             | 10.25                | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                   | 0.000254                   | 7.43                   | 36                   | 10.25               | 0                    | 0.00                | 10.25          | 104,713.91       | 0.00                  |
| TCWSC/0019+45         | TCWSC/0017+58           | 189           | 36             | 10.00                | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                   | 0.000257                   | 7.45                   | 36                   | 10.00               | 0                    | 0.00                | 10.00          | 24,047.30        | 0.00                  |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36             | 10.20                | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                   | 0.000263                   | 7.53                   | 36                   | 10.20               | 0                    | 0.00                | 10.20          | 72,778.07        | 0.00                  |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36             | 10.29                | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                   | 0.000270                   | 7.60                   | 36                   | 10.29               | 0                    | 0.00                | 10.29          | 68,197.64        | 0.00                  |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36             | 10.13                | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                   | 0.000275                   | 7.66                   | 36                   | 10.13               | 0                    | 0.00                | 10.13          | 80,921.08        | 0.00                  |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36             | 10.18                | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                   | 0.000280                   | 7.72                   | 36                   | 10.18               | 0                    | 0.00                | 10.18          | 102,169.22       | 0.00                  |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36             | 10.25                | 11.05                 | 19.29                 | 0.0042    | -0.0241   | 54                   | 0.000284                   | 7.76                   | 36                   | 10.25               | 0                    | 0.00                | 10.25          | 111,711.80       | 0.00                  |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36             | 10.20                | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                   | 0.000534                   | 7.78                   | 36                   | 10.20               | 0                    | 0.00                | 10.20          | 72,523.61        | 0.00                  |
| TCWSC/0068+65         | TCWSC/0059+40           | 59            | 36             | 9.95                 | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                   | 0.000534                   | 7.78                   | 36                   | 9.95                | 0                    | 0.00                | 9.95           | 7,506.83         | 0.00                  |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36             | 10.04                | 11.11                 | 19.35                 | 0.0041    | -0.0240   | 48                   | 0.000535                   | 7.79                   | 36                   | 10.04               | 0                    | 0.00                | 10.04          | 93,517.28        | 0.00                  |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27             | 12.53                | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                   | 0.001099                   | 7.85                   | 27                   | 12.53               | 0                    | 0.00                | 12.53          | 53,677.01        | 0.00                  |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36             | 10.22                | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                   | 0.000538                   | 7.81                   | 36                   | 10.22               | 0                    | 0.00                | 10.22          | 43,259.69        | 0.00                  |
| TCWSC/A/0006+17       | TCWSC/A/0003+40         | 277           | 36             | 10.13                | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                   | 0.000538                   | 7.82                   | 36                   | 10.13               | 0                    | 0.00                | 10.13          | 35,243.93        | 0.00                  |
| TCWSC/A/0007+96       | TCWSC/A/0006+17         | 179           | 30             | 8.88                 | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                   | 0.001097                   | 7.82                   | 30                   | 8.88                | 0                    | 0.00                | 8.88           | 15,815.94        | 0.00                  |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 734           | 30             | 10.86                | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                   | 0.001097                   | 7.82                   | 30                   | 10.86               | 0                    | 0.00                | 10.86          | 64,854.20        | 0.00                  |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 220           | 27             | 21.09                | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                   | 0.001097                   | 7.82                   | 27                   | 21.09               | 0                    | 0.00                | 21.09          | 15,745.26        | 0.00                  |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 2211          | 27             | 6.66                 | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                   | 0.001097                   | 7.84                   | 27                   | 6.66                | 0                    | 0.00                | 6.66           | 158,239.83       | 0.00                  |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 10            | 27             | 8.08                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                   | 0.000000                   | -0.02                  | 27                   | 8.08                | 0                    | 0.00                | 8.08           | 715.69           | 0.00                  |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16             | -16.02               | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                   | 0.000000                   | -0.02                  | 16                   | -16.02              | 0                    | 0.00                | -16.02         | 326.73           | 0.00                  |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16             | 0.00                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                   | 0.000000                   | -0.02                  | 16                   | 0.00                | 0                    | 0.00                | 0.00           | 150.80           | 0.00                  |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16             | 0.00                 | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                   | 0.000000                   | -0.02                  | 16                   | 0.00                | 0                    | 0.00                | 0.00           | 301.59           | 0.00                  |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16             | 11.50                | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                   | 0.000000                   | -0.01                  | 16                   | 11.50               | 0                    | 0.00                | 11.50          | 628.32           | 0.00                  |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27             | 8.97                 | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                   | 0.001099                   | 7.85                   | 27                   | 8.97                | 0                    | 0.00                | 8.97           | 21,613.94        | 0.00                  |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30             | 11.53                | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                   | 0.001099                   | 7.85                   | 30                   | 11.53               | 0                    | 0.00                | 11.53          | 26,065.38        | 0.00                  |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27             | 9.86                 | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                   | 0.000000                   | 0.00                   | 27                   | 9.86                | 0                    | 0.00                | 9.86           | 10,735.40        | 0.00                  |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27             | 25.47                | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                   | 0.002653                   | 5.27                   | 27                   | 25.47               | 0                    | 0.00                | 25.47          | 25,764.96        | 0.00                  |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27             | 24.49                | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                   | 0.004654                   | 5.28                   | 27                   | 24.49               | 0                    | 0.00                | 24.49          | 6,083.39         | 0.00                  |

DESIGN CONDITION: OPTION NO. 5b  
 2015 Eq. Pop. = 17,430.50 20657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2015 Eq. Pop. = 9,134.77  
 2015 Sew. Ac. = 1,254.35  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr. ROW. Financ. Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL PIPE  
 REPL. PIPE CAP.  
 PROP. PARL PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times MGD^{1.54} / D^{(8/3)}]^{1/2}$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5b  
 Includes Flow only from Richland Hills, North Richland Hills flow is assumed to be diverted to the proposed City of Fort Worth Outfall Sewer.

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 TCWSC Option 5b.xls  
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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 7.66                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 7.70                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 7.85                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,605.65              | 0.00                   |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 8.06                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 8.29                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0038    | -0.0206   | 54                    | 0.000257                   | 8.33                   | 36                    | 10.00                 | 0                     | 0.00                  | 10.00           | 24,047.30              | 0.00                   |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 8.43                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 27,778.07              | 0.00                   |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 8.54                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 68,197.64              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 8.62                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 80,921.08              | 0.00                   |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 8.70                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 8.75                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 8.77                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 8.77                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 8.78                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 8.79                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001098                   | 8.81                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC-A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 8.80                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 43,259.69              | 0.00                   |
| TCWSC-A/0006+17       | TCWSC-A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 8.80                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 35,243.93              | 0.00                   |
| TCWSC-A/0007+96       | TCWSC-A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 8.80                   | 30                    | 8.88                  | 0                     | 0.00                  | 8.88            | 15,815.94              | 0.00                   |
| TCWSC-A/0015+30       | TCWSC-A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 8.80                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC-A/0017+50       | TCWSC-A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 8.80                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 15,745.26              | 0.00                   |
| TCWSC-A/0039+61       | TCWSC-A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 30                    | 0.000000                   | 8.80                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 158,239.83             | 0.00                   |
| TCWSC-B/0001+14.8     | TCWSC-A/0039+61         | 10            | 16               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.07                  | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 715.69                 | 0.00                   |
| TCWSC-B/0001+28.94    | TCWSC-B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.07                  | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 326.73                 | 0.00                   |
| TCWSC-B/0001+34.94    | TCWSC-B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.07                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC-B/0001+46.94    | TCWSC-B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.07                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.06                  | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 8.81                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 8.81                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 26,065.38              | 0.00                   |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.00                   | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 5.58                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 5.58                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION NO. 5b  
 2020 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2020 Eq. Pop. = 9,374.37  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2020 Sew. Ac. = 1,254.35  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr., ROW, Financ., Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

UPSTREAM MAIN/STATION LENGTH  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNING'S EQN.: S = [ 1629.6 x n x MGD^1.54 / D^4.83 ]^0.2, n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 CAPACITY OF REPLACEMENT PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 PROPOSED PARALLEL PIPE IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [ D^4.83 / 1629.6 x n ] / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 5b  
 Includes Flow only from Richland Hills, North  
 Richland Hills flow is assumed to be diverted to the proposed City of Fort Worth Outfall Sewer.

12/31/1999, 10:41 AM  
 TCWSC Option 5b.xls  
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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36              | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 7.09                   | 36                    | 142.07                | 0                     | 0.00                  | 142.07          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36              | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 7.16                   | 36                    | 44.89                 | 0                     | 0.00                  | 44.89           | 10,178.75              | 0.00                   |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36              | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000221                   | 7.40                   | 36                    | 13.97                 | 0                     | 0.00                  | 13.97           | 41,605.65              | 0.00                   |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36              | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000228                   | 7.76                   | 36                    | 10.16                 | 0                     | 0.00                  | 10.16           | 64,380.60              | 0.00                   |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36              | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 8.15                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 104,713.91             | 0.00                   |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36              | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 8.23                   | 36                    | 10.00                 | 0                     | 0.00                  | 10.00           | 24,047.30              | 0.00                   |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36              | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 8.40                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,778.07              | 0.00                   |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36              | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 8.59                   | 36                    | 10.29                 | 0                     | 0.00                  | 10.29           | 68,197.64              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36              | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 8.74                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 80,921.08              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0036+89           | 803           | 36              | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 8.88                   | 36                    | 10.18                 | 0                     | 0.00                  | 10.18           | 102,169.22             | 0.00                   |
| TCWSC/0044+92         | TCWSC/0036+89           | 878           | 36              | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 8.98                   | 36                    | 10.25                 | 0                     | 0.00                  | 10.25           | 111,711.80             | 0.00                   |
| TCWSC/0053+70         | TCWSC/0044+92           | 570           | 36              | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 8.99                   | 36                    | 10.20                 | 0                     | 0.00                  | 10.20           | 72,523.61              | 0.00                   |
| TCWSC/0059+40         | TCWSC/0053+70           | 866           | 36              | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 8.98                   | 36                    | 9.95                  | 0                     | 0.00                  | 9.95            | 7,506.83               | 0.00                   |
| TCWSC/0059+99         | TCWSC/0059+40           | 735           | 36              | 10.04                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 8.98                   | 36                    | 10.22                 | 0                     | 0.00                  | 10.22           | 110,184.99             | 0.00                   |
| TCWSC/0068+65         | TCWSC/0068+65           | 866           | 36              | 10.22                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 9.00                   | 36                    | 10.04                 | 0                     | 0.00                  | 10.04           | 93,517.28              | 0.00                   |
| TCWSC/0076+00         | TCWSC/0076+00           | 750           | 27              | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 8.88                   | 27                    | 12.53                 | 0                     | 0.00                  | 12.53           | 53,677.01              | 0.00                   |
| TCWSC/A-B/0000+00     | TCWSC/A-B/0000+00       | 340           | 36              | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 8.97                   | 36                    | 10.13                 | 0                     | 0.00                  | 10.13           | 43,259.69              | 0.00                   |
| TCWSC/A/0003+40       | TCWSC/A/0003+40         | 277           | 36              | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 8.95                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 15,815.94              | 0.00                   |
| TCWSC/A/0006+17       | TCWSC/A/0006+17         | 179           | 30              | 8.88                   | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 8.95                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 64,854.20              | 0.00                   |
| TCWSC/A/0007+96       | TCWSC/A/0007+96         | 734           | 30              | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 8.95                   | 30                    | 10.86                 | 0                     | 0.00                  | 10.86           | 15,745.26              | 0.00                   |
| TCWSC/A/0015+30       | TCWSC/A/0015+30         | 220           | 27              | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 8.94                   | 27                    | 21.09                 | 0                     | 0.00                  | 21.09           | 158,239.83             | 0.00                   |
| TCWSC/A/0017+50       | TCWSC/A/0017+50         | 221           | 27              | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 8.88                   | 27                    | 6.66                  | 0                     | 0.00                  | 6.66            | 715.69                 | 0.00                   |
| TCWSC/A/0039+61       | TCWSC/A/0039+61         | 10            | 27              | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 27                    | 8.08                  | 0                     | 0.00                  | 8.08            | 326.73                 | 0.00                   |
| TCWSC/B/0001+14.8     | TCWSC/B/0001+14.8       | 13            | 16              | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 16                    | -16.02                | 0                     | 0.00                  | -16.02          | 150.80                 | 0.00                   |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+28.94      | 6             | 16              | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 150.80                 | 0.00                   |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+34.94      | 12            | 16              | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.26                  | 16                    | 0.00                  | 0                     | 0.00                  | 0.00            | 301.59                 | 0.00                   |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+46.94      | 25            | 16              | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.25                  | 16                    | 11.50                 | 0                     | 0.00                  | 11.50           | 628.32                 | 0.00                   |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+73.07      | 302           | 27              | 8.97                   | 11.39                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 8.87                   | 27                    | 8.97                  | 0                     | 0.00                  | 8.97            | 21,613.94              | 0.00                   |
| TCWSC/B/0003+02       | TCWSC/B/0003+02         | 295           | 30              | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 8.85                   | 30                    | 11.53                 | 0                     | 0.00                  | 11.53           | 28,065.38              | 0.00                   |
| TCWSC/B/0005+96       | TCWSC/B/0005+96         | 150           | 27              | 9.86                   | -0.02                 | 0.00                  | 0.0000    | 0.0001    | 27                    | 0.000000                   | 0.01                   | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC/B/0008+15       | TCWSC/B/0008+15         | 360           | 27              | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.33                   | 27                    | 25.47                 | 0                     | 0.00                  | 25.47           | 25,764.96              | 0.00                   |
| TCWSC/B/0011+93       | TCWSC/B/0011+93         | 150           | 27              | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.31                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |
| TCWSC/B/0012+35       | TCWSC/B/0012+35         | 85            | 27              | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.31                   | 27                    | 24.49                 | 0                     | 0.00                  | 24.49           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION NO. 5b 2050

F.W. Model Eq. Pop. = 17,430.50 20,657.50 2050 Eq. Pop. = 11,289.18

F.W. Model Sew. Ac. = 2,550.82 2,764.11 2050 Sew. Ac. = 1,254.35

TOTAL ESTIM. CONST. COST = \$1,446,203.47

+ Engr., ROW, Financ, Conting. (1.5x) = \$2,169,305.20

Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

UPSTREAM MAIN/STATION

UPSTREAM MAIN/STATION

LENGTH

EXIST DIA.

EXIST PIPE CAP

2000 MODEL FLOW

2020 MODEL FLOW

COEF. "A", COEF. "B"

MODEL PROP DIA.

MODEL H.G. SLOPE

DESIGN FLOW

PROP. REPL. PIPE

REPL. PIPE CAP.

PARL. PIPE CAP.

BOTH CAP.

ESTIM. REPL. PIPE COST

ESTIM. PARL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY

DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY

LENGTH OF PIPE SEGMENT IN FEET

EXISTING PIPE DIAMETER IN INCHES

EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS

YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS

YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS

CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES

PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN

COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQN.: S = [1629.6 x n x MGD^1.54 / D^(8/3)]^2, n = 0.0145

CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES

PROPOSED REPLACEMENT PIPE IN INCHES

CAPACITY OF REPLACEMENT PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS

PROPOSED PARALLEL PIPE IN INCHES

PROPOSED PARALLEL PIPE CAPACITY IN MGD = [D^(8/3) x S^(1/2) / 1629.6 x n] / 1.54

COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD

ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 5b

Includes Flow only from Richland Hills, North to be diverted to the proposed City of Fort Worth Outfall Sewer.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 7.09                   | 36                    | 142.07                | 0                     | 3.52                  | 145.59          | \$2,544.69             | \$0.00                 |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | 0.0029    | 54                    | 0.000219                   | 7.16                   | 36                    | 44.89                 | 0                     | 3.54                  | 48.43           | 10,178.75              | 0.00                   |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 7.40                   | 36                    | 13.97                 | 0                     | 3.61                  | 17.58           | 41,605.65              | 0.00                   |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 7.76                   | 36                    | 10.16                 | 0                     | 3.70                  | 13.88           | 64,380.60              | 0.00                   |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000257                   | 8.15                   | 36                    | 10.25                 | 0                     | 3.81                  | 14.06           | 104,713.91             | 0.00                   |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 8.23                   | 36                    | 10.00                 | 0                     | 3.83                  | 13.83           | 24,047.30              | 0.00                   |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 8.40                   | 36                    | 10.20                 | 0                     | 3.88                  | 14.08           | 72,778.07              | 0.00                   |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 8.59                   | 36                    | 10.29                 | 0                     | 3.92                  | 14.21           | 88,197.64              | 0.00                   |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 8.74                   | 36                    | 10.13                 | 0                     | 3.96                  | 14.09           | 80,921.08              | 0.00                   |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 8.88                   | 36                    | 10.18                 | 0                     | 4.00                  | 14.18           | 102,169.22             | 0.00                   |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 8.98                   | 36                    | 10.25                 | 0                     | 4.02                  | 14.27           | 111,711.80             | 0.00                   |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 8.99                   | 36                    | 10.20                 | 0                     | 5.52                  | 15.72           | 72,523.61              | 0.00                   |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 8.98                   | 36                    | 9.95                  | 0                     | 5.53                  | 15.47           | 7,506.83               | 0.00                   |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 8.98                   | 36                    | 10.22                 | 0                     | 5.53                  | 15.75           | 110,184.99             | 0.00                   |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000538                   | 9.00                   | 36                    | 10.04                 | 0                     | 5.53                  | 15.57           | 93,517.28              | 0.00                   |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 9.00                   | 27                    | 12.53                 | 0                     | 4.37                  | 16.90           | 53,677.01              | 0.00                   |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 8.98                   | 36                    | 10.22                 | 0                     | 3.06                  | 13.28           | 43,299.69              | 0.00                   |
| TCWSC/A/0006+17       | TCWSC/A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 8.97                   | 36                    | 10.13                 | 0                     | 3.06                  | 13.28           | 43,299.69              | 0.00                   |
| TCWSC/A/0007+96       | TCWSC/A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 8.95                   | 30                    | 8.88                  | 0                     | 4.36                  | 15.22           | 64,854.20              | 0.00                   |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 8.95                   | 30                    | 10.86                 | 0                     | 4.36                  | 15.22           | 64,854.20              | 0.00                   |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 8.94                   | 27                    | 21.09                 | 0                     | 2.03                  | 23.12           | 15,745.26              | 0.00                   |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 8.88                   | 27                    | 6.66                  | 0                     | 2.03                  | 23.12           | 15,745.26              | 0.00                   |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 27                    | 8.08                  | 0                     | 0.04                  | 8.12            | 158,239.83             | 0.00                   |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 16                    | -16.02                | 0                     | 0.04                  | -15.98          | 326.73                 | 0.00                   |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.28                  | 16                    | 0.00                  | 0                     | 0.04                  | 0.04            | 150.80                 | 0.00                   |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.26                  | 16                    | 0.00                  | 0                     | 0.04                  | 0.04            | 301.59                 | 0.00                   |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.25                  | 16                    | 11.50                 | 0                     | 0.04                  | 11.54           | 628.32                 | 0.00                   |
| TCWSC/B/0003+02       | TCWSC/B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 8.87                   | 27                    | 8.97                  | 0                     | 2.03                  | 11.00           | 21,613.94              | 0.00                   |
| TCWSC/B/0005+96       | TCWSC/B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 8.85                   | 30                    | 11.53                 | 0                     | 2.03                  | 13.56           | 26,065.38              | 0.00                   |
| TCWSC/B/0008+15       | TCWSC/B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.01                   | 27                    | 9.86                  | 0                     | 0.00                  | 9.86            | 10,735.40              | 0.00                   |
| TCWSC/B/0011+93       | TCWSC/B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 4.33                   | 27                    | 25.47                 | 0                     | 3.15                  | 28.62           | 25,764.96              | 0.00                   |
| TCWSC/B/0012+35       | TCWSC/B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 4.31                   | 27                    | 24.49                 | 0                     | 4.17                  | 28.66           | 6,083.39               | 0.00                   |

DESIGN CONDITION: OPTION 5b  
 2070  
 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2070 Eq. Pop. = 11,289.18  
 2070 Sew. Ac. = 1,254.35  
 TOTAL ESTIM. CONST. COST = \$1,446,203.47  
 + Engr., ROW, Financ., Conting. (1.5x) = \$2,169,305.20  
 Assume Rehab. Cost = 0.33 x Repl. Cost = \$715,870.72

UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup>(18/3)]<sup>1/2</sup>, n = 0.0145  
 Calculated Design Flow in MGD based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Capacity of Replacement Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [D<sup>4.75</sup>(18/3) x s<sup>1/2</sup>] / 1629.6 x n / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 5b  
 Includes Flow only from  
 Richland Hills, North  
 Richland Hills flow is assumed  
 to be diverted to the proposed  
 City of Fort Worth Outfall Sewer.

TCWSC Option 5b.xls  
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***OPTION 6a***

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2000 COEF. "A" | 2000 COEF. "B" | MODEL PROP. DIA (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|------------------------|
| M402A0000+50          | M280A0304+97            | 102           | 54              | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                   | 0.000350                   | 60.14                  | 84                    | 69.57                 | 78              | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A0020+17          | M402A0000+50            | 1726          | 54              | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 61.82                  | 84                    | 72.04                 | 78              | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A0020+90          | M402A0020+17            | 73            | 24              | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 61.83                  | 84                    | 72.06                 | 78              | 59.13                 | -11.44          | 50,568.60              | 43,602.52              |
| M402A0022+40          | M402A0020+90            | 150           | 24              | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                   | 0.000375                   | 61.83                  | 84                    | 72.06                 | 78              | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A0023+09          | M402A0022+40            | 69            | 24              | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                   | 0.000376                   | 61.85                  | 84                    | 72.08                 | 78              | 59.15                 | 133.46          | 47,797.72              | 41,213.34              |
| M402A0028+40          | M402A0023+09            | 870           | 54              | 25.04                  | 18.78                 | 87.63                 | -0.0011        | 0.0090         | 90                   | 0.000383                   | 62.33                  | 84                    | 72.74                 | 78              | 59.69                 | 84.73           | 602,666.92             | 519,646.47             |
| M402A0032+40          | M402A0028+40            | 399           | 54              | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                   | 0.000385                   | 62.48                  | 84                    | 72.93                 | 78              | 59.85                 | 95.52           | 276,395.52             | 238,320.62             |
| M402A0036+79          | M402A0032+40            | 433           | 54              | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                   | 0.000558                   | 62.60                  | 78                    | 72.09                 | 66              | 46.17                 | 78.56           | 258,628.65             | 185,171.99             |
| M402A0040+28          | M402A0036+79            | 361           | 54              | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                   | 0.000559                   | 62.68                  | 78                    | 72.19                 | 66              | 46.24                 | 75.27           | 215,623.42             | 154,381.27             |
| M402A0045+95          | M402A0040+28            | 559           | 54              | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                   | 0.000561                   | 62.76                  | 78                    | 72.28                 | 66              | 46.29                 | 80.11           | 333,987.79             | 239,055.76             |
| M402A0049+00          | M402A0045+95            | 307           | 54              | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 62.81                  | 78                    | 72.33                 | 66              | 46.33                 | 75.04           | 183,369.50             | 131,288.22             |
| M402A0051+91          | M402A0049+00            | 252           | 54              | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                   | 0.000562                   | 62.84                  | 78                    | 72.38                 | 66              | 46.36                 | 78.08           | 150,518.29             | 107,675.53             |
| M402A0054+21          | M402A0051+91            | 255           | 54              | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                   | 0.000563                   | 62.88                  | 78                    | 72.41                 | 66              | 46.38                 | 81.57           | 152,310.17             | 109,050.48             |
| M402A0060+68          | M402A0054+21            | 645           | 54              | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 66.28                  | 78                    | 72.51                 | 66              | 46.44                 | 76.16           | 385,255.15             | 275,833.57             |
| M402A0061+67          | M402A0060+68            | 99            | 54              | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                   | 0.000564                   | 66.28                  | 78                    | 72.52                 | 66              | 46.45                 | 78.33           | 59,132.19              | 42,337.24              |
| M402A0065+95          | M402A0061+67            | 510           | 54              | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                   | 0.000566                   | 66.32                  | 78                    | 72.60                 | 66              | 46.50                 | 78.89           | 304,620.35             | 218,100.96             |
| M402A0072+77          | M402A0065+95            | 691           | 54              | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                   | 0.000568                   | 66.39                  | 78                    | 72.71                 | 66              | 46.57                 | 78.09           | 412,730.71             | 295,505.42             |
| M402A0080+78          | M402A0072+77            | 808           | 54              | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                   | 0.000570                   | 66.49                  | 78                    | 72.88                 | 66              | 46.68                 | 78.91           | 482,614.20             | 345,540.34             |
| M402A0085+50          | M402A0080+78            | 400           | 54              | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                   | 0.000571                   | 66.54                  | 78                    | 72.95                 | 66              | 46.73                 | 82.40           | 238,917.92             | 171,059.58             |
| M402A0086+56          | M402A0085+50            | 151           | 54              | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                   | 0.000572                   | 66.57                  | 78                    | 72.99                 | 66              | 46.75                 | 76.01           | 90,191.51              | 64,574.99              |
| M402A0088+51          | M402A0086+56            | 820           | 54              | 31.72                  | 31.56                 | 88.99                 | -0.0004        | 0.0060         | 84                   | 0.000575                   | 66.60                  | 78                    | 73.00                 | 66              | 46.78                 | 71.20           | 100,345.53             | 71,845.02              |
| M402A0096+65          | M402A0088+51            | 711           | 54              | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                   | 0.000577                   | 66.75                  | 78                    | 73.34                 | 66              | 46.98                 | 68.87           | 424,676.60             | 304,058.40             |
| M402A0103+76          | M402A0096+65            | 135           | 54              | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                   | 0.000578                   | 66.91                  | 78                    | 73.39                 | 66              | 47.00                 | 100.47          | 80,634.80              | 57,732.61              |
| M402A0109+91          | M402A0103+76            | 807           | 54              | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                   | 0.000581                   | 67.07                  | 78                    | 73.59                 | 66              | 47.14                 | 72.22           | 482,016.90             | 345,112.69             |
| M402A0113+81          | M402A0109+91            | 345           | 54              | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                   | 0.000582                   | 67.14                  | 78                    | 73.66                 | 66              | 47.18                 | 86.57           | 206,066.71             | 147,538.88             |
| M402A0117+43          | M402A0113+81            | 695           | 54              | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 70.06                  | 78                    | 73.87                 | 66              | 47.31                 | 88.09           | 415,119.89             | 297,216.01             |
| M402A0120+25          | M402A0117+43            | 126           | 54              | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                   | 0.000586                   | 70.08                  | 78                    | 73.91                 | 66              | 47.34                 | 89.08           | 75,259.14              | 53,883.77              |
| M402B0123+40          | M402A0120+25            | 308           | 54              | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                   | 0.000588                   | 70.14                  | 78                    | 74.00                 | 66              | 47.40                 | 84.37           | 183,966.80             | 131,715.87             |
| M402B0136+74          | M402B0123+40            | 1160          | 48              | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                   | 0.001823                   | 64.06                  | 66                    | 83.60                 | 60              | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 6a  
 DESIGN YEAR: 2000  
 F.W. Model Eq. Pop. = 57,207.50  
 F.W. Model Sew. Ac. = 9,004.81  
 2000 Eq. Pop. = 69,948.30  
 2000 Sew. Ac. = 14,709.75  
 TOTAL ESTIM. CONST. COST = \$8,569,370.81  
 + Engr., ROW, Finance, Conting. (1.5x) = \$12,854,056.21  
 \$9,800,478.44  
 Constant Intel Flow = 6.00

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.  $s = [1629.6 \times n \times \text{MGD}^{1.48} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} \times s^{1.48} / 1629.6 \times n]^{1/2}$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} \times s^{1.48} / 1629.6 \times n]^{1/2}$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6a  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil, plus Marine Creek Area, year 2020 BF X Area, and Constant 6.0 MGD Intel Facility Flow.  
 The Cities of NRH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2005 COEF. "A" | 2005 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 65.97                  | 84                    | 69.57                 | 78                    | 57.09                 | 279.20          | \$70,657.50            | \$60,924.07            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 67.90                  | 84                    | 72.04                 | 78                    | 59.12                 | 93.15           | 1,195,635.75           | 1,030,930.82           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | 70.57                  | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 67.91                  | 84                    | 72.06                 | 78                    | 59.13                 | -11.44          | 43,602.52              | 43,602.52              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 67.91                  | 84                    | 72.06                 | 78                    | 59.13                 | 59.13           | 103,908.09             | 89,594.22              |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 67.93                  | 84                    | 72.08                 | 78                    | 59.15                 | 133.46          | 47,797.72              | 41,213.34              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.67                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 68.48                  | 84                    | 72.74                 | 78                    | 59.69                 | 84.73           | 276,666.92             | 519,646.47             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 33.39                  | 18.87                 | 87.66                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 68.77                  | 78                    | 72.09                 | 78                    | 59.85                 | 95.52           | 238,320.62             | 238,320.62             |
| M402A/0040+28         | M402A/0032+40           | 433           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 68.86                  | 78                    | 72.19                 | 78                    | 59.85                 | 75.27           | 276,395.52             | 276,395.52             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 68.94                  | 78                    | 72.28                 | 78                    | 59.85                 | 80.11           | 333,887.79             | 239,055.76             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | -18.99                | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 69.00                  | 78                    | 72.33                 | 78                    | 59.85                 | 75.04           | 183,369.50             | 131,288.22             |
| M402A/0054+21         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 69.03                  | 78                    | 72.38                 | 78                    | 59.85                 | 76.08           | 150,518.29             | 107,767.53             |
| M402A/0061+67         | M402A/0054+21           | 285           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 69.07                  | 78                    | 72.41                 | 78                    | 59.85                 | 81.57           | 152,310.17             | 109,050.48             |
| M402A/0066+68         | M402A/0061+67           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000564                   | 71.97                  | 84                    | 88.35                 | 78                    | 72.51                 | 102.23          | 446,804.79             | 385,255.15             |
| M402A/0066+95         | M402A/0066+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 71.98                  | 84                    | 88.37                 | 78                    | 72.52                 | 104.40          | 468,579.34             | 59,132.19              |
| M402A/0072+77         | M402A/0066+95           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 72.03                  | 84                    | 88.46                 | 78                    | 72.60                 | 104.99          | 353,287.50             | 304,620.35             |
| M402A/0085+50         | M402A/0072+77           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 72.11                  | 84                    | 88.60                 | 78                    | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0086+56         | M402A/0085+50           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 72.23                  | 84                    | 88.80                 | 78                    | 72.88                 | 105.11          | 559,718.24             | 482,614.20             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 72.29                  | 84                    | 88.89                 | 78                    | 72.95                 | 108.62          | 277,088.24             | 238,917.92             |
| M402A/0103+76         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | 89.19                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 72.52                  | 84                    | 89.19                 | 78                    | 73.03                 | 97.45           | 116,377.06             | 100,345.53             |
| M402A/0109+91         | M402A/0103+76           | 711           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 72.65                  | 84                    | 89.37                 | 78                    | 73.34                 | 95.23           | 482,524.34             | 424,676.60             |
| M402A/0109+91         | M402A/0109+91           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 72.69                  | 84                    | 89.42                 | 78                    | 73.39                 | 126.86          | 93,517.28              | 80,634.80              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 72.87                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 75.46                  | 84                    | 90.01                 | 78                    | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | -0.0002        | 0.0034         | 84                    | 0.000586                   | 75.49                  | 84                    | 90.06                 | 78                    | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | -0.0002        | 0.0034         | 84                    | 0.000588                   | 75.56                  | 84                    | 90.17                 | 78                    | 74.00                 | 110.97          | 213,357.94             | 183,966.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 69.29                  | 66                    | 83.60                 | 60                    | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 6a  
 DESIGN YEAR: 2005  
 F.W. Model Eq. Pop. = 57,207.50 83,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2005 Eq. Pop. = 75,006.22  
 2005 Sew. Ac. = 16,002.64  
 TOTAL ESTIM. CONST. COST = \$9,277,334.79 \$7,792,254.93  
 + Engr., ROW, Financ., Conting. (1.5%) = \$13,916,002.18 \$11,688,382.40  
 Constant Intel Flow = 6.00

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75(8/3)}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6a  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil plus Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Intel Facility Flow.  
 The Cities of NRH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2010 COEF. "A" | 2010 COEF. "B" | 2010 MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|----------------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                         | 0.000350                   | 70.24                  | 90                    | 83.62                 | 84                    | 69.57                 | 291.68          | \$81,111.93            | \$70,657.50            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                         | 0.000375                   | 72.31                  | 90                    | 86.59                 | 84                    | 72.04                 | 106.07          | 1,372,541.04           | 1,195,635.75           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                         | 0.000375                   | 72.32                  | 90                    | 86.61                 | 84                    | 72.06                 | 1.49            | 58,050.69              | 50,568.60              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                         | 0.000375                   | 72.32                  | 90                    | 86.61                 | 84                    | 72.06                 | 72.06           | 119,908.09             | 103,908.09             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0089         | 90                         | 0.000376                   | 72.34                  | 90                    | 86.64                 | 84                    | 72.08                 | 146.39          | 54,869.83              | 47,797.72              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                         | 0.000383                   | 72.92                  | 90                    | 87.43                 | 84                    | 72.74                 | 97.78           | 691,837.02             | 602,666.92             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                         | 0.000385                   | 73.10                  | 90                    | 87.66                 | 84                    | 72.93                 | 108.60          | 317,290.77             | 276,395.52             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                         | 0.000558                   | 73.24                  | 84                    | 87.84                 | 78                    | 72.09                 | 104.48          | 299,948.02             | 258,628.65             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                         | 0.000559                   | 73.34                  | 84                    | 87.96                 | 78                    | 72.19                 | 101.22          | 250,072.13             | 215,623.42             |
| M402A/0045+95         | M402A/0040+28           | 599           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                         | 0.000561                   | 73.43                  | 84                    | 88.07                 | 78                    | 72.28                 | 106.10          | 387,230.81             | 333,887.79             |
| M402A/0051+91         | M402A/0045+95           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                         | 0.000562                   | 73.48                  | 84                    | 88.14                 | 78                    | 72.33                 | 101.04          | 212,665.22             | 183,369.50             |
| M402A/0060+68         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                         | 0.000563                   | 73.56                  | 84                    | 88.23                 | 78                    | 72.41                 | 107.60          | 176,643.75             | 152,310.17             |
| M402A/0061+67         | M402A/0060+68           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                         | 0.000564                   | 76.57                  | 84                    | 88.35                 | 78                    | 72.51                 | 102.23          | 446,804.78             | 385,255.15             |
| M402A/0065+95         | M402A/0061+67           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                         | 0.000565                   | 76.58                  | 84                    | 88.37                 | 78                    | 72.52                 | 104.40          | 68,579.34              | 59,132.19              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                         | 0.000566                   | 76.63                  | 84                    | 88.46                 | 78                    | 72.60                 | 104.99          | 353,287.50             | 304,620.35             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                         | 0.000568                   | 76.72                  | 84                    | 88.60                 | 78                    | 72.71                 | 104.23          | 478,669.93             | 412,730.71             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                         | 0.000570                   | 76.85                  | 84                    | 88.80                 | 78                    | 72.88                 | 105.11          | 599,119.24             | 482,614.20             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                         | 0.000571                   | 76.91                  | 84                    | 88.89                 | 78                    | 72.95                 | 108.62          | 277,088.24             | 236,917.92             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                         | 0.000572                   | 76.95                  | 84                    | 88.94                 | 78                    | 72.99                 | 102.25          | 104,600.81             | 90,191.51              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                         | 0.000573                   | 76.99                  | 84                    | 88.99                 | 78                    | 73.03                 | 97.45           | 116,377.06             | 100,345.53             |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.53                 | 89.37                 | -0.0004        | 0.0060         | 84                         | 0.000577                   | 77.16                  | 84                    | 89.37                 | 78                    | 73.20                 | 104.92          | 568,030.89             | 489,781.73             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                         | 0.000578                   | 77.35                  | 84                    | 89.42                 | 78                    | 73.39                 | 95.23           | 93,517.28              | 80,634.80              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                         | 0.000581                   | 77.54                  | 84                    | 89.67                 | 78                    | 73.59                 | 98.67           | 559,025.52             | 482,016.90             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                         | 0.000582                   | 77.62                  | 84                    | 89.76                 | 78                    | 73.66                 | 113.05          | 238,988.61             | 206,066.71             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                         | 0.000586                   | 80.23                  | 84                    | 90.01                 | 78                    | 73.87                 | 114.65          | 481,440.81             | 415,119.89             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06                 | 0.0002         | 0.0034         | 84                         | 0.000586                   | 80.26                  | 84                    | 90.06                 | 78                    | 73.91                 | 115.65          | 87,282.79              | 75,259.14              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                         | 0.000588                   | 80.34                  | 84                    | 90.17                 | 78                    | 74.00                 | 110.97          | 213,357.94             | 183,968.80             |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                         | 0.001829                   | 73.88                  | 66                    | 83.60                 | 60                    | 64.84                 | 96.24           | 496,072.77             | 409,977.50             |

DESIGN CONDITION: OPTION NO. 6a  
 DESIGN YEAR: 2010  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2010 Eq. Pop. = 80,064.14  
 2010 Sew. Ac. = 17,107.83  
 Constant Intel Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5x) = \$14,747,213.88  
 \$12,724,913.30

NOTES:  
 UPSTREAM MAIN/STATION  
 DOWNSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 LENGTH  
 Length of Pipe Segment in Feet  
 EXIST DIA.  
 Existing Pipe Diameter in Inches  
 EXIST PIPE CAP  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 2000 MODEL FLOW  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 2020 MODEL FLOW  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 COEF. "A", COEF. "B"  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 MODEL PROP DIA.  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 MODEL H.G. SLOPE  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eq.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^2$ ,  $n = 0.0145$   
 DESIGN FLOW  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 REPL. PIPE CAP.  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 PROF. PARL. PIPE  
 Proposed Parallel Pipe in Inches  
 PARL. PIPE CAP.  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n] / 1.54$   
 BOTH CAP.  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 ESTIM. REPL. PIPE COST  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 ESTIM. PARL. PIPE COST  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 6a**  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil, plus Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Intel Facility Flow.  
 The Cities of NRH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | 2015 COEF. "A" | 2015 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 88.34                  | 96                    | 99.32                 | 90                    | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93            |
| M402A/0020+17         | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.33                  | 96                    | 102.85                | 90                    | 86.59                 | 120.62          | 1,561,946.69           | 1,372,541.04           |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.35                  | 96                    | 102.88                | 90                    | 86.61                 | 16.04           | 66,048.79              | 58,048.79              |
| M402A/0022+40         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 91.35                  | 96                    | 102.88                | 90                    | 86.61                 | 86.61           | 135,716.69             | 119,282.25             |
| M402A/0023+09         | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64                 | -0.0011        | 0.0090         | 90                    | 0.000376                   | 91.38                  | 96                    | 102.91                | 90                    | 86.64                 | 160.95          | 52,429.68              | 54,869.83              |
| M402A/0028+40         | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 92.17                  | 96                    | 103.85                | 90                    | 87.43                 | 112.47          | 787,156.79             | 691,837.02             |
| M402A/0032+40         | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66                 | -0.0011        | 0.0090         | 90                    | 0.000385                   | 92.40                  | 96                    | 104.12                | 90                    | 87.66                 | 123.33          | 361,006.39             | 317,290.77             |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | 87.84                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 92.57                  | 90                    | 105.58                | 84                    | 87.84                 | 120.23          | 344,328.08             | 299,948.02             |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | 87.96                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 92.69                  | 90                    | 105.73                | 84                    | 87.96                 | 116.99          | 287,072.60             | 250,072.13             |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 92.80                  | 90                    | 105.86                | 84                    | 88.07                 | 121.89          | 444,525.17             | 387,230.81             |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 92.87                  | 90                    | 106.00                | 84                    | 88.14                 | 116.85          | 244,131.00             | 212,665.22             |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 92.87                  | 90                    | 106.00                | 84                    | 88.19                 | 119.91          | 200,394.17             | 174,565.59             |
| M402A/0054+21         | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23                 | -0.0011        | 0.0091         | 84                    | 0.000564                   | 92.92                  | 90                    | 106.05                | 84                    | 88.23                 | 123.42          | 202,779.82             | 176,643.75             |
| M402A/0060+68         | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 92.16                  | 90                    | 106.20                | 84                    | 88.35                 | 118.07          | 512,913.65             | 446,804.78             |
| M402A/0061+67         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37                 | -0.0004        | 0.0058         | 84                    | 0.000566                   | 92.18                  | 90                    | 106.22                | 84                    | 88.37                 | 120.25          | 78,726.28              | 68,579.34              |
| M402A/0065+95         | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 92.28                  | 90                    | 106.33                | 84                    | 88.46                 | 120.85          | 405,559.63             | 353,287.50             |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 92.42                  | 90                    | 106.50                | 84                    | 88.60                 | 120.12          | 549,493.54             | 478,669.93             |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 92.63                  | 90                    | 106.74                | 84                    | 88.80                 | 121.03          | 642,533.69             | 559,718.24             |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 92.72                  | 90                    | 106.85                | 84                    | 88.89                 | 124.56          | 318,085.98             | 277,088.24             |
| M402A/0086+56         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.94                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 92.77                  | 90                    | 106.91                | 84                    | 88.94                 | 118.20          | 120,077.46             | 104,600.81             |
| M402A/0088+51         | M402A/0086+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99                 | -0.0004        | 0.0060         | 84                    | 0.000573                   | 92.82                  | 90                    | 106.97                | 84                    | 88.99                 | 113.41          | 133,596.11             | 116,377.06             |
| M402A/0096+55         | M402A/0088+51           | 820           | 54               | 21.89                  | 31.63                 | 89.37                 | -0.0004        | 0.0060         | 84                    | 0.000577                   | 93.01                  | 90                    | 107.21                | 84                    | 89.19                 | 120.91          | 652,076.27             | 568,030.89             |
| M402A/0103+76         | M402A/0096+55           | 711           | 54               | 53.47                  | 31.66                 | 89.42                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 93.18                  | 90                    | 107.42                | 84                    | 89.37                 | 111.26          | 565,397.84             | 492,524.34             |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 25.08                  | 31.70                 | 89.67                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 93.23                  | 90                    | 107.48                | 84                    | 89.42                 | 142.89          | 107,354.02             | 93,517.28              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 39.39                  | 31.77                 | 89.76                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 93.48                  | 90                    | 107.78                | 84                    | 89.67                 | 114.75          | 641,738.48             | 559,025.52             |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 41.74                  | 42.22                 | 90.01                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 93.56                  | 90                    | 107.89                | 84                    | 89.76                 | 129.15          | 274,349.16             | 238,988.61             |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 36.97                  | 42.20                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 93.06                  | 90                    | 108.19                | 84                    | 90.01                 | 130.79          | 552,674.40             | 481,440.81             |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.20                 | 90.06                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 93.22                  | 90                    | 108.38                | 84                    | 90.06                 | 131.80          | 100,197.09             | 87,282.79              |
| M402B/0120+25         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 93.22                  | 90                    | 108.38                | 84                    | 90.17                 | 127.14          | 244,926.21             | 213,357.94             |
| M402B/0123+40         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 87.25                  | 72                    | 105.43                | 66                    | 83.60                 | 115.00          | 590,367.59             | 496,072.77             |

DESIGN CONDITION: OPTION NO. 6a  
 DESIGN YEAR: 2015  
 F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33  
 2015 Eq. Pop. = 89,256.39  
 2015 Sew. Ac. = 20,353.79  
 Constant Inlet Flow = 6.00  
 TOTAL ESTIM. CONST. COST = \$11,279,590.65 \$9,831,475.92  
 + Engr., ROW, Financ., Conting. (1.5x) = \$16,919,385.98 \$14,747,213.88

NOTES:

- UPSTREAM MAIN/STATION
  - DOWNSTREAM MAIN/STATION
  - LENGTH
  - EXIST. DIA.
  - EXIST. PIPE CAP.
  - 2000 MODEL FLOW
  - 2020 MODEL FLOW
  - COEF. "A", COEF. "B"
  - MODEL PROP. DIA.
  - MODEL H.G. SLOPE
  - DESIGN FLOW
  - PROP. REPL. PIPE
  - REPL. PIPE CAP.
  - PROP. PARL. PIPE
  - PARL. PIPE CAP.
  - BOTH CAP.
  - ESTIM. REPL. PIPE COST
  - ESTIM. PARL. PIPE COST
- Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Manning's Eqn.:  $s = 1 / (1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75})$   $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} / (1629.6 \times n)] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / (1629.6 \times n)] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6a

Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil, plus Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Inlet Facility Flow. The Cities of NRH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

| UPSTREAM MAIN/STATION  | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2050 COEF. "A" | 2050 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|--|-------------------------|---------------|------------------|------------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|-------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50  | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | 83.62          | 0.0010         | 90                    | 0.000350                   | 98.86             | 96                    | 99.32                 | 90              | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17  | M402A/0000+50           | 1726          | 54               | 34.03                  | 18.71                 | 86.59          | -0.0011        | 90                    | 0.000375                   | 101.52            | 96                    | 102.85                | 90              | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90  | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | 86.61          | -0.0011        | 90                    | 0.000375                   | 101.54            | 96                    | 102.88                | 90              | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0022+40  | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | 86.61          | -0.0011        | 90                    | 0.000375                   | 101.54            | 96                    | 102.88                | 90              | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A/0023+09  | M402A/0022+40           | 69            | 24               | 74.31                  | 18.71                 | 86.64          | -0.0011        | 90                    | 0.000376                   | 101.57            | 96                    | 102.91                | 90              | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0028+40  | M402A/0023+09           | 870           | 54               | 25.04                  | 18.78                 | 87.43          | -0.0011        | 90                    | 0.000383                   | 102.37            | 96                    | 103.85                | 90              | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A/0036+79  | M402A/0028+40           | 399           | 54               | 35.67                  | 18.81                 | 87.66          | -0.0011        | 90                    | 0.000385                   | 102.61            | 96                    | 104.12                | 90              | 87.66                 | 123.33          | 361,006.39             | 317,290.77              |
| M402A/0040+28  | M402A/0036+79           | 361           | 54               | 29.03                  | 18.87                 | 87.84          | -0.0011        | 84                    | 0.000558                   | 102.82            | 90                    | 105.58                | 84              | 87.84                 | 120.23          | 344,328.08             | 299,948.02              |
| M402A/0045+95  | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | 88.07          | -0.0011        | 84                    | 0.000561                   | 102.97            | 90                    | 105.86                | 84              | 87.96                 | 116.99          | 287,072.60             | 250,072.13              |
| M402A/0049+00  | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | 88.14          | -0.0011        | 84                    | 0.000562                   | 103.19            | 90                    | 106.00                | 84              | 88.07                 | 121.89          | 444,525.17             | 387,230.81              |
| M402A/0051+91  | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | 88.19          | -0.0011        | 84                    | 0.000562                   | 103.24            | 90                    | 106.05                | 84              | 88.14                 | 116.85          | 244,131.00             | 212,665.22              |
| M402A/0054+21  | M402A/0051+91           | 255           | 54               | 35.19                  | 19.06                 | 88.23          | -0.0011        | 84                    | 0.000563                   | 103.33            | 90                    | 106.05                | 84              | 88.19                 | 119.91          | 200,394.17             | 174,565.59              |
| M402A/0060+68  | M402A/0054+21           | 645           | 54               | 29.72                  | 31.63                 | 88.35          | -0.0004        | 84                    | 0.000564                   | 112.36            | 96                    | 126.14                | 90              | 88.23                 | 123.42          | 202,779.82             | 176,643.75              |
| M402A/0061+67  | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | 88.37          | -0.0004        | 84                    | 0.000565                   | 112.36            | 96                    | 126.14                | 90              | 106.20                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0065+95  | M402A/0061+67           | 510           | 54               | 32.39                  | 31.54                 | 88.46          | -0.0004        | 84                    | 0.000566                   | 112.40            | 96                    | 126.17                | 90              | 106.22                | 138.10          | 89,573.01              | 78,726.28               |
| M402A/0072+77  | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | 88.60          | -0.0004        | 84                    | 0.000566                   | 112.40            | 96                    | 126.30                | 90              | 106.33                | 138.72          | 461,436.74             | 405,559.63              |
| M402A/0080+78  | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | 88.80          | -0.0004        | 84                    | 0.000568                   | 112.50            | 96                    | 126.50                | 90              | 106.50                | 138.02          | 625,201.54             | 549,493.54              |
| M402A/0085+50  | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | 88.89          | -0.0004        | 84                    | 0.000570                   | 112.66            | 96                    | 126.78                | 90              | 106.74                | 138.97          | 731,060.56             | 642,533.69              |
| M402A/0088+56  | M402A/0085+50           | 151           | 54               | 29.26                  | 31.43                 | 88.99          | -0.0004        | 84                    | 0.000571                   | 112.77            | 96                    | 126.98                | 90              | 106.85                | 142.52          | 361,911.17             | 318,085.99              |
| M402A/0096+55  | M402A/0088+56           | 168           | 54               | 24.42                  | 31.45                 | 88.99          | -0.0004        | 84                    | 0.000572                   | 112.84            | 96                    | 126.98                | 90              | 106.91                | 136.17          | 136,621.47             | 120,077.46              |
| M402A/0098+65  | M402A/0096+55           | 820           | 54               | 31.72                  | 31.56                 | 89.19          | -0.0004        | 84                    | 0.000573                   | 112.84            | 96                    | 127.05                | 90              | 106.97                | 131.39          | 152,002.69             | 133,596.11              |
| M402A/0103+76  | M402A/0098+65           | 711           | 54               | 21.89                  | 31.63                 | 89.42          | -0.0004        | 84                    | 0.000577                   | 113.32            | 96                    | 127.60                | 90              | 107.21                | 138.93          | 741,917.89             | 652,076.27              |
| M402A/0105+11  | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | 89.42          | -0.0004        | 84                    | 0.000578                   | 113.39            | 96                    | 127.67                | 90              | 107.42                | 129.31          | 643,297.10             | 565,397.84              |
| M402A/0109+91  | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | 89.67          | -0.0004        | 84                    | 0.000581                   | 113.66            | 96                    | 128.02                | 90              | 107.78                | 160.95          | 122,145.02             | 107,354.02              |
| M402A/0113+81  | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | 89.76          | -0.0004        | 84                    | 0.000582                   | 113.79            | 96                    | 128.15                | 90              | 107.89                | 147.28          | 730,155.78             | 641,738.48              |
| M402A/0117+43  | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 90.01          | -0.0002        | 84                    | 0.000586                   | 121.44            | 96                    | 128.58                | 90              | 108.19                | 148.97          | 312,148.38             | 274,349.16              |
| M402A/0120+25  | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 90.06          | 0.0002         | 84                    | 0.000586                   | 121.58            | 96                    | 128.58                | 90              | 108.25                | 149.99          | 628,820.65             | 552,674.40              |
| M402B/0123+40  | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 90.17          | 0.0002         | 84                    | 0.000588                   | 121.58            | 96                    | 128.74                | 90              | 108.38                | 145.35          | 114,002.02             | 100,197.09              |
| M402B/0136+74  | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | 83.60          | -0.0001        | 66                    | 0.001829                   | 109.37            | 78                    | 130.52                | 72              | 105.43                | 136.83          | 278,671.60             | 244,926.21              |
| DESIGN CONDITION: OPTION NO. 6a  |                         |               |                  |                        |                       |                |                |                       |                            |                   |                       |                       |                 |                       |                 |                        |                         |
| DESIGN YEAR: 2050  |                         |               |                  |                        |                       |                |                |                       |                            |                   |                       |                       |                 |                       |                 |                        |                         |
| F.W. Model Eq. Pop. = 57,207.50 93,287.50 2050 Eq. Pop. = 129,181.14   |                         |               |                  |                        |                       |                |                |                       |                            |                   |                       |                       |                 |                       |                 |                        |                         |
| F.W. Model Sew. Ac. = 9,004.81 20,981.33 2050 Sew. Ac. = 26,316.11     |                         |               |                  |                        |                       |                |                |                       |                            |                   |                       |                       |                 |                       |                 |                        |                         |
| Constant Intel Flow = 6.00   |                         |               |                  |                        |                       |                |                |                       |                            |                   |                       |                       |                 |                       |                 |                        |                         |
| TOTAL ESTIM. CONST. COST = \$12,194,932.56 \$10,686,176.50             |                         |               |                  |                        |                       |                |                |                       |                            |                   |                       |                       |                 |                       |                 |                        |                         |
| + Engr., ROW, Financ. Conting (1.5x) = \$18,292,398.84 \$16,029,264.76 |                         |               |                  |                        |                       |                |                |                       |                            |                   |                       |                       |                 |                       |                 |                        |                         |

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP  
 PROP. PARL. PIPE  
 PARL. PIPE CAP  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING PIPE DIAMETER IN INCHES  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FT. WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQN.: S = [ 1629.6 x n x MGD^-1.54 / D^(8/3) ]^2, n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGD = [ D^(8/3) x s^(1/2) / 1629.6 x n ] / 1.54  
 PROPOSED PARALLEL PIPE IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [ D^(8/3) x s^(1/2) / 1629.6 x n ] / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 6a  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil, plus Main Creek Area, year 2020 B.F.X. Area, and Constant 6.0 MGD Intel Facility Flow.  
 The Cities of NRH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2070 COEF. "A" | 2070 COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|----------------|----------------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| M402A/0000+50         | M280A/0304+97           | 102           | 54               | 222.11                 | 18.94                 | -0.0010        | 0.0084         | 90                    | 0.000350                   | 100.68                 | 96                    | 99.32                 | 90              | 83.62                 | 305.73          | \$92,287.35            | \$81,111.93             |
| M402A/0020+17         | M402A/0000+50           | 1728          | 54               | 34.03                  | 18.71                 | -0.0011        | 0.0088         | 90                    | 0.000375                   | 102.98                 | 96                    | 102.85                | 90              | 86.59                 | 120.62          | 1,561,646.69           | 1,372,541.04            |
| M402A/0020+90         | M402A/0020+17           | 73            | 24               | -70.57                 | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 102.99                 | 96                    | 102.88                | 90              | 86.61                 | 16.04           | 66,048.79              | 58,050.69               |
| M402A/0022+09         | M402A/0020+90           | 150           | 24               | 0.00                   | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000375                   | 102.99                 | 96                    | 102.88                | 90              | 86.61                 | 86.61           | 135,716.69             | 119,282.25              |
| M402A/0023+09         | M402A/0022+09           | 69            | 24               | 74.31                  | 18.71                 | -0.0011        | 0.0089         | 90                    | 0.000376                   | 103.02                 | 96                    | 102.91                | 90              | 86.64                 | 160.95          | 62,429.68              | 54,869.83               |
| M402A/0028+40         | M402A/0023+09           | 399           | 54               | 25.04                  | 18.78                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 103.78                 | 96                    | 103.85                | 90              | 87.43                 | 112.47          | 787,156.79             | 691,837.02              |
| M402A/0032+40         | M402A/0028+40           | 361           | 54               | 35.67                  | 18.81                 | -0.0011        | 0.0090         | 90                    | 0.000383                   | 104.02                 | 96                    | 104.12                | 90              | 87.66                 | 123.33          | 317,290.77             | 317,290.77              |
| M402A/0036+79         | M402A/0032+40           | 433           | 54               | 32.39                  | 18.87                 | -0.0011        | 0.0091         | 84                    | 0.000558                   | 104.25                 | 96                    | 125.41                | 90              | 105.58                | 137.97          | 391,768.84             | 344,328.08              |
| M402A/0040+28         | M402A/0036+79           | 361           | 54               | 29.03                  | 18.92                 | -0.0011        | 0.0091         | 84                    | 0.000559                   | 104.41                 | 96                    | 125.58                | 90              | 105.73                | 134.76          | 326,624.83             | 287,072.60              |
| M402A/0045+95         | M402A/0040+28           | 559           | 54               | 33.82                  | 18.97                 | -0.0011        | 0.0091         | 84                    | 0.000561                   | 104.56                 | 96                    | 125.74                | 90              | 105.86                | 139.68          | 505,770.86             | 444,525.17              |
| M402A/0049+00         | M402A/0045+95           | 307           | 54               | 28.71                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 104.65                 | 96                    | 125.84                | 90              | 105.94                | 134.65          | 277,766.82             | 244,131.00              |
| M402A/0051+91         | M402A/0049+00           | 252           | 54               | 31.72                  | 18.99                 | -0.0011        | 0.0091         | 84                    | 0.000562                   | 104.69                 | 96                    | 125.91                | 90              | 106.00                | 137.72          | 228,004.04             | 200,394.17              |
| M402A/0060+68         | M402A/0051+91           | 645           | 54               | 35.19                  | 19.06                 | -0.0011        | 0.0091         | 84                    | 0.000563                   | 104.81                 | 96                    | 125.97                | 90              | 106.05                | 141.24          | 230,718.37             | 202,779.82              |
| M402A/0061+87         | M402A/0060+68           | 99            | 54               | 31.88                  | 31.61                 | -0.0004        | 0.0058         | 84                    | 0.000565                   | 119.76                 | 96                    | 126.14                | 90              | 106.20                | 135.92          | 583,581.76             | 512,913.65              |
| M402A/0065+95         | M402A/0061+87           | 510           | 54               | 32.39                  | 31.54                 | -0.0004        | 0.0059         | 84                    | 0.000566                   | 119.75                 | 96                    | 126.30                | 90              | 106.33                | 138.72          | 461,436.74             | 405,559.63              |
| M402A/0072+77         | M402A/0065+95           | 691           | 54               | 31.52                  | 31.50                 | -0.0004        | 0.0059         | 84                    | 0.000568                   | 119.83                 | 96                    | 126.50                | 90              | 106.54                | 138.02          | 625,201.54             | 549,493.54              |
| M402A/0080+78         | M402A/0072+77           | 808           | 54               | 32.23                  | 31.45                 | -0.0004        | 0.0060         | 84                    | 0.000570                   | 119.94                 | 96                    | 126.78                | 90              | 106.74                | 138.97          | 731,060.56             | 642,533.69              |
| M402A/0085+50         | M402A/0080+78           | 400           | 54               | 35.67                  | 31.43                 | -0.0004        | 0.0060         | 84                    | 0.000571                   | 119.99                 | 96                    | 126.91                | 90              | 106.85                | 142.52          | 361,911.17             | 318,085.99              |
| M402A/0088+51         | M402A/0085+50           | 151           | 54               | 29.26                  | 31.45                 | -0.0004        | 0.0060         | 84                    | 0.000572                   | 120.04                 | 96                    | 126.98                | 90              | 106.91                | 136.17          | 136,621.47             | 120,077.46              |
| M402A/0096+65         | M402A/0088+51           | 820           | 54               | 31.72                  | 31.56                 | -0.0004        | 0.0060         | 84                    | 0.000575                   | 120.41                 | 96                    | 127.05                | 90              | 106.97                | 131.39          | 152,002.69             | 133,596.11              |
| M402A/0103+76         | M402A/0096+65           | 711           | 54               | 21.89                  | 31.63                 | -0.0004        | 0.0060         | 84                    | 0.000578                   | 120.72                 | 96                    | 127.67                | 90              | 107.21                | 138.93          | 741,917.89             | 652,076.27              |
| M402A/0105+11         | M402A/0103+76           | 135           | 54               | 53.47                  | 31.66                 | -0.0004        | 0.0060         | 84                    | 0.000581                   | 120.99                 | 96                    | 128.02                | 90              | 107.48                | 160.95          | 643,297.10             | 565,397.84              |
| M402A/0109+91         | M402A/0105+11           | 807           | 54               | 25.08                  | 31.70                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 121.15                 | 96                    | 128.15                | 90              | 107.78                | 132.86          | 730,155.78             | 641,738.48              |
| M402A/0113+81         | M402A/0109+91           | 345           | 54               | 39.39                  | 31.77                 | -0.0004        | 0.0060         | 84                    | 0.000582                   | 121.15                 | 96                    | 128.15                | 90              | 107.89                | 147.28          | 312,148.38             | 274,349.16              |
| M402A/0117+43         | M402A/0113+81           | 695           | 54               | 40.78                  | 42.22                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 133.71                 | 96                    | 128.51                | 90              | 108.19                | 148.97          | 628,802.65             | 552,674.40              |
| M402A/0120+25         | M402A/0117+43           | 126           | 54               | 41.74                  | 42.22                 | 0.0002         | 0.0034         | 84                    | 0.000586                   | 133.75                 | 96                    | 128.58                | 90              | 108.25                | 149.99          | 114,000.02             | 100,197.09              |
| M402B/0123+40         | M402A/0120+25           | 308           | 54               | 36.97                  | 42.20                 | 0.0002         | 0.0034         | 84                    | 0.000588                   | 133.83                 | 96                    | 128.74                | 90              | 108.38                | 145.35          | 278,671.60             | 244,926.21              |
| M402B/0136+74         | M402B/0123+40           | 1160          | 48               | 31.40                  | 33.78                 | -0.0001        | 0.0045         | 66                    | 0.001829                   | 118.20                 | 78                    | 130.52                | 72              | 105.43                | 138.83          | 692,861.97             | 590,367.59              |

DESIGN CONDITION: OPTION NO. 6A  
 DESIGN YEAR: 2070

F.W. Model Eq. Pop. = 57,207.50 93,287.50  
 F.W. Model Sew. Ac. = 9,004.81 20,981.33

2070 Eq. Pop. = 148,253.92  
 2070 Sew. Ac. = 28,760.92

CONSTANT INTEL FLOW = 6.00

TOTAL ESTIM. CONST. COST = \$12,432,355.48 \$10,908,281.81  
 + Engr., ROW, Financ., Conting. (1.5x) = \$18,648,533.22 \$16,362,422.72

NOTES:

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST. PIPE CAP  
 2000 MODEL FLOW  
 2070 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP. DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST

UPSTREAM STA. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2070 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2070 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{4.75} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6a  
 Cities Served by City of Fort Worth Big Fossil Outfall including only Haltom City and Haltom City Little Fossil, plus Marine Creek Area, year 2020 BFX Area, and Constant 6.0 MGD Intel Facility Flow.  
 The Cities of NPH and Richland Hills are not included in this model. Those cities are served by the TCWSC line.

**OPTION 6b**

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2000 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|-------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 20.01                  | 60                    | 22.34                 | 54                    | 16.87                 | 158.94          | \$7,068.58             | \$5,725.55              |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 20.12                  | 60                    | 22.46                 | 54                    | 16.96                 | 61.85           | 28,274.31              | 22,902.19               |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 20.55                  | 60                    | 23.51                 | 54                    | 17.30                 | 31.27           | 115,571.24             | 93,612.71               |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 21.13                  | 60                    | 23.52                 | 54                    | 17.76                 | 27.92           | 178,835.01             | 144,856.36              |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 21.76                  | 60                    | 24.18                 | 54                    | 18.26                 | 28.51           | 290,871.96             | 235,608.29              |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0204   | 54                    | 0.000257                   | 21.87                  | 60                    | 24.30                 | 54                    | 18.35                 | 28.35           | 66,796.06              | 54,106.43               |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0216   | 54                    | 0.000263                   | 22.16                  | 60                    | 24.61                 | 54                    | 18.58                 | 28.78           | 202,161.32             | 163,750.67              |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 22.45                  | 60                    | 24.91                 | 54                    | 18.81                 | 29.10           | 189,437.88             | 153,444.68              |
| TCWSC/0036+89         | TCWSC/0030+53           | 638           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 22.68                  | 60                    | 25.15                 | 54                    | 18.99                 | 29.12           | 224,780.76             | 182,072.42              |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 22.91                  | 60                    | 25.39                 | 54                    | 19.17                 | 29.35           | 283,803.39             | 229,880.74              |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 23.06                  | 60                    | 25.55                 | 54                    | 19.29                 | 29.54           | 310,310.55             | 251,351.55              |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 23.11                  | 54                    | 26.46                 | 48                    | 19.33                 | 29.53           | 163,178.11             | 128,930.85              |
| TCWSC/0059+99         | TCWSC/0059+40           | 866           | 36               | 9.95                   | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 23.13                  | 54                    | 26.49                 | 48                    | 19.35                 | 29.57           | 247,916.22             | 195,884.42              |
| TCWSC/0068+65         | TCWSC/0059+99           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 23.16                  | 54                    | 26.53                 | 48                    | 19.38                 | 29.42           | 210,413.88             | 166,252.94              |
| TCWSC/0076+00         | TCWSC/0068+65           | 340           | 36               | 10.22                  | 11.16                 | 19.42                 | 0.0040    | -0.0238   | 42                    | 0.001099                   | 23.18                  | 48                    | 27.96                 | 48                    | 27.73                 | 40.26           | 214,708.04             | 169,645.86              |
| TCWSC/A/B/0000+00     | TCWSC/A/B/0000+00       | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 23.18                  | 48                    | 27.70                 | 48                    | 19.40                 | 28.28           | 40,468.81              | 30,999.25               |
| TCWSC/A/0006+17       | TCWSC-A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 23.18                  | 48                    | 27.70                 | 42                    | 19.40                 | 30.26           | 166,026.75             | 127,114.23              |
| TCWSC/A/0007+96       | TCWSC-A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 23.17                  | 48                    | 27.70                 | 42                    | 19.40                 | 40.49           | 49,762.79              | 38,099.63               |
| TCWSC/A/0015+30       | TCWSC-A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 23.17                  | 48                    | 27.70                 | 42                    | 19.40                 | 26.06           | 500,116.00             | 382,901.31              |
| TCWSC/A/0017+50       | TCWSC-A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 23.16                  | 48                    | 27.70                 | 42                    | 19.40                 | 8.47            | 2,261.94               | 1,731.80                |
| TCWSC/B/0001+14.8     | TCWSC-B/0001+14.8       | 10            | 17               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.23                  | 48                    | 0.56                  | 42                    | 0.39                  | -15.63          | 2,940.53               | 2,051.34                |
| TCWSC/B/0001+28.94    | TCWSC-B/0001+28.94      | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.23                  | 48                    | 0.56                  | 42                    | 0.39                  | 0.39            | 1,357.17               | 1,039.08                |
| TCWSC/B/0001+34.94    | TCWSC-B/0001+34.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.23                  | 48                    | 0.56                  | 42                    | 0.39                  | 0.39            | 2,714.33               | 2,078.16                |
| TCWSC/B/0001+46.94    | TCWSC-B/0001+46.94      | 12            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.21                  | 48                    | 0.49                  | 42                    | 0.34                  | 11.84           | 5,654.86               | 4,329.50                |
| TCWSC/B/0001+73.07    | TCWSC-B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 23.18                  | 48                    | 27.73                 | 42                    | 19.42                 | 28.39           | 68,310.73              | 52,300.40               |
| TCWSC/B/0003+02       | TCWSC-B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001098                   | 23.18                  | 48                    | 27.73                 | 42                    | 19.42                 | 30.95           | 66,727.37              | 51,088.14               |
| TCWSC/B/0005+96       | TCWSC-B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.00                   | 36                    | 0.00                  | 30                    | 0.00                  | 9.86            | 19,085.16              | 13,253.58               |
| TCWSC/B/0008+15       | TCWSC-B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 14.41                  | 36                    | 20.00                 | 30                    | 12.30                 | 37.77           | 45,804.38              | 31,808.60               |
| TCWSC/B/0011+93       | TCWSC-B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 14.41                  | 30                    | 16.29                 | 18                    | 4.17                  | 28.66           | 7,510.36               | 2,703.73                |

DESIGN CONDITION: **OPTION 6b**  
 2000 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2000 Eq. Pop. = 23,952.45  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2000 Sew. Ac. = 3,176.17  
 TOTAL ESTIM. CONST. COST = \$3,906,414.01  
 + Engr., ROW, Financ., Conting. (1.5x) = \$5,859,821.02 \$4,638,944.84

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2020 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^{1/2}$ , n = 0.0145  
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in inches  
 Proposed Replacement Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe in inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{(1/2)} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 6b**  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition. Assumes R. Hills and NRH will not be connected to the COFW Big Fossil line.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL DIA. (in) | MODEL SLOPE (ft/100) | 2005 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------|----------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | 19957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54              | 0.000217             | 21.10                  | 60                    | 22.34                 | 54                    | 16.87                 | 158.94          | \$7,068.58             | \$5,725.55             |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54              | 0.000219             | 21.22                  | 60                    | 22.46                 | 54                    | 16.96                 | 61.85           | 28,274.31              | 22,902.19              |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54              | 0.000228             | 21.66                  | 60                    | 22.91                 | 54                    | 17.30                 | 31.27           | 115,571.24             | 93,612.71              |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54              | 0.000241             | 22.27                  | 60                    | 23.52                 | 54                    | 17.76                 | 27.92           | 178,835.01             | 144,866.36             |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54              | 0.000254             | 22.93                  | 60                    | 24.18                 | 54                    | 18.26                 | 28.51           | 290,871.96             | 235,606.29             |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54              | 0.000257             | 23.05                  | 60                    | 24.30                 | 54                    | 18.35                 | 28.35           | 66,798.06              | 54,106.43              |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54              | 0.000263             | 23.35                  | 60                    | 24.61                 | 54                    | 18.58                 | 28.78           | 202,161.32             | 163,750.67             |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54              | 0.000270             | 23.66                  | 60                    | 24.91                 | 54                    | 18.81                 | 29.10           | 189,437.88             | 153,444.68             |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54              | 0.000275             | 23.90                  | 60                    | 25.15                 | 54                    | 18.99                 | 29.12           | 224,780.78             | 182,072.42             |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54              | 0.000280             | 24.13                  | 60                    | 25.39                 | 54                    | 19.17                 | 29.35           | 283,803.39             | 229,880.74             |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54              | 0.000284             | 24.29                  | 60                    | 25.55                 | 54                    | 19.29                 | 29.54           | 310,310.55             | 251,351.55             |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0041    | -0.0240   | 48              | 0.000534             | 24.34                  | 54                    | 26.46                 | 48                    | 19.33                 | 29.53           | 163,178.11             | 128,930.85             |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48              | 0.000534             | 24.34                  | 54                    | 26.46                 | 48                    | 19.33                 | 29.57           | 247,916.22             | 195,884.42             |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48              | 0.000537             | 24.36                  | 54                    | 26.48                 | 48                    | 19.35                 | 29.57           | 210,413.88             | 166,252.94             |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48              | 0.000538             | 24.40                  | 54                    | 26.53                 | 48                    | 19.38                 | 29.42           | 214,708.04             | 169,645.86             |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.40                 | 0.0041    | -0.0231   | 42              | 0.001099             | 24.43                  | 48                    | 27.96                 | 48                    | 27.73                 | 40.26           | 97,334.31              | 76,906.12              |
| TCWSC-A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.42                 | 0.0041    | -0.0238   | 42              | 0.001099             | 24.43                  | 48                    | 27.96                 | 48                    | 27.73                 | 40.26           | 97,334.31              | 76,906.12              |
| TCWSC-A/0006+17       | TCWSC-A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48              | 0.000538             | 24.42                  | 54                    | 26.56                 | 48                    | 19.40                 | 29.53           | 79,298.84              | 62,655.87              |
| TCWSC-A/0007+96       | TCWSC-A/0006+17         | 179           | 30               | 8.86                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42              | 0.001097             | 24.42                  | 48                    | 27.70                 | 42                    | 19.40                 | 30.26           | 166,026.75             | 127,114.23             |
| TCWSC-A/0015+30       | TCWSC-A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42              | 0.001097             | 24.42                  | 48                    | 27.70                 | 42                    | 19.40                 | 30.26           | 166,026.75             | 127,114.23             |
| TCWSC-A/0017+50       | TCWSC-A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42              | 0.001097             | 24.41                  | 48                    | 27.70                 | 42                    | 19.40                 | 30.26           | 166,026.75             | 127,114.23             |
| TCWSC-A/0039+61       | TCWSC-A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42              | 0.001097             | 24.41                  | 48                    | 27.70                 | 42                    | 19.40                 | 30.26           | 166,026.75             | 127,114.23             |
| TCWSC-B/0001+14.8     | TCWSC-A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30              | 0.000000             | -0.24                  | 48                    | 0.56                  | 42                    | 0.39                  | -15.63          | 2,261.94               | 1,731.80               |
| TCWSC-B/0001+28.94    | TCWSC-B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30              | 0.000000             | -0.24                  | 48                    | 0.56                  | 42                    | 0.39                  | -15.63          | 2,261.94               | 1,731.80               |
| TCWSC-B/0001+34.94    | TCWSC-B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30              | 0.000000             | -0.24                  | 48                    | 0.56                  | 42                    | 0.39                  | -15.63          | 2,261.94               | 1,731.80               |
| TCWSC-B/0001+46.94    | TCWSC-B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30              | 0.000000             | -0.24                  | 48                    | 0.56                  | 42                    | 0.39                  | -15.63          | 2,261.94               | 1,731.80               |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0016    | 30              | 0.000000             | -0.21                  | 48                    | 0.56                  | 42                    | 0.39                  | -15.63          | 2,261.94               | 1,731.80               |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42              | 0.001099             | 24.42                  | 48                    | 27.73                 | 42                    | 19.42                 | 28.39           | 5,654.86               | 4,329.50               |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42              | 0.001099             | 24.42                  | 48                    | 27.73                 | 42                    | 19.42                 | 28.39           | 5,654.86               | 4,329.50               |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30              | 0.000000             | 0.00                   | 36                    | 0.00                  | 30                    | 0.00                  | 9.86            | 19,085.16              | 13,253.58              |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30              | 0.0002653            | 15.22                  | 36                    | 20.00                 | 30                    | 12.30                 | 37.77           | 45,804.38              | 31,808.60              |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27              | 0.004854             | 15.22                  | 30                    | 16.29                 | 18                    | 4.17                  | 28.66           | 7,510.36               | 2,703.73               |

DESIGN CONDITION: OPTION 6b  
 2005 Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2005 Eq. Pop. = 25,333.66  
 2005 Sew. Ac. = 3,363.38  
 TOTAL ESTIM. CONST. COST = \$3,906,414.01  
 + Engr. ROW, Financ., Conting. (1.5x) = \$5,859,621.02  
 \$3,092,629.89  
 \$4,638,944.84

OPTION 6b  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition. Assumes R. Hills and NRH will not be connected to the COFW Big Fossil line.

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 EXISTING GRAVITY FLOW CAPACITY OF PIPE IN MGD BASED ON FL WORTH MASTER PLAN DATA USING COLBROOK-WHITE EQUATIONS  
 YEAR 2000 FLOW RATE IN FL WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 YEAR 2020 FLOW RATE IN FL WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ POP + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN FL WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQUATION: S = [ 1629.6 x n x MGD^1.54 / D^4.75 ]^0.2, n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE IN INCHES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN MGD = [ D^4.75 / 1629.6 x n ] / 1.54  
 PROPOSED PARALLEL PIPE IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [ D^4.75 x S^1.12 / 1629.6 x n ] / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2010 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|-----------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                | 10.84                 | 18.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 23.81                  | 66                    | 28.81                 | 28.81                 | 60              | 22.34                 | 164.41          | \$8,532.98             | \$7,068.58              |
| TCWSC/0001+27         | TCWSC/0000+20           | 80            | 36               | 44.89                 | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 23.96                  | 66                    | 28.96                 | 28.96                 | 60              | 22.46                 | 67.35           | 34,211.92              | 28,274.31               |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                 | 10.91                 | 17.30                 | 0.0031    | -0.0189   | 54                    | 0.000228                   | 24.54                  | 66                    | 29.54                 | 29.54                 | 60              | 22.91                 | 36.88           | 139,841.20             | 115,571.24              |
| TCWSC/0017+56         | TCWSC/0004+27           | 506           | 36               | 10.16                 | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 25.34                  | 66                    | 30.33                 | 30.33                 | 60              | 23.52                 | 33.68           | 216,390.36             | 178,835.01              |
| TCWSC/0019+45         | TCWSC/0009+33           | 823           | 36               | 10.25                 | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 26.22                  | 66                    | 31.18                 | 31.18                 | 60              | 24.18                 | 34.43           | 351,955.08             | 290,871.96              |
| TCWSC/0025+17         | TCWSC/0017+56           | 189           | 36               | 10.00                 | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 26.38                  | 66                    | 31.34                 | 31.34                 | 60              | 24.35                 | 35.35           | 80,825.65              | 54,106.43               |
| TCWSC/0030+53         | TCWSC/0019+45           | 572           | 36               | 10.20                 | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 27.19                  | 66                    | 31.73                 | 31.73                 | 60              | 24.58                 | 38.35           | 229,219.83             | 163,750.67              |
| TCWSC/0036+88         | TCWSC/0025+17           | 536           | 36               | 10.29                 | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 27.51                  | 66                    | 32.12                 | 32.12                 | 60              | 24.81                 | 41.31           | 224,780.76             | 153,444.68              |
| TCWSC/0044+92         | TCWSC/0036+88           | 636           | 36               | 10.13                 | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 27.82                  | 66                    | 32.74                 | 32.74                 | 60              | 25.15                 | 44.31           | 343,402.10             | 229,880.74              |
| TCWSC/0053+70         | TCWSC/0044+92           | 803           | 36               | 10.18                 | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 28.04                  | 66                    | 32.94                 | 32.94                 | 60              | 25.35                 | 47.28           | 406,069.41             | 251,351.55              |
| TCWSC/0059+40         | TCWSC/0053+70           | 878           | 36               | 10.25                 | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 28.09                  | 66                    | 33.05                 | 33.05                 | 60              | 25.54                 | 50.25           | 482,072.42             | 318,345.47              |
| TCWSC/0068+65         | TCWSC/0059+40           | 59            | 36               | 9.95                  | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 28.08                  | 60                    | 35.05                 | 35.05                 | 48              | 19.33                 | 29.53           | 201,454.46             | 128,930.85              |
| TCWSC/0076+00         | TCWSC/0068+65           | 866           | 36               | 10.04                 | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 28.10                  | 60                    | 35.08                 | 35.08                 | 48              | 19.35                 | 29.57           | 306,069.41             | 195,884.42              |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 735           | 36               | 10.22                 | 11.11                 | 19.42                 | 0.0040    | -0.0231   | 48                    | 0.000537                   | 28.14                  | 60                    | 35.14                 | 35.14                 | 48              | 19.38                 | 29.42           | 259,770.22             | 166,252.94              |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 750           | 36               | 12.53                 | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 28.08                  | 54                    | 37.96                 | 37.96                 | 48              | 19.40                 | 29.52           | 214,708.04             | 169,645.86              |
| TCWSC/A/0005+17       | TCWSC/A/0003+40         | 340           | 36               | 10.22                 | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 28.15                  | 54                    | 37.96                 | 37.96                 | 48              | 19.40                 | 29.52           | 97,334.31              | 76,906.12               |
| TCWSC/A/0007+96       | TCWSC/A/0005+17         | 277           | 36               | 10.13                 | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 28.14                  | 54                    | 37.92                 | 37.92                 | 48              | 19.40                 | 29.53           | 79,298.84              | 62,655.87               |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 179           | 30               | 8.88                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 28.14                  | 54                    | 37.92                 | 37.92                 | 42              | 19.40                 | 28.28           | 51,243.65              | 30,999.25               |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 734           | 30               | 10.86                 | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 28.12                  | 54                    | 37.92                 | 37.92                 | 42              | 19.40                 | 30.26           | 210,127.60             | 127,114.23              |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 220           | 27               | 21.09                 | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 28.11                  | 54                    | 37.92                 | 37.92                 | 42              | 19.40                 | 40.48           | 62,981.03              | 38,099.63               |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 2111          | 27               | 6.66                  | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 28.06                  | 54                    | 37.92                 | 37.92                 | 42              | 19.40                 | 26.06           | 632,959.31             | 382,901.31              |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 10            | 16               | -16.02                | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.42                  | 48                    | 0.56                  | 0.56                  | 30              | 0.16                  | -15.86          | 2,261.94               | 883.57                  |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16               | 0.00                  | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.42                  | 48                    | 0.56                  | 0.56                  | 30              | 0.16                  | -15.86          | 2,940.53               | 1,148.64                |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16               | 0.00                  | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.41                  | 48                    | 0.56                  | 0.56                  | 30              | 0.16                  | 0.16            | 1,357.17               | 530.14                  |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 25            | 16               | 11.50                 | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.37                  | 48                    | 0.49                  | 0.49                  | 30              | 0.14                  | 11.64           | 5,654.86               | 2,209.93                |
| TCWSC/B/0003+02       | TCWSC/B/0001+73.07      | 302           | 27               | 8.97                  | 11.37                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 28.06                  | 48                    | 27.73                 | 27.73                 | 30              | 7.92                  | 16.89           | 88,310.73              | 26,683.88               |
| TCWSC/B/0005+96       | TCWSC/B/0003+02         | 295           | 30               | 11.53                 | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 28.05                  | 48                    | 27.73                 | 27.73                 | 30              | 7.92                  | 19.45           | 66,727.37              | 26,065.38               |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                  | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.01                   | 36                    | 0.00                  | 0.00                  | 30              | 0.00                  | 9.86            | 19,085.16              | 13,253.58               |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                 | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 16.58                  | 36                    | 20.00                 | 20.00                 | 30              | 12.30                 | 37.77           | 45,804.38              | 31,808.60               |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                 | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 16.56                  | 30                    | 16.29                 | 16.29                 | 27              | 12.30                 | 36.79           | 7,510.36               | 6,083.39                |

DESIGN CONDITION: **OPTION 6b**  
 2010 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 2010 Sew. Ac. = 2,550.82 2,764.11  
 2010 Eq. Pop. = 26,714.86  
 2010 Sew. Ac. = 3,446.17  
 TOTAL ESTIM. CONST. COST = \$4,608,436.86 + Engr., ROW, Financ. Conting. (1.5x) = \$6,912,655.28 \$3,157,689.96 \$4,736,534.94

**UPSTREAM MAIN/STATION**  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

**DOWNSTREAM MAIN/STATION**  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.: s = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>4.75</sup> ]<sup>2</sup>, n = 0.0145  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD = [ D<sup>4.75</sup> / (1629.6 x n) ] / 1.54  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD = [ D<sup>4.75</sup> x s<sup>0.12</sup> / (1629.6 x n) ] / 1.54  
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 6b**  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COFW Big Fossil line.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2015 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. CAP. (MGD) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|------------------|-----------------------|-----------------|------------------------|-------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 25.73                  | 66                    | 28.81            | 22.34                 | 164.41          | \$8,552.98             | \$7,068.58              |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 25.91                  | 66                    | 28.96            | 22.46                 | 67.35           | 34,211.92              | 28,274.31               |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 26.59                  | 66                    | 29.54            | 22.91                 | 33.88           | 139,841.20             | 115,571.24              |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 27.53                  | 66                    | 30.33            | 23.52                 | 33.68           | 216,390.36             | 178,835.01              |
| TCWSC/0017+55         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 28.58                  | 66                    | 31.18            | 24.18                 | 34.43           | 351,955.08             | 290,871.96              |
| TCWSC/0025+17         | TCWSC/0017+55           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 28.77                  | 66                    | 31.34            | 24.30                 | 34.30           | 80,825.65              | 66,798.06               |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 29.24                  | 66                    | 31.73            | 24.61                 | 34.81           | 244,615.19             | 202,161.32              |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 29.73                  | 66                    | 32.12            | 24.91                 | 35.20           | 229,219.83             | 189,437.88              |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0230   | 54                    | 0.000280                   | 30.12                  | 66                    | 32.43            | 25.15                 | 35.28           | 271,984.73             | 224,780.76              |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.05                 | 19.40                 | 0.0042    | -0.0236   | 54                    | 0.000284                   | 30.49                  | 66                    | 32.74            | 25.39                 | 35.57           | 343,402.10             | 283,803.39              |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0041    | -0.0241   | 48                    | 0.000534                   | 30.78                  | 66                    | 35.05            | 26.46                 | 36.56           | 375,475.77             | 310,310.55              |
| TCWSC/0068+65         | TCWSC/0059+40           | 866           | 36               | 9.95                   | 11.07                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 30.81                  | 60                    | 35.08            | 26.46                 | 36.41           | 201,454.46             | 163,178.11              |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 30.81                  | 60                    | 35.08            | 26.46                 | 36.41           | 201,454.46             | 163,178.11              |
| TCWSC/A-B/0000+00     | TCWSC/A-B/0000+00       | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0041    | -0.0231   | 42                    | 0.001099                   | 30.72                  | 60                    | 35.14            | 26.49                 | 36.71           | 306,069.41             | 247,916.22              |
| TCWSC/A-0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0231   | 42                    | 0.001099                   | 30.72                  | 60                    | 35.14            | 26.49                 | 36.71           | 306,069.41             | 247,916.22              |
| TCWSC/A-0006+17       | TCWSC/A-0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0231   | 42                    | 0.001099                   | 30.72                  | 60                    | 35.14            | 26.49                 | 36.71           | 306,069.41             | 247,916.22              |
| TCWSC/A-0007+96       | TCWSC/A-0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0231   | 42                    | 0.001099                   | 30.72                  | 60                    | 35.14            | 26.49                 | 36.71           | 306,069.41             | 247,916.22              |
| TCWSC/A-0015+30       | TCWSC/A-0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0231   | 42                    | 0.001099                   | 30.72                  | 60                    | 35.14            | 26.49                 | 36.71           | 306,069.41             | 247,916.22              |
| TCWSC/A-0017+50       | TCWSC/A-0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0231   | 42                    | 0.001099                   | 30.72                  | 60                    | 35.14            | 26.49                 | 36.71           | 306,069.41             | 247,916.22              |
| TCWSC/A-0039+61       | TCWSC/A-0017+50         | 221           | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0235   | 42                    | 0.001097                   | 30.78                  | 60                    | 35.14            | 26.49                 | 36.71           | 306,069.41             | 247,916.22              |
| TCWSC/B/0001+14.8     | TCWSC/A-0039+61         | 10            | 27               | 8.08                   | 11.32                 | 19.40                 | 0.0040    | -0.0235   | 42                    | 0.001097                   | 30.78                  | 60                    | 35.14            | 26.49                 | 36.71           | 306,069.41             | 247,916.22              |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.56                  | 48                    | 0.56             | 0.16                  | -15.86          | 2,261.94               | 863.57                  |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.56                  | 48                    | 0.56             | 0.16                  | -15.86          | 2,261.94               | 863.57                  |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.56                  | 48                    | 0.56             | 0.16                  | -15.86          | 2,261.94               | 863.57                  |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.54                  | 48                    | 0.56             | 0.16                  | -15.86          | 2,261.94               | 863.57                  |
| TCWSC/B/0005+96       | TCWSC/B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 30.69                  | 48                    | 0.49             | 11.64                 | 11.64           | 5,654.86               | 2,008.93                |
| TCWSC/B/0008+15       | TCWSC/B/0005+96         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 30.67                  | 48                    | 0.49             | 11.64                 | 11.64           | 5,654.86               | 2,008.93                |
| TCWSC/B/0011+93       | TCWSC/B/0008+15         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 42                    | 0.000000                   | 0.02                   | 36                    | 0.00             | 0.00                  | 0.00            | 66,727.37              | 52,300.40               |
| TCWSC/B/0012+35       | TCWSC/B/0011+93         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 17.45                  | 30                    | 20.00            | 12.30                 | 37.77           | 19,086.16              | 13,253.58               |
| TCWSC/B/0011+93       | TCWSC/B/0012+35         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 17.45                  | 30                    | 16.29            | 12.30                 | 36.79           | 45,804.38              | 31,808.60               |

DESIGN CONDITION: **OPTION 6b**  
 2015 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2015 Eq. Pop. = 27,521.61  
 2015 Sew. Ac. = 3,472.90  
 TOTAL ESTIM. CONST. COST = \$4,747,436.90 \$3,584,999.61  
 + Engr., ROW, Financ., Conting. (1.5x) = \$7,121,155.35 5,377,499.41

NOTES:  
 UPSTREAM MAIN/STATION  
 LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / \text{D}^4(8/3)]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in MGD =  $[ \text{D}^4(8/3) \times s^{1/2} / 1629.6 \times n ] / 1.54$   
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[ \text{D}^4(8/3) \times s^{1/2} / 1629.6 \times n ] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 6b**  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COFW  
 Big Fossil line.



| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2020 DESIGN FLOW (MGD) | PROP. REPL. PIPE CAP. (MGD) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|-----------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------------|-----------------------|-----------------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9857/0001+32           | 20            | 36              | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 27.65                  | 66                          | 28.81                 | 60                          | 22.34           | 164.41                 | \$7,068.58             |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36              | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 27.85                  | 66                          | 28.96                 | 60                          | 22.46           | 67.35                  | 34,211.92              |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36              | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0189   | 54                    | 0.000228                   | 28.63                  | 66                          | 29.54                 | 60                          | 22.91           | 36.88                  | 119,841.20             |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36              | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0165   | 54                    | 0.000241                   | 29.73                  | 66                          | 30.33                 | 60                          | 23.52           | 33.68                  | 216,390.36             |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36              | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 30.93                  | 66                          | 31.18                 | 60                          | 24.18           | 34.43                  | 351,955.08             |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36              | 10.00                  | 10.98                 | 18.35                 | 0.0036    | -0.0206   | 54                    | 0.000257                   | 31.17                  | 66                          | 31.34                 | 60                          | 24.30           | 34.30                  | 80,825.65              |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36              | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 31.71                  | 66                          | 31.73                 | 60                          | 24.61           | 34.81                  | 244,615.19             |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36              | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 32.78                  | 66                          | 32.12                 | 60                          | 24.91           | 35.70                  | 229,219.83             |
| TCWSC/0036+88         | TCWSC/0030+53           | 636           | 36              | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 32.73                  | 66                          | 32.43                 | 60                          | 25.15           | 35.28                  | 271,984.73             |
| TCWSC/0044+92         | TCWSC/0036+88           | 803           | 36              | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 33.15                  | 66                          | 32.74                 | 60                          | 25.39           | 35.57                  | 343,402.10             |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36              | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 33.45                  | 66                          | 32.94                 | 60                          | 25.55           | 35.80                  | 375,475.77             |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36              | 10.20                  | 11.05                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 33.51                  | 60                          | 35.05                 | 54                          | 26.46           | 36.66                  | 201,454.46             |
| TCWSC/0068+65         | TCWSC/0059+40           | 866           | 36              | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 33.48                  | 60                          | 35.05                 | 54                          | 26.46           | 36.41                  | 306,069.41             |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36              | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 33.51                  | 60                          | 35.08                 | 54                          | 26.49           | 36.71                  | 259,770.22             |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 36              | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 33.56                  | 60                          | 35.14                 | 54                          | 26.53           | 36.57                  | 247,916.22             |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36              | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 33.35                  | 60                          | 50.27                 | 54                          | 37.96           | 50.49                  | 210,413.88             |
| TCWSC/A/0006+17       | TCWSC/A/0003+40         | 277           | 36              | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 33.54                  | 60                          | 35.17                 | 54                          | 26.56           | 36.78                  | 120,165.82             |
| TCWSC/A/0007+96       | TCWSC/A/0006+17         | 179           | 30              | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 33.51                  | 60                          | 35.17                 | 54                          | 26.56           | 36.69                  | 97,899.80              |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 734           | 30              | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 33.47                  | 54                          | 37.92                 | 48                          | 27.70           | 36.58                  | 51,243.65              |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 220           | 27              | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 33.45                  | 54                          | 37.92                 | 48                          | 27.70           | 36.56                  | 210,127.60             |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 2211          | 27              | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 33.33                  | 54                          | 37.92                 | 48                          | 27.70           | 34.36                  | 632,959.31             |
| TCWSC-B/0001+14.8     | TCWSC-A/0039+61         | 10            | 27              | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 48                    | 0.000000                   | -0.71                  | 48                          | 0.56                  | 48                          | 0.56            | 8.64                   | 2,261.94               |
| TCWSC-B/0001+28.94    | TCWSC-B/0001+14.8       | 13            | 16              | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.71                  | 48                          | 0.56                  | 48                          | 0.56            | -15.46                 | 2,940.53               |
| TCWSC-B/0001+34.94    | TCWSC-B/0001+28.94      | 6             | 16              | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -0.71                  | 48                          | 0.56                  | 48                          | 0.56            | 1,357.17               | 2,940.53               |
| TCWSC-B/0001+46.94    | TCWSC-B/0001+34.94      | 12            | 16              | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.68                  | 48                          | 0.56                  | 48                          | 0.56            | 2,714.33               | 2,940.53               |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16              | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.63                  | 48                          | 0.49                  | 48                          | 11.99           | 5,654.86               | 5,654.86               |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27              | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 33.31                  | 48                          | 27.73                 | 48                          | 27.73           | 66,310.73              | 66,310.73              |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30              | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 33.28                  | 48                          | 27.73                 | 48                          | 27.73           | 39,266.72              | 39,266.72              |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27              | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.03                   | 36                          | 20.00                 | 36                          | 20.00           | 19,085.16              | 19,085.16              |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27              | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 18.38                  | 36                          | 20.00                 | 36                          | 20.00           | 45,804.38              | 45,804.38              |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27              | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 18.34                  | 30                          | 16.29                 | 30                          | 16.29           | 7,510.36               | 7,510.36               |

DESIGN CONDITION: OPTION 6b 2020  
 F.W. Model Eq. Pop. = 17,430.50 20,657.50  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11  
 2020 Eq. Pop. = 28,328.36  
 2020 Sew. Ac. = 3,499.63  
 TOTAL ESTIM. CONST. COST = \$4,747,436.90  
 + Engr., ROW, Financ., Conting. (1.5x) = \$7,121,155.35 \$5,859,621.02

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2020 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Pipe Diameter in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{(8/3)}]^2$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe Capacity in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{(8/3)} \times s^{1/2} / 1629.6 \times n] / 1.54$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. in.) x \$0.125/sq. in. x Length (Ft.)

OPTION 6b  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COFW  
 Big Fossil line

12/31/1999, 10.43 AM  
 TCWSC Option 6b.xls  
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| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2050 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | PROP. CAP. (MGD) | REPL. PIPE (in) | PROP. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARAL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|------------------|-----------------|-----------------|-----------------------|-----------------|------------------------|-------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 26.09                  | 66                    | 28.81            | 60              | 22.34           | 164.41                | \$8,552.98      | \$7,068.58             |                         |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 26.33                  | 66                    | 28.96            | 60              | 22.46           | 67.35                 | 34,211.92       | 28,274.31              |                         |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 27.27                  | 66                    | 29.54            | 60              | 22.91           | 36.88                 | 139,841.20      | 115,571.24             |                         |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 28.61                  | 66                    | 30.33            | 60              | 23.52           | 33.68                 | 216,390.36      | 178,835.01             |                         |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 30.10                  | 66                    | 31.18            | 60              | 24.18           | 34.43                 | 351,955.08      | 290,871.96             |                         |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0038    | -0.0206   | 54                    | 0.000257                   | 30.35                  | 66                    | 31.73            | 60              | 24.30           | 34.30                 | 80,825.65       | 66,798.06              |                         |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 31.08                  | 66                    | 31.73            | 60              | 24.61           | 34.81                 | 244,615.19      | 202,161.32             |                         |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0223   | 54                    | 0.000270                   | 31.77                  | 66                    | 32.12            | 60              | 24.91           | 35.20                 | 229,219.83      | 189,437.88             |                         |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 32.33                  | 66                    | 32.43            | 60              | 25.15           | 35.28                 | 271,984.73      | 224,780.76             |                         |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 32.85                  | 66                    | 32.74            | 60              | 25.39           | 35.57                 | 343,402.10      | 283,803.39             |                         |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 33.22                  | 66                    | 32.94            | 60              | 25.55           | 35.80                 | 375,475.77      | 310,310.55             |                         |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 48                    | 0.000534                   | 33.27                  | 60                    | 35.05            | 54              | 26.46           | 36.66                 | 201,454.46      | 163,178.11             |                         |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 33.22                  | 60                    | 35.05            | 54              | 26.46           | 36.41                 | 20,852.30       | 16,890.37              |                         |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 33.24                  | 60                    | 35.08            | 54              | 26.49           | 36.71                 | 306,069.41      | 247,916.22             |                         |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 33.26                  | 60                    | 35.14            | 54              | 26.53           | 36.57                 | 259,770.22      | 210,413.88             |                         |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 750           | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 32.84                  | 48                    | 50.27            | 54              | 27.70           | 38.56                 | 51,243.65       | 40,488.81              |                         |
| TCWSC/A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 33.22                  | 60                    | 35.17            | 54              | 26.56           | 36.78                 | 120,165.82      | 97,334.31              |                         |
| TCWSC/A/0006+17       | TCWSC/A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 33.17                  | 60                    | 35.17            | 54              | 26.56           | 36.69                 | 97,899.80       | 79,298.84              |                         |
| TCWSC/A/0007+96       | TCWSC/A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 33.17                  | 54                    | 37.92            | 48              | 27.70           | 38.56                 | 210,127.60      | 166,026.75             |                         |
| TCWSC/A/0015+30       | TCWSC/A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 33.10                  | 54                    | 37.92            | 48              | 27.70           | 38.56                 | 62,981.03       | 49,762.79              |                         |
| TCWSC/A/0017+50       | TCWSC/A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 33.05                  | 54                    | 37.92            | 48              | 27.70           | 38.56                 | 632,959.31      | 500,116.00             |                         |
| TCWSC/A/0039+61       | TCWSC/A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 32.83                  | 54                    | 37.92            | 48              | 27.70           | 38.56                 | 2,261.94        | 1,731.80               |                         |
| TCWSC/B/0001+14.8     | TCWSC/A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56             | 42              | 0.39            | -15.63                | 2,940.53        | 2,251.54               |                         |
| TCWSC/B/0001+28.94    | TCWSC/B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56             | 42              | 0.39            | 0.39                  | 1,357.17        | 1,039.08               |                         |
| TCWSC/B/0001+34.94    | TCWSC/B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56             | 42              | 0.39            | 0.39                  | 2,714.33        | 2,078.16               |                         |
| TCWSC/B/0001+46.94    | TCWSC/B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -1.02                  | 48                    | 0.56             | 42              | 0.34            | 11.84                 | 5,654.86        | 4,329.50               |                         |
| TCWSC/B/0001+73.07    | TCWSC/B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0015    | 30                    | 0.000000                   | -0.95                  | 48                    | 0.49             | 42              | 19.42           | 28.39                 | 68,310.73       | 52,300.40              |                         |
| TCWSC/B/0003+02       | TCWSC/B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001099                   | 32.72                  | 48                    | 27.73            | 42              | 19.42           | 30.95                 | 66,727.37       | 51,088.14              |                         |
| TCWSC/B/0005+96       | TCWSC/B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001099                   | 32.72                  | 48                    | 27.73            | 42              | 19.42           | 30.95                 | 19,085.16       | 13,253.58              |                         |
| TCWSC/B/0008+15       | TCWSC/B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0000    | -0.0001   | 30                    | 0.000000                   | 0.05                   | 36                    | 0.00             | 30              | 0.00            | 0.00                  | 37.77           | 45,804.38              |                         |
| TCWSC/B/0011+93       | TCWSC/B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 27                    | 0.002653                   | 15.73                  | 36                    | 20.00            | 30              | 12.30           | 33.47                 | 7,510.36        | 4,806.63               |                         |
| TCWSC/B/0012+35       | TCWSC/B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 15.66                  | 30                    | 16.29            | 24              | 8.98            |                       |                 |                        |                         |

DESIGN CONDITION: OPTION 6b  
 2050 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2050 Eq. Pop. = 32,547.85 TOTAL ESTIM. CONST. COST = \$4,747,436.90  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2050 Sew. Ac. = 3,549.06 + Engr., ROW, Financ., Conting. (1.5x) = \$7,121,155.35 \$5,773,101.63

UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 PROP. REPL. PIPE  
 REPL. PIPE CAP.  
 PROP. PARL. PIPE  
 PARL. PIPE CAP.  
 BOTH CAP.  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

UPSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 DOWNSTREAM STA. OF PIPE BASED ON CITY OF FORT WORTH MASTER PLAN DESIGNATIONS. STATIONS CONFIRMED BY FIELD SURVEY  
 LENGTH OF PIPE SEGMENT IN FEET  
 EXISTING PIPE DIAMETER IN INCHES  
 YEAR 2000 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON COLBROOK-WHITE EQUATIONS  
 YEAR 2020 FLOW RATE IN FT. WORTH MASTER PLAN BASED ON HYDROWORKS CALCULATIONS  
 CALIBRATION COEFFICIENTS USED TO COMPUTE DESIGN FLOWS BASED ON MODEL FLOWS: FLOW = A x EQ. POP. + B x SEWERED ACRES  
 PROPOSED DIAMETER PIPE SHOWN IN FT. WORTH MASTER PLAN FOR THE YEAR 2020 DESIGN  
 COMPUTED HYDRAULIC GRADIENT SLOPE OF MODEL PIPE USING MANNINGS EQN.: S = [ 1629.6 x n x MGD<sup>1.54</sup> / D<sup>5.48</sup> ]<sup>1/2</sup>, n = 0.0145  
 CALCULATED DESIGN FLOW IN MGD BASED ON COMPUTED COEF. "A" AND "B" AND DESIGN PERIOD EQUIVALENT POPULATION AND SEWERED ACRES  
 PROPOSED REPLACEMENT PIPE CAPACITY IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN INCHES  
 PROPOSED PARALLEL PIPE CAPACITY IN MGD = [ D<sup>5.48</sup> / (83) x S<sup>1/2</sup> ] / 1629.6 x n ] / 1.54  
 COMBINED CAPACITY OF EXISTING PIPE AND PROPOSED PARALLEL PIPE IN MGD  
 ESTIMATED CONSTRUCTION COST OF PROPOSED REPLACEMENT PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)  
 ESTIMATED CONSTRUCTION COST OF PROPOSED PARALLEL PIPE = AREA OF PIPE (SQ. IN.) x \$0.125/SQ. IN. x LENGTH (FT.)

OPTION 6b  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition. Assumes R. Hills and NRH will not be connected to the COPW Big Fossil line.

| UPSTREAM MAIN/STATION | DOWNSTREAM MAIN/STATION | LENGTH (feet) | EXIST. DIA. (in) | EXIST. PIPE CAP. (MGD) | 2000 MODEL FLOW (MGD) | 2020 MODEL FLOW (MGD) | COEF. "A" | COEF. "B" | MODEL PROP. DIA. (in) | MODEL H.G. SLOPE (ft/foot) | 2070 DESIGN FLOW (MGD) | PROP. REPL. PIPE (in) | REPL. PIPE CAP. (MGD) | PROP. PARL. PIPE (in) | PARL. PIPE CAP. (MGD) | BOTH CAP. (MGD) | ESTIM. REPL. PIPE COST | ESTIM. PARL. PIPE COST |
|-----------------------|-------------------------|---------------|------------------|------------------------|-----------------------|-----------------------|-----------|-----------|-----------------------|----------------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------|------------------------|------------------------|
| TCWSC/0000+20         | L9957/0001+32           | 20            | 36               | 142.07                 | 10.84                 | 16.87                 | 0.0029    | -0.0155   | 54                    | 0.000217                   | 26.09                  | 66                    | 28.81                 | 60                    | 22.34                 | 164.41          | \$8,552.98             | \$7,068.58             |
| TCWSC/0001+00         | TCWSC/0000+20           | 80            | 36               | 44.89                  | 10.86                 | 16.96                 | 0.0029    | -0.0158   | 54                    | 0.000219                   | 26.33                  | 66                    | 28.96                 | 60                    | 22.46                 | 67.35           | 34,211.92              | 28,274.31              |
| TCWSC/0004+27         | TCWSC/0001+00           | 327           | 36               | 13.97                  | 10.91                 | 17.30                 | 0.0031    | -0.0169   | 54                    | 0.000228                   | 27.21                  | 66                    | 29.54                 | 60                    | 22.92                 | 36.88           | 139,841.20             | 115,571.24             |
| TCWSC/0009+33         | TCWSC/0004+27           | 506           | 36               | 10.16                  | 10.95                 | 17.76                 | 0.0033    | -0.0185   | 54                    | 0.000241                   | 28.67                  | 66                    | 30.33                 | 60                    | 23.52                 | 33.68           | 216,390.36             | 178,835.01             |
| TCWSC/0017+56         | TCWSC/0009+33           | 823           | 36               | 10.25                  | 10.98                 | 18.26                 | 0.0036    | -0.0203   | 54                    | 0.000254                   | 30.10                  | 66                    | 31.18                 | 60                    | 24.18                 | 34.43           | 351,955.08             | 290,871.96             |
| TCWSC/0019+45         | TCWSC/0017+56           | 189           | 36               | 10.00                  | 10.98                 | 18.35                 | 0.0038    | -0.0206   | 54                    | 0.000257                   | 30.38                  | 66                    | 31.34                 | 60                    | 24.30                 | 34.30           | 66,798.06              | 56,798.06              |
| TCWSC/0025+17         | TCWSC/0019+45           | 572           | 36               | 10.20                  | 11.00                 | 18.58                 | 0.0038    | -0.0214   | 54                    | 0.000263                   | 31.05                  | 66                    | 32.12                 | 60                    | 24.91                 | 34.81           | 80,825.65              | 202,161.32             |
| TCWSC/0030+53         | TCWSC/0025+17           | 536           | 36               | 10.29                  | 11.00                 | 18.81                 | 0.0039    | -0.0230   | 54                    | 0.000270                   | 31.77                  | 66                    | 32.43                 | 60                    | 25.15                 | 35.20           | 229,219.83             | 189,437.88             |
| TCWSC/0036+89         | TCWSC/0030+53           | 636           | 36               | 10.13                  | 11.00                 | 18.99                 | 0.0040    | -0.0230   | 54                    | 0.000275                   | 32.33                  | 66                    | 32.74                 | 60                    | 25.39                 | 35.57           | 271,984.73             | 224,780.76             |
| TCWSC/0044+92         | TCWSC/0036+89           | 803           | 36               | 10.18                  | 11.02                 | 19.17                 | 0.0041    | -0.0236   | 54                    | 0.000280                   | 32.85                  | 66                    | 32.74                 | 60                    | 25.55                 | 35.80           | 343,402.10             | 283,803.39             |
| TCWSC/0053+70         | TCWSC/0044+92           | 878           | 36               | 10.25                  | 11.02                 | 19.29                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 33.22                  | 66                    | 32.94                 | 60                    | 26.46                 | 36.66           | 406,069.41             | 310,310.55             |
| TCWSC/0059+40         | TCWSC/0053+70           | 570           | 36               | 10.20                  | 11.05                 | 19.33                 | 0.0042    | -0.0241   | 54                    | 0.000284                   | 33.27                  | 60                    | 35.05                 | 54                    | 26.55                 | 35.80           | 375,475.77             | 310,310.55             |
| TCWSC/0059+99         | TCWSC/0059+40           | 59            | 36               | 9.95                   | 11.07                 | 19.33                 | 0.0041    | -0.0240   | 48                    | 0.000534                   | 33.22                  | 60                    | 35.05                 | 54                    | 26.46                 | 36.41           | 201,454.46             | 163,178.11             |
| TCWSC/0068+65         | TCWSC/0059+99           | 866           | 36               | 10.22                  | 11.09                 | 19.35                 | 0.0041    | -0.0240   | 48                    | 0.000535                   | 33.24                  | 60                    | 35.08                 | 54                    | 26.56                 | 36.71           | 207,916.22             | 210,413.88             |
| TCWSC/0076+00         | TCWSC/0068+65           | 735           | 36               | 10.04                  | 11.11                 | 19.38                 | 0.0041    | -0.0240   | 48                    | 0.000537                   | 33.28                  | 60                    | 35.14                 | 54                    | 26.53                 | 36.57           | 306,069.41             | 247,916.22             |
| TCWSC/A-B/0000+00     | TCWSC/0076+00           | 27            | 27               | 12.53                  | 11.34                 | 19.42                 | 0.0040    | -0.0231   | 42                    | 0.001099                   | 32.84                  | 60                    | 50.27                 | 54                    | 37.96                 | 50.49           | 265,071.66             | 214,708.04             |
| TCWSC-A/0003+40       | TCWSC/A-B/0000+00       | 340           | 36               | 10.22                  | 11.16                 | 19.40                 | 0.0041    | -0.0238   | 48                    | 0.000538                   | 33.22                  | 60                    | 35.17                 | 54                    | 26.56                 | 36.78           | 120,165.82             | 97,334.31              |
| TCWSC-A/0006+17       | TCWSC-A/0003+40         | 277           | 36               | 10.13                  | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 48                    | 0.000538                   | 33.17                  | 60                    | 35.17                 | 54                    | 26.56                 | 36.69           | 97,989.80              | 79,298.84              |
| TCWSC-A/0007+96       | TCWSC-A/0006+17         | 179           | 30               | 8.88                   | 11.18                 | 19.40                 | 0.0041    | -0.0237   | 42                    | 0.001097                   | 33.17                  | 54                    | 37.92                 | 48                    | 27.70                 | 38.58           | 51,243.65              | 40,468.81              |
| TCWSC-A/0015+30       | TCWSC-A/0007+96         | 734           | 30               | 10.86                  | 11.21                 | 19.40                 | 0.0041    | -0.0236   | 42                    | 0.001097                   | 33.10                  | 54                    | 37.92                 | 48                    | 27.70                 | 38.56           | 210,127.60             | 166,026.75             |
| TCWSC-A/0017+50       | TCWSC-A/0015+30         | 220           | 27               | 21.09                  | 11.23                 | 19.40                 | 0.0041    | -0.0235   | 42                    | 0.001097                   | 33.05                  | 54                    | 37.92                 | 48                    | 27.70                 | 38.56           | 62,981.03              | 49,762.79              |
| TCWSC-A/0039+61       | TCWSC-A/0017+50         | 2211          | 27               | 6.66                   | 11.32                 | 19.40                 | 0.0040    | -0.0231   | 42                    | 0.001097                   | 32.83                  | 54                    | 37.92                 | 48                    | 27.70                 | 34.36           | 632,959.31             | 500,116.00             |
| TCWSC-B/0001+14.8     | TCWSC-A/0039+61         | 10            | 27               | 8.08                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56                  | 42                    | 0.39                  | 8.47            | 2,261.94               | 1,731.80               |
| TCWSC-B/0001+28.94    | TCWSC-B/0001+14.8       | 13            | 16               | -16.02                 | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56                  | 42                    | 0.39                  | -15.63          | 2,940.53               | 2,251.34               |
| TCWSC-B/0001+34.94    | TCWSC-B/0001+28.94      | 6             | 16               | 0.00                   | 0.23                  | -0.16                 | -0.0002   | 0.0017    | 30                    | 0.000000                   | -1.07                  | 48                    | 0.56                  | 42                    | 0.39                  | 0.39            | 1,357.17               | 1,039.08               |
| TCWSC-B/0001+46.94    | TCWSC-B/0001+34.94      | 12            | 16               | 0.00                   | 0.21                  | -0.16                 | -0.0002   | 0.0016    | 30                    | 0.000000                   | -0.95                  | 48                    | 0.49                  | 42                    | 0.34                  | 11.84           | 5,654.86               | 4,329.50               |
| TCWSC-B/0001+73.07    | TCWSC-B/0001+46.94      | 25            | 16               | 11.50                  | 0.21                  | -0.14                 | -0.0002   | 0.0020    | 30                    | 0.001089                   | 32.77                  | 48                    | 27.73                 | 42                    | 19.42                 | 28.39           | 66,310.73              | 52,300.40              |
| TCWSC-B/0003+02       | TCWSC-B/0001+73.07      | 302           | 27               | 8.97                   | 11.37                 | 19.42                 | 0.0040    | -0.0230   | 42                    | 0.001089                   | 32.72                  | 48                    | 27.73                 | 42                    | 19.42                 | 30.95           | 66,727.37              | 51,088.14              |
| TCWSC-B/0005+96       | TCWSC-B/0003+02         | 295           | 30               | 11.53                  | 11.39                 | 19.42                 | 0.0040    | -0.0229   | 42                    | 0.001089                   | 32.72                  | 48                    | 27.73                 | 42                    | 19.42                 | 30.95           | 19,085.16              | 13,253.58              |
| TCWSC-B/0008+15       | TCWSC-B/0005+96         | 150           | 27               | 9.86                   | -0.02                 | 0.00                  | 0.0001    | -0.0001   | 30                    | 0.000000                   | 0.05                   | 36                    | 0.00                  | 30                    | 0.00                  | 0.00            | 45,804.38              | 31,808.60              |
| TCWSC-B/0011+93       | TCWSC-B/0008+15         | 360           | 27               | 25.47                  | 9.24                  | 12.30                 | 0.0013    | -0.0052   | 30                    | 0.002653                   | 15.73                  | 36                    | 20.00                 | 30                    | 12.30                 | 37.77           | 7,510.36               | 4,806.63               |
| TCWSC-B/0012+35       | TCWSC-B/0011+93         | 85            | 27               | 24.49                  | 9.27                  | 12.30                 | 0.0013    | -0.0051   | 27                    | 0.004654                   | 15.66                  | 30                    | 16.29                 | 24                    | 8.98                  | 33.47           | 4,806.63               | 3,100.00               |

DESIGN CONDITION: **OPTION 6b** 2070 F.W. Model Eq. Pop. = 17,430.50 20,657.50 2070 Eq. Pop. = 32,547.85 TOTAL ESTIM. CONST. COST = \$4,747,436.90 \$3,848,734.42  
 F.W. Model Sew. Ac. = 2,550.82 2,764.11 2070 Sew. Ac. = 3,549.06 + Engr., ROW, Financ., Conting. (1.5X) = \$7,121,155.35 \$5,773,101.63

NOTES:  
 UPSTREAM MAIN/STATION  
 UPSTREAM MAIN/STATION LENGTH  
 EXIST DIA.  
 EXIST PIPE CAP  
 2000 MODEL FLOW  
 2020 MODEL FLOW  
 COEF. "A", COEF. "B"  
 MODEL PROP DIA.  
 MODEL H.G. SLOPE  
 DESIGN FLOW  
 REPL. PIPE CAP  
 PROP. PIPE CAP  
 PARL. PIPE CAP  
 PARL. PIPE CAP  
 ESTIM. REPL. PIPE COST  
 ESTIM. PARL. PIPE COST

Upstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Downstream Sta. of Pipe Based on City of Fort Worth Master Plan Designations. Stations confirmed by Field Survey  
 Length of Pipe Segment in Feet  
 Existing Gravity Flow Capacity in Inches  
 Existing Gravity Flow Capacity of Pipe in MGD based on Ft. Worth Master Plan Data using Colbrook-White equations  
 Year 2000 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Year 2020 Flow Rate in Ft. Worth Master Plan based on HydroWorks Calculations  
 Calibration Coefficients used to Compute Design Flows based on Model Flows: Flow = A x Eq. Pop. + B x Sewered Acres  
 Proposed Diameter Pipe shown in Ft. Worth Master Plan for the Year 2020 Design.  
 Computed Hydraulic Gradient Slope of Model Pipe Using Mannings Eqn.:  $s = [1629.6 \times n \times \text{MGD}^{1.54} / D^{4.75}]^{1/2}$ ,  $n = 0.0145$   
 Calculated Design Flow in MGD Based on Computed Coef. "A" and "B" and Design Period Equivalent Population and Sewered Acres  
 Proposed Replacement Pipe in Inches  
 Proposed Replacement Pipe Capacity in Inches  
 Proposed Parallel Pipe in Inches  
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n]^{1/2}$   
 Proposed Parallel Pipe Capacity in MGD =  $[D^{4.75} / 1629.6 \times n]^{1/2}$   
 Combined Capacity of Existing Pipe and Proposed Parallel Pipe in MGD  
 Estimated Construction Cost of Proposed Replacement Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)  
 Estimated Construction Cost of Proposed Parallel Pipe = Area of Pipe (Sq. In.) x \$0.125/sq. in. x Length (Ft.)

**OPTION 6b**  
 Includes Flows from Richland Hills and North Richland Hills, which is the current condition.  
 Assumes R. Hills and NRH will not be connected to the COFW (Big Fossil line).

| PIPE DIA. | 1997 F.W.M.P. CONST. COST. (Per Ft.) | 2000 ESTIM. CONST. COST (Per Ft.) | ESTIM. CONST. COST (Per In.) | PIPE AREA (sq. in.) | ESTIM. CONST. COST (Per S.I.) |
|-----------|--------------------------------------|-----------------------------------|------------------------------|---------------------|-------------------------------|
| 4         | 32.31                                | 34.41                             | 8.60                         | 12.57               | 2.7383                        |
| 6         | 83.04                                | 88.44                             | 14.74                        | 28.27               | 3.1279                        |
| 8         | 87.32                                | 93.00                             | 11.62                        | 50.27               | 1.8501                        |
| 10        | 95.88                                | 102.11                            | 10.21                        | 78.54               | 1.3001                        |
| 12        | 99.03                                | 105.47                            | 8.79                         | 113.10              | 0.9325                        |
| 15        | 102.18                               | 108.82                            | 7.25                         | 176.71              | 0.6158                        |
| 18        | 105.33                               | 112.18                            | 6.23                         | 254.47              | 0.4408                        |
| 24        | 108.47                               | 115.52                            | 4.81                         | 452.39              | 0.2554                        |
| 30        | 122.64                               | 130.61                            | 4.35                         | 706.86              | 0.1848                        |
| 36        | 142.45                               | 151.71                            | 4.21                         | 1,017.87            | 0.1490                        |
| 42        | 195.22                               | 207.91                            | 4.95                         | 1,385.44            | 0.1501                        |
| 48        | 229.84                               | 244.78                            | 5.10                         | 1,809.55            | 0.1353                        |
| 54        | 276.31                               | 294.27                            | 5.45                         | 2,290.21            | 0.1285                        |
| 60        | 325.13                               | 346.26                            | 5.77                         | 2,827.42            | 0.1225                        |
| 66        | 366.75                               | 390.59                            | 5.92                         | 3,421.18            | 0.1142                        |
| 72        | 457.97                               | 487.74                            | 6.77                         | 4,071.49            | 0.1198                        |
| 78        | 506.32                               | 539.23                            | 6.91                         | 4,778.34            | 0.1128                        |
| 84        | 566.77                               | 603.61                            | 7.19                         | 5,541.75            | 0.1089                        |
| 90        | 662.43                               | 705.49                            | 7.84                         | 6,361.70            | 0.1109                        |
| 96        | 743.15                               | 791.45                            | 8.24                         | 7,238.20            | 0.1093                        |
| 108       | 990.71                               | 1,055.11                          | 9.77                         | 9,160.85            | 0.1152                        |
| 120       | 1,429.60                             | 1,522.52                          | 12.69                        | 11,309.69           | 0.1346                        |

Avg = 0.1239  
(Above 30")

**TAB 8**

**TEXAS WATER DEVELOPMENT BOARD**

**CONTRACT**

**ENGINEERING SERVICES AGREEMENT**

**AND**

**MISCELLANEOUS CORRESPONDENCE**

CITY OF  
NORTH RICHLAND HILLS

(copy)

Department: Public Works Department

Council Meeting Date: 6/14/99

Subject: Approve Regional Facility Planning Contract with the  
Texas Water Development Board for the Big Fossil Creek  
Wastewater System - Resolution No. 99-38

Agenda Number: \_\_\_\_\_

The Big Fossil Creek Wastewater Outfall System affects four separate entities. Richland Hills has a 36-inch wastewater outfall that was installed in the 1950's by the previous owner of Richland Hills and North Richland Hills water and sewer systems. North Richland Hills has a large amount of wastewater that flows down this outfall. The city of Fort Worth has a 48-inch wastewater outfall down this same creek bottom that carries flows from the city of Fort Worth customers as well as Haltom City's wastewater flows.

All four cities have received Administrative Orders (AO) from the United States Environmental Protection Agency (EPA) with this Big Fossil Creek Wastewater Outfall System being recognized as needing to be studied in detail to decide the best plan for increasing the capacity to meet ultimate needs. Only a portion of the Big Fossil Creek service area has been developed.

Previously, the planning grant application was submitted to the Texas Water Development Board (TWDB) by the city of Fort Worth, but was not approved. The TWDB staff gave indications that it would be better received if one of the other three cities (North Richland Hills, Richland Hills, or Haltom City) involved be the one submitting for the grant. North Richland Hills offered to be the lead city on this grant. When we resubmitted the application early this year, it was approved.

The TWDB has sent a revised contract for North Richland Hills to execute and return. Staff previously reviewed the contract and made comments. The main items covered by the contract are listed below.

1. Contract execution deadline is July 8, 1999.
2. Study completion date is August 31, 1999 with the final report deadline being October 31, 1999.
3. The study will identify three cost-effective alternatives for providing wastewater system capacity for the four cities.
4. Total study costs are \$59,950 with the TWDB paying \$29,975 of the total.
5. The City of North Richland Hills is responsible for \$29,975. This cost will be split evenly between Richland Hills, Fort Worth, Haltom City, and North Richland Hills.

Finance Review

Source of Funds:

Bonds (GO/Rev.) \_\_\_\_\_  
 Operating Budget \_\_\_\_\_  
 Other \_\_\_\_\_

Account Number \_\_\_\_\_

Sufficient Funds Available \_\_\_\_\_

*Jany Kerner*

Finance Director

*[Handwritten Signature]*  
Department Head Signature

\_\_\_\_\_  
City Manager Signature

**CITY OF  
NORTH RICHLAND HILLS**

The other three cities have obligated themselves for one-fourth of the study costs, up to \$7,500 each. North Richland Hills has sufficient money in the Unspecified Utility CIP Fund for paying it's share (approximately \$7,500).

Recommendation: To approve Resolution No. 99-38.

RESOLUTION NO. 99-38

BE IT RESOLVED by the City Council of the City of North Richland Hills, Texas,  
that:

1.

The City Manager be, and is hereby authorized to execute the attached Agreement with the Texas Water Development Board concerning the Regional Facility Planning Grant for a study on the Big Fossil Creek Wastewater Outfall System serving North Richland Hills, Richland Hills, Fort Worth, and Haltom City, as an act and deed of the City.

PASSED AND APPROVED this the 14<sup>th</sup> day June, 1999.

\_\_\_\_\_  
Charles Scoma, Mayor

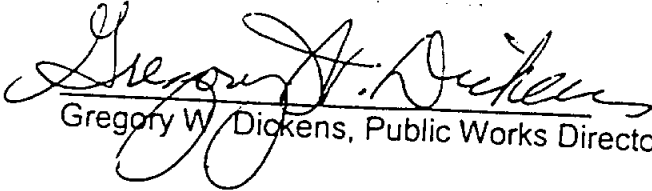
ATTEST:

\_\_\_\_\_  
Patricia Hutson, City Secretary

APPROVED AS TO LEGALITY:

\_\_\_\_\_  
Rex McEntire, Attorney for the City

APPROVED AS TO CONTENT:

  
\_\_\_\_\_  
Gregory W. Dickens, Public Works Director





# TEXAS WATER DEVELOPMENT BOARD

*W. J. Gile*

William B. Madden, *Chairman*  
Elaine M. Barrón, M.D., *Member*  
Charles L. Geren, *Member*

Craig D. Pedersen  
*Executive Administrator*

RECEIVED MAY 24 1999

Fernández, *Vice-Chairman*  
Jack Hunt, *Member*  
Wales H. Madden, Jr., *Member*

May 14, 1999

Mr. Larry J. Cunningham  
City Manager  
City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, Texas 76180

Re: Regional Facility Planning Contract Between the City of North Richland Hills (City) and the Texas Water Development Board (Board)

Dear Mr. Cunningham:

Enclosed are three copies of a regional facility planning contract between the Board and the City. The deadline for execution of this contract is July 8, 1999.

The Board's share of the \$59,950.00 facility plan is \$29,975.00 or 50 percent to be provided from the Research and Planning Fund. The local share of the plan will be provided by the City in the amount of \$29,975.00 in cash and \$0.00 in in-kind services.

Please sign and date all three copies of the contract by July 8, 1999, retain a copy for your files and return the remaining two executed copies, along with the City's federal or state vendor identification number, to the attention of the Board's Research and Planning Fund Grants Management Division.

A Payment Request Checklist and return address labels are enclosed for your information and use. If you have any questions concerning this contract, please contact Mr. Ralph Boeker, the Board's designated Contract Manager for this study, at (512) 936-0851.

Sincerely,

*Tommy Knowles*  
Tommy Knowles, Ph.D., P.E.  
Deputy Executive Administrator  
Office of Planning

Enclosures

Cc: Gregory W. Dickens, P.E. ✓  
Ralph Boeker, TWDB

### Our Mission

*Provide leadership, technical services and financial assistance to support planning, conservation, and responsible development of water for Texas.*

P.O. Box 13231 • 1700 N. Congress Avenue • Austin, Texas 78711-3231  
Telephone (512) 463-7347 • Telefax (512) 475-2053 • 1-800-RELAY TX (for the hearing impaired)  
URL Address: <http://www.twdh.state.tx.us> • E-Mail Address: [info@twdh.state.tx.us](mailto:info@twdh.state.tx.us)

Printed on Recycled Paper

:STATE OF TEXAS

TWDB Contract No. 99-483-308

COUNTY OF TRAVIS

Research and Planning Fund

Regional Facility Planning

THIS Contract, (hereinafter "CONTRACT"), between the Texas Water Development Board (hereinafter "BOARD") and the City of North Richland Hills (hereinafter "CONTRACTOR (S)"), is composed of two parts: Section I. Specific Conditions and Exceptions to the Standard Agreement and Section II. Standard Agreement. The terms and conditions set forth in Section I will take precedence over terms and conditions in Section II.

**SECTION I. SPECIFIC CONDITIONS AND EXCEPTIONS  
TO STANDARD AGREEMENT**

**ARTICLE I. DEFINITIONS:** For the purposes of this Contract, the following terms or phrases shall have the meaning ascribed therewith:

- A. BOARD - The Texas Water Development Board, or its designated representative
- B. CONTRACTOR (S) - City of North Richland Hills
- C. EXECUTIVE ADMINISTRATOR - The Executive Administrator of the Board or his designated representative
- D. PARTICIPANT (S) - City of North Richland Hills, City of Fort Worth, City of Richland Hills, and City of Haltom City
- E. REQUIRED INTERLOCAL AGREEMENT (S) -Not applicable
- F. REGIONAL PLAN - Regional wastewater facility
- G. BOARD APPROVAL DATE - April 8, 1999
- H. PLANNING AREA - The planning area is the Fossil Creek Basin of the Trinity River. The project area is more specifically defined in Exhibit A (the original grant application).
- I. DEADLINE FOR CONTRACT EXECUTION - July 8, 1999
- J. CONTRACT INITIATION DATE - April 8, 1999
- K. STUDY COMPLETION DATE - August 31, 1999

## SECTION II. STANDARD AGREEMENT

### ARTICLE I. RECITALS

Whereas, the CONTRACTOR (S) applied to the BOARD, Austin, Texas for a planning grant to develop a REGIONAL FACILITY PLAN;

Whereas, the CONTRACTOR (S) and PARTICIPANT (S) will commit cash and/or in-kind services to pay for the local share of this planning project;

Whereas, the CONTRACTOR (S) is the entity who will act as administrator of the BOARD's planning grant and will be responsible for the execution of this contract;

Whereas, on the BOARD APPROVAL DATE, the BOARD approved the CONTRACTOR (S)'s application for financial assistance;

Now, therefore, the BOARD and the CONTRACTOR (S), agree as follows:

### ARTICLE II. PROJECT DESCRIPTION AND SERVICES TO BE PERFORMED

1. Services and activities provided under this Contract shall be in strict accordance with requirements of the Texas Water Code, Chapter 15; associated rules of the Texas Administrative Code, Chapter 355, Sections 355.1-355.11, Subchapter A; Exhibit A, the original grant application, which is incorporated herein and made a permanent part of this Contract; and this Contract.
2. The CONTRACTOR (S) will prepare a REGIONAL FACILITY PLAN for the PLANNING AREA, as delineated and described in Exhibit A, according to the Scope of Work contained in Exhibit B. The CONTRACTOR (S) will consider BOARD population and water use projections, and if not used in the REGIONAL FACILITY PLAN, provide an explanation of why not used. Where applicable, the CONTRACTOR (S) will develop water conservation plans according to Texas Administrative Code, Chapters 363.15, 363.71, 375.37, and 375.101.
3. The CONTRACTOR (S) will establish formal, direct, and continuous liaisons with all cities, counties, councils of governments, river authorities, regional water planning groups designated under Texas Water Code §16.053 and 31 Texas Administrative Code §357.4, and all applicable state agencies, federal agencies, and other governmental entities in the PLANNING AREA, and all entities providing water and/or wastewater service in the PLANNING AREA for the purpose of coordinating the scope of work and REGIONAL FACILITY PLAN with all existing studies, plans, or activities for the purpose of providing information and obtaining available data for the development of the REGIONAL FACILITY PLAN.

ready original, and nine (9) bound double-sided copies of the final report to the EXECUTIVE ADMINISTRATOR no later than the FINAL REPORT DEADLINE. The CONTRACTOR (S) will submit one (1) electronic copy of any computer programs, maps, or models and an operations manual developed under the terms of this Contract.

5. The CONTRACTOR (S) will submit progress reports with submittal of vouchers according to the VOUCHER SUBMISSION SCHEDULE. Progress reports shall be in written form and shall include a brief statement of the overall progress made since the last status report; a brief description of any problems that have been encountered during the previous reporting period that will affect the study, delay the timely completion of any portion of this Contract, inhibit the completion of or cause a change in any of the study's products or objectives; and a description of any action the CONTRACTOR (S) plans to take to correct any problems that have been encountered.
6. The EXECUTIVE ADMINISTRATOR can extend the COMPLETION DATE and the FINAL REPORT DEADLINE upon written approval. The CONTRACTOR (S) should submit a written request to the EXECUTIVE ADMINISTRATOR at least thirty (30) working days prior to the COMPLETION DATE or thirty (30) days prior to the FINAL REPORT DEADLINE for an extension to the respective dates and explanation of why the deadlines have not been met.

#### ARTICLE IV. COMPENSATION AND REIMBURSEMENT

1. The BOARD agrees to compensate and reimburse the CONTRACTOR (S) in a total amount not to exceed the BOARD'S SHARE OF THE TOTAL STUDY COSTS for costs incurred and paid by the CONTRACTOR (S) pursuant to performance of this Contract. The CONTRACTOR (S) will contribute local matching funds in sources and amounts defined as the LOCAL SHARE OF THE TOTAL STUDY COSTS. The BOARD shall reimburse the CONTRACTOR (S) for ninety percent (90%) of the BOARD's share of each invoice pending the CONTRACTOR (S)'s performance, completion of a Final Report, and written acceptance of said Final Report by the EXECUTIVE ADMINISTRATOR, at which time the BOARD shall pay the retained ten percent (10%) to the CONTRACTOR (S).
2. The CONTRACTOR (S) shall submit vouchers and documentation for reimbursement billing according to the VOUCHER SUBMISSION SCHEDULE and in accordance with the approved task and expense budgets contained in Exhibit C to this Contract. At the discretion of the EXECUTIVE ADMINISTRATOR and upon written memorandum to the contract file, the CONTRACTOR (S) has budget flexibility within task and expense budget categories to the extent that the resulting change in amount in any one task or

- C. For travel and subsistence expenses, including such expenses for subcontractors --
- (1) names, dates, work locations, time periods at work locations, itemization of subsistence expenses of each employee, limited, however, to travel expenses authorized for state employees by the General Appropriations Act, Tex. Law Regular Session, 1997, Art. IX, Sec. 13 through 21, at IX-54 or as amended or superseded;
  - (2) other transportation costs -- copies of invoices covering tickets for transportation or, if not available, names, dates, and points of travel of individuals; and
  - (3) all other reimbursable expenses -- invoices or purchase vouchers showing reason for expense with receipts to evidence the amount incurred.

#### ARTICLE V. OWNERSHIP, PUBLICATION, AND SUBCONTRACTING

1. The BOARD shall have unlimited rights to technical or other data resulting directly from the performance of services under this Contract. It is agreed that all reports, drafts of reports, or other material, data, drawings, computer programs and codes associated with this Contract and developed by the CONTRACTOR(S) or its subcontractors pursuant to this Contract shall become the joint property of the CONTRACTOR(S) and the BOARD. These materials shall not be copyrighted or patented by the CONTRACTOR (S) or by any consultants involved in this Contract unless the EXECUTIVE ADMINISTRATOR approves in writing the right to establish copyright or patent; provided, however, that copyrighting or patenting by the CONTRACTOR (S) or its subcontractors will in no way limit the BOARD's access to or right to request and receive or distribute data and information obtained or developed pursuant to this Contract. Any material subject to a BOARD copyright and produced by the CONTRACTOR (S) or BOARD pursuant to this Contract may be printed by the CONTRACTOR (S) or the BOARD at their own cost and distributed by either at their discretion. The CONTRACTOR (S) may otherwise utilize such material provided under this Contract as it deems necessary and appropriate, including the right to publish and distribute the materials or any parts thereof under its own name, provided that any BOARD copyright is appropriately noted on the printed materials.
2. The CONTRACTOR (S) agrees to acknowledge the BOARD in any news releases or other publications relating to the work performed under this Contract.
3. No work herein called for by the CONTRACTOR (S) shall be reimbursed for expenses by the BOARD to the CONTRACTOR (S) without prior written approval

**ARTICLE VIII.**

**LICENSES, PERMIT, AND INSURANCE**

1. For the purpose of this Contract, the CONTRACTOR (S) will be considered an independent contractor and therefore solely responsible for liability resulting from negligent acts or omissions. The CONTRACTOR (S) shall obtain all necessary insurance, in the judgement of the CONTRACTOR (S), to protect themselves, the BOARD, and employees and officials of the BOARD from liability arising out of this Contract. The CONTRACTOR (S) shall indemnify and hold the BOARD and the State of Texas harmless, to the extent the CONTRACTOR (S) may do so in accordance with state law, from any and all loses, damages, liability, or claims therefore, on account of personal injury, death, or property damage of any nature whatsoever caused by the CONTRACTOR (S), arising out of the activities under this Contract.
2. The CONTRACTOR (S) shall be solely and entirely responsible for procuring all appropriate licenses and permits, which may be required by any competent authority for the CONTRACTOR (S) to perform the subject, work.

**ARTICLE IX. SEVERANCE PROVISION**

1. Should any one or more provisions of this Contract be held to be null, void, voidable, or for any reason whatsoever, of no force and effect, such provision(s) shall be construed as severable from the remainder of this Contract and shall not affect the validity of all other provisions of this Contract which shall remain of full force and effect.

**ARTICLE X. CORRESPONDENCE**

All correspondence between the parties shall be made to the following addresses:

For the **BOARD**:

Mr. Craig D. Pedersen  
Executive Administrator  
Texas Water Development Board  
P.O. Box 13231, Capitol Station  
Austin, Texas 78711-3231

For the **CONTRACTOR(S)**:

Mr. Gregory W. Dickens, P.E.  
Public Works Director  
City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, Texas 76180

Attention: Research and Planning Fund  
Grants Management Division

EXHIBIT A

ORIGINAL GRANT APPLICATION

EXHIBIT B

SCOPE OF WORK



27. A detailed scope of work for proposed planning. (Not to exceed 6 pages.)

The City of North Richland Hills in cooperation with the cities of Richland Hills, Haltom City, and Fort Worth for the Big Fossil Relief Sewer Planning Study proposes the following scope of work.

- Task 1: Obtain and review available existing sanitary sewer design data (drawings and specifications) for COFW Big Fossil Sewer and TCWSC Big Fossil Sewer.
- Task 2: Conduct preliminary easement ownership research. Provide services of a right-of-way consultant.
- Task 3: Prepare parcel map for the lower section of the COFW Big Fossil Sewer and the TCWSC Big Fossil Sewer. Provide surveying services.
- Task 4: Determine if any additional right-of-way is required for the TCWSC Big Fossil Sewer.
- Task 5: Determine capacity requirements in gallons per minute for the proposed relief sanitary sewer utilizing data from the Fort Worth Wet Weather Program and available Sanitary Sewer Evaluation Studies that were recently completed by the cities of North Richland Hills, Haltom City and Richland Hills. Determine required sanitary sewer sizes (diameter).
- Task 6: Identify three cost effective alternative routes for the proposed relief sewer.
- Task 7: Determine easement requirements for each alternative route for the proposed relief sanitary sewer.
- Task 8: Develop evaluation matrix to select the optimum route for the proposed relief sanitary sewer. The matrix will include the following criteria:
- capital cost
  - additional easement required
  - impact on participating communities
  - design considerations (creek and road crossings, topography)
  - construction impacts
  - sanitary sewer maintenance requirements

EXHIBIT C

TASK AND EXPENSE CATEGORY BUDGET

TASK BUDGET

| TASK    | DESCRIPTION | AMOUNT      |
|---------|-------------|-------------|
| Task 1  |             | \$690.00    |
| Task 2  |             | 9,880.00    |
| Task 3  |             | 10,580.00   |
| Task 4  |             | 1,900.00    |
| Task 5  |             | 4,060.00    |
| Task 6  |             | 2,760.00    |
| Task 7  |             | 2,760.00    |
| Task 8  |             | 4,880.00    |
| Task 9  |             | 11,760.00   |
| Task 10 |             | 5,000.00    |
| Task 11 |             | 810.00      |
| Task 12 |             | 4,870.00    |
| Total   |             | \$59,950.00 |

EXPENSE BUDGET

| CATEGORY                                       | TOTAL AMOUNT | SUBCONTRACT |
|--|--------------|-------------|
| A. Salaries and Wages <sup>1</sup>             | \$12,204.00  |             |
| B. Fringe <sup>2</sup>                         | 4,515.00     |             |
| C. Travel                                      | 50.00        |             |
| D. Surveying                                   | 6,000.00     | ✓           |
| E. Subcontract                                 | 15,000.00    | ✓           |
| F. Employee Mileage                            | 100.00       |             |
| G. communications (phone, fax, mail, delivery) | 100.00       |             |
| H. Reproduction                                | 250.00       |             |
| I. Overhead <sup>3</sup>                       | 15,621.00    |             |
| J. Profit                                      | 6,110.00     |             |
| Total  | \$59,950.00  | \$15,000.00 |

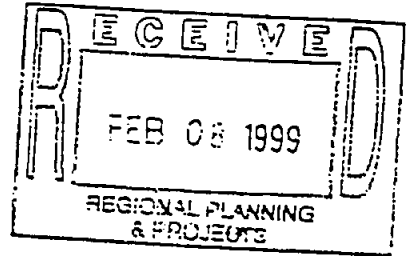
<sup>1</sup> Salaries and Wages is defined as the cost of salaries of engineers, draftsmen, stenographers, surveymen, clerks, laborers, etc., for time directly chargeable to this contract.

<sup>2</sup> Fringe is defined as the cost of social security contributions, unemployment, excise, and payroll taxes, employment compensation insurance, retirement benefits, medical and insurance benefits, sick leave, vacation, and holiday pay applicable thereto.

<sup>3</sup> Other Expenses is defined to include expendable supplies, communications, reproduction, postage, and costs of public meetings directly chargeable to this CONTRACT.

TEXAS WATER DEVELOPMENT BOARD  
RESEARCH AND PLANNING FUND

APPLICATION CHECKLIST



I. GENERAL INFORMATION

1. Legal name of applicant(s).

City of North Richland Hills, Texas  
City of Fort Worth, Texas  
City of Richland Hills, Texas  
City of Haltom City, Texas

2. Participating political subdivision(s).

Same as above.

3. Authority of law under which the applicant was created.

All four of the applicants are municipalities operating under the authority of the laws of the State of Texas.

4. Applicant's official representative, name, title, mailing address, phone number, fax number and if available, e-mail address and vendor I.D. number.

Gregory W. Dickens, P.E.  
Public Works Director  
City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, Texas 76180  
Telephone number: (817) 581-5521  
Fax number: (817) 656-7538  
E-mail: [www.nrhoadm@airmail.net](mailto:www.nrhoadm@airmail.net)

5. Citations of applicant's legal authority to plan, develop, and operate a regional facility for the planning area or if authority to plan is by interlocal agreement, attach agreement to application.

The cities of Richland Hills, Haltom City and North Richland Hills discharge their wastewater into the City of Fort Worth's sanitary sewer collection system.

13. Total grant funds requested from the Texas Water Development Board.

\$30,000

14. Detailed description of why proposed planning is needed. (Not to exceed 1 page.)

Each of the four applicants have experienced wet-weather overflows from their sanitary sewer systems. These sanitary sewer overflows (SSOs) have recurred with sufficient frequency to result in the issuance of Administrative Orders (AO's) from the United States Environmental Protection Agency (EPA) Region 6 for field studies, evaluations of the collection system, and ultimately the correction/elimination of these SSOs.

All four applicants have completed their sanitary sewer evaluation studies (SSES). All studies confirmed that a parallel relief sewer is required for each of the four municipalities. Preliminary planning conferences have been held which identified the mutual benefit of a joint project involving the City of North Richland Hills, City of Richland Hills, City of Haltom City, and City of Fort Worth in extending, replacing, and/or renovating the Big Fossil Creek Sewer System.

At the present time there are two parallel sanitary sewer lines in the Big Fossil Creek Sewer System that were constructed in the 1950s. These lines will need to be rehabilitated and have capacity increased with a potential parallel sanitary sewer line. Alternately, a single relief interceptor may be cost-effective when compared to rehabilitation and capacity increases by parallel facilities.

15. Detailed description of why state funding assistance is needed. (Not to exceed 1 page.)

All four communities are faced with significant funding requirements to rehabilitate the collection systems that are internal to each cities' facilities. The main outfall sewers that convey sanitary flow from portions of each of the four systems to the Village Creek outfall sewer system is an area for which the ownership and operation and maintenance responsibility is unclear. Accordingly, no funds have been planned for studying or replacing this aging system. In order to avoid excessive cost burdens that none of the four participating municipalities are willing to undertake individually, the assistance from the Texas Water Development Board (TWDB) is requested.

23. Average population growth rate in proposed planning area for the past 10 years.
- 2.11 percent
24. List date(s) and description(s) of most recent water supply and/or wastewater facility planning in proposed planning area.
- City of North Richland Hills – “Final Water and Wastewater Impact Fee Update Report”, July 1997
- City of Haltom City – “Summary of Impact Fee Effort pertaining to City of Fort Worth (Pass-through 1996 Impact Fees for City of Haltom City), January 1997
- City of Richland Hills – Wastewater Master Plan completed in 1983 and Impact Fee Analysis completed in 1995
- City of Fort Worth – “Water and Wastewater System Master Plan,” June 1989
25. List of political subdivisions, as defined earlier, in proposed planning area.
- Political subdivisions in the Big Fossil Creek Drainage Basin are the City of Fort Worth, City of Richland Hills, City of Haltom City, City of North Richland Hills, City of Blue Mound, City of Saginaw, City of Watauga, and Tarrant County.
26. Percentage of political subdivisions in proposed planning area that are participating.
- 92.45 percent
27. A detailed scope of work for proposed planning. (Not to exceed 6 pages.)
- The City of North Richland Hills in cooperation with the cities of Richland Hills, Haltom City, and Fort Worth for the Big Fossil Relief Sewer Planning Study proposes the following scope of work.
- Task 1: Obtain and review available existing sanitary sewer design data (drawings and specifications) for COFW Big Fossil Sewer and TCWSC Big Fossil Sewer.

Task 12: Manage the progress of the project, including schedule, budget and coordination with the Texas Water Development Board.

28. A task budget for detailed scope of work by task.

Please see Table 1.

29. An expense budget for detailed scope of work by expense category.

Please see Table 1.

30. A time schedule for completing detailed scope of work by task.

| EVENT   | TIME FROM AUTHORIZATION TO PROCEED |
|---|------------------------------------|
| Complete Tasks 1 through 4 and Conduct Project Workshop No. 1 | 4 Weeks                            |
| Complete Tasks 5 through 8 and Conduct Project Workshop No. 2 | 8 Weeks                            |
| Submit Draft Report to TWDB for Review                        | 9 Weeks                            |
| Complete Task 9 and Submit Final Report to TWDB               | 12 Weeks                           |
| TOTAL PROJECT TIME  | 90 Days                            |

**31. Method of monitoring study progress.**

Monthly progress meetings will be scheduled to take place in the City of North Richland Hills City Hall, which is the lead City and is a convenient, central location to all four cities that are involved in the planning process.

**32. Qualifications and direct experience of proposed project staff.**

This project will be administered under the direction of Mr. Gregory Dickens, P.E. who has extensive experience in administering and coordinating multi-million dollar wastewater collection system and planning and development projects of this magnitude.

**III. EXISTING SYSTEM INFORMATION**

**If proposed planning includes regional water supply planning, include the following information for each entity participating in this study:**

Items 33 through 39 as listed in the Texas Water Development Board "Application Checklist" are not applicable to this project.

**If proposed planning includes regional wastewater planning, include the following information for each entity participating in this study:**

**40. Number of permit violations in past 12 months for fecal coliform, D.O. or nutrients, metals/organics, and other.**

There have been no permit violations at the Village Creek Wastewater Treatment Plant (WWTP). EPA alleges each sanitary sewer overflow (SSO) in the applicants or participating cities collection systems are permit violations and must only be reported.

**41. Number of enforcement actions in past 12 months.**

EPA has previously issued Administrative Orders (AO's) as an enforcement action to all four of the participating cities in this planning effort. Additionally, the EPA has also issued AO's to the cities of North Richland Hills, Richland Hills, and Haltom City requiring these cities to correct/eliminate their SSO's within 5 years, 3 years and 5 years, respectively.

**42. Percent of facility capacity used at present.**

The Fossil Creek Sanitary Sewer System has adequate capacity for dry weather flows, however, at the present time adequate peak wet weather capacity is not provided. This lack of capacity for wet weather events has

**Implementation of viable solutions identified through the proposed planning will be diligently pursued and identification of potential sources of funding for implementation of viable solutions.**

EPA Region 6 will include in their AO's as part of enforcement, a schedule to remedy wet weather SSOs in the Fossil Creek Drainage Basin. Failure to pursue solutions to the SSOs will result in further enforcement activities by the EPA.

**If proposed planning includes regional wastewater planning, the proposal will conform to the approved state water quality management plan or that an amendment to the water quality management plan which will bring the proposed planning into compliance with the water quality plan is being processed for the proposed planning area.**

The City of Fort Worth monitors compliance of its wastewater collection and treatment facilities for its residents and the residents of each of the other three participating municipalities as well as more than 18 additional municipalities in the Village Creek Wastewater system service area. The three participating municipalities are customers of the Fort Worth Village Creek Wastewater Treatment System in the North Central Texas Council of Government's Water Quality Management Plan.

**If a grant is awarded, written evidence that local matching funds and in-kind services are available for the proposed planning must be provided when the contract is executed.**

Local matching funds will be available for this effort on receipt of a proposed contract with the TWDB. These funds can be committed by the Utility Directors and City Managers of each of the respective cities. if necessary, City Council resolutions can be enacted, if required by the TWDB.

**An approved water conservation plan has been implemented in the proposed planning area or will be developed as part of the overall planning project.**

The cities of North Richland Hills, Haltom City, Richland Hills, and Fort Worth all have water conservation plans in place.



City of Watauga – Mr. Dale Cheatham, City Manager  
7101 Whitley Road, Watauga, Texas 76148

Tarrant County – Ms. Suzanne Henderson, County Clerk  
100 East Weatherford, Fort Worth, Texas 76196

**VI. RESOLUTION**

A resolution from the governing body of each applicant and/or participant:

- stating the entity's representative is authorized to apply for a grant from the Texas Water Development Board;
- granting authority for the entity to enter into a contract with the Texas Water Development Board; and
- stating the intent to commit local matching funds in cash and/or in kind services.

Resolutions from the City Managers of each of the applicants are included at the end of this submittal.



CITY OF HALTOM CITY

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September 30, 1997

Texas Water Development Board  
-1700 North Congress Avenue  
P.O. Box 13231  
Austin, TX 78711 - 3231

**RE: MULTI-JURISDICTIONAL GRANT APPLICATION  
SANITARY SEWER STUDY**

Dear Madam or Sir:

Haltom City was recently made aware of a potential grant from the Texas Water Development Board (TWDB) for multi-jurisdictional sanitary sewer studies.

The grant application process was discussed during a Special-Called Meeting of the Haltom City Council yesterday evening. At that time, the City Council unanimously directed staff to apply for this grant and to appropriate Haltom City's necessary share of funds. It is our understanding that if the grant application is approved, fifty percent (50%) of the funding for this type of sanitary sewer study would be provided by the TWDB and the remaining 50% of funding, in cash, would be shared on an equitable basis between the applicant cities of Fort Worth, Haltom City, North Richland Hills and Richland Hills. Additionally, the City Council will formally adopt a Resolution to this effect upon receipt of notice of approval of the grant application from the TWDB.

If I can provide you with any additional information, please do not hesitate to contact me.

Sincerely,

Bill Eisen  
City Manager

MINUTES OF THE RICHLAND HILLS CITY COUNCIL

REGULAR MEETING

NOVEMBER 11, 1997

1. CALL TO ORDER

Mayor Kelley called the meeting to order at 7:30 p.m. in the Council Chambers of the Richland Hills City Hall, 3200 Diana Drive, Richland Hills, Texas.

**Councilmembers Present:** Pat Watkins, Jim McKnight, Horace Hamilton, Phil Heinze, and Wayne Erickson.

**City Staff Present:** City Manager James W. Quin, City Secretary Terri Willis and City Attorney Paul Wieneskie.

2. INVOCATION AND PLEDGES OF ALLEGIANCE

The invocation was given by Mayor Pro Tem Watkins.

Councilmember McKnight led the Pledge of Allegiance to the United States and Texas flags.

3. COUNCIL-APPOINTED BOARDS

At this time, the City Council considered resignations and appointments to the City's boards, commissions, and committees.

**MOTION:** A motion was made by Councilmember Hamilton, and seconded by Mayor Pro Tem Watkins, to appoint Gabriella Bendslev to Place 3A on the Teen Court Advisory Board.

Mayor Kelley advised there being no objection, Ms. Bendslev was duly appointed.

4. PRESENTATIONS/RECOGNITIONS - RECOGNITION OF MR. MARK STRUHS

City Manager Quin advised that Mr. Mark Struhs, Vice-President of Dynamo Ltd., was being recognized for being 1 of 12 executives selected to meet with President Clinton regarding NAFTA and the President's Fast Track Authority.

Mayor Kelley advised that Mr. Struhs was unable to attend the meeting, and explained that Dynamo Ltd. was one of the larger exporters in the world of game tables. This same company was previously recognized as being named "Exporter of the Year" in 1996.

→ 14. DISCUSSION OF BIG FOSSIL RELIEF SEWER PLANNING STUDY (cont'd.)

MOTION: A motion was made by Mayor Pro Tem Watkins, and seconded by Councilmember Heinze, to approve participation in the Big Fossil Relief Sewer Planning Study in the amount of \$7,500. The motion unanimously carried.

~~15. WATER SYSTEM REVENUE REQUIREMENTS WORKSHOP~~

~~City Manager Quin advised that this item was for consideration of scheduling a workshop for Thursday, December 11, 1997 at 7:00 p.m. to review the water system revenue requirements study completed by the engineering firm of Carter and Burgess, Inc. This study was approved by the City Council in August of this year. The study was needed in order to determine the rate increase needed to fund \$200,000 in capital improvements in next year's budget.~~

~~MOTION: A motion was made by Councilmember Heinze, and seconded by Councilmember Hamilton, to schedule a workshop for 7:00 p.m. on Thursday, December 11, 1997 to review the water system revenue requirements study. The motion unanimously carried.~~

16. REMOVAL OF CONSENT AGENDA ITEMS

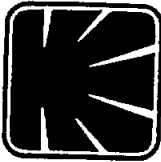
There were no items removed from the Consent Agenda for individual consideration.

17. CONSENT AGENDA

City Manager Quin reviewed the Consent Agenda as follows:

Approval of the Minutes of the October 28, 1997 Regular City Council Meeting

MOTION: A motion was made by Councilmember Heinze, and seconded by Mayor Pro Tem Watkins, to approve the Consent Agenda as presented. The motion unanimously carried.



**KNOWLTON-ENGLISH-FLOWERS, INC.**  
CONSULTING ENGINEERS / Fort Worth-Dallas

COPY TO E  
BILLING  
FILE

ROUTING  
JOB NO. 3-436  
FILING Bohr  
KEE RTEN  
BRF SWF  
RWA JVS  
DHC \_\_\_\_\_ JFP \_\_\_\_\_  
MER \_\_\_\_\_ RMW \_\_\_\_\_  
GRP \_\_\_\_\_ LDR \_\_\_\_\_  
SAG \_\_\_\_\_ JEH \_\_\_\_\_  
JOH \_\_\_\_\_ CLS \_\_\_\_\_  
7-20-97

**AUTHORIZATION FOR  
PROFESSIONAL ENGINEERING SERVICES**

PROJECT NO.: 3-436  
PROJECT NAME: North Richland Hills Big Fossil Relief Sewer Planning  
CLIENT: The City of North Richland Hills, Texas  
ADDRESS: City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, TX 76180

Hereby requests and authorizes Knowlton-English-Flowers, Inc., Consulting Engineers to perform the following services:

SCOPE: See Attached Scope of Work  
COMPENSATION: Compensation to Knowlton-English-Flowers, Inc., shall be on a Lump Sum basis in the Total Amount of Fifty Nine Thousand Nine Hundred Fifty Dollars and no/100, (\$59,950.00)

Approved for  
The City of North Richland Hills

By: Jerry J. Cunningham

Title: CITY MANAGER

Date: 7-15-97

Accepted for  
Knowlton-English-Flowers, Inc.

By: Richard W. Albin  
Richard W. Albin, P.E.

Title: Vice President

Date: July 5, 1999

# NORTH RICHLAND HILLS BIG FOSSIL RELIEF SEWER PLANNING

## SCOPE OF WORK

The City of North Richland Hills, in cooperation with the cities of Richland Hills, Haltom City and Fort Worth for the Big Fossil Relief Sewer Planning Study proposes the following Scope of Work:

- Task 1: Obtain and review available existing sanitary sewer design data (drawings and specifications) for COFW Big Fossil Sewer and TCWSC Big Fossil Sewer.
- Task 2: Conduct preliminary easement ownership research. Provide services of a right-of-way consultant.
- Task 3: Prepare parcel map for the lower section of the COFW Big Fossil Sewer and the TCWSC Big Fossil Sewer. Provide surveying services.
- Task 4: Determine if any additional right-of-way is required for the TCWSC Big Fossil Sewer.
- Task 5: Determine capacity requirements in gallons per minute for the proposed relief sanitary sewer utilizing data from the Fort Worth Wet Weather Program and available Sanitary Sewer Evaluation Studies that were recently completed by the cities of North Richland Hills, Haltom City and Richland Hills. Determine required sanitary sewer sizes (diameter).
- Task 6: Identify three cost effective alternative routes for the proposed relief sewer.
- Task 7: Determine easement requirement for each alternative route for the proposed relief sanitary sewer.
- Task 8: Develop evaluation matrix to select the optimum route for the proposed relief sanitary sewer. The matrix will include the following criteria:
  - capital cost
  - additional easement required
  - impact on participating communities
  - design considerations (creek and road crossings, topography)
  - construction impacts
  - sanitary sewer maintenance requirements

- Task 9: Prepare study report document Tasks 1 through 8. Report will recommend proposed relief sanitary sewer sizes and route(s). Provide services of a technical editor.
- Task 10: Conduct two project workshops for quality control, discussion of project issues, and consensus on proposed relief sanitary sewer. Conduct monthly progress meetings with the applicants.
- Task 11: Provide word processing support.
- Task 12: Manage the progress of the project, including schedule, budget and coordination with the Texas Water Development Board.

CITY OF  
NORTH RICHLAND HILLS

Department: Public Works Department

Council Meeting Date: 7/12/99

Subject: Approve Agreement for Engineering Services with Knowlton, English & Flowers, Inc. for the Big Fossil Creek Wastewater Outfall System Planning Study - Resolution No. 99-43

Agenda Number: PW 99-14

The cities of North Richland Hills, Fort Worth, Richland Hills and Haltom City received administrative orders from the Environmental Protection Agency requiring correction of sanitary sewer collection system problems to eliminate overflows. A study is necessary to determine the feasibility of extending, replacing or renovating the existing sanitary sewer pipelines within the Big Fossil Creek wastewater outfall system.

The city of North Richland Hills submitted a grant application to the Texas Water Development Board (TWDB) for grant funds, with the cities of Richland Hills, Haltom City and Fort Worth to perform a multi-jurisdictional wastewater planning study for the section of the outfall system between Broadway Avenue south to the existing Fort Worth 90" and 96" Village Creek Treatment Plant outfall lines. The grant was approved by the TWDB and approved by Council at the June 28, 1999 meeting.

Staff has requested and received an agreement from Knowlton-English-Flowers, Inc. (KEF) to conduct this regional planning study in accordance with the scope of work as outlined in the TWDB contract.

The study will entail reviewing existing sewer design data, researching existing sewer easements and property ownership, preparing parcel map, identifying three alternative solutions, and providing all information in a report.

KEF has agreed to perform the study for \$59,950 within the proposed 90-day schedule. The proposed agreement is attached.

The TWDB grant is for half of the total study cost of \$59,950. The other half is to be paid for by the four cities. The other three cities have appropriated their quarter share to be paid to us. The TWDB will reimburse their \$29,975 on a monthly basis as we expend the funds. Sufficient funds are available in the Unspecified Utility CIP fund to pay our share, which totals \$7,493.75.

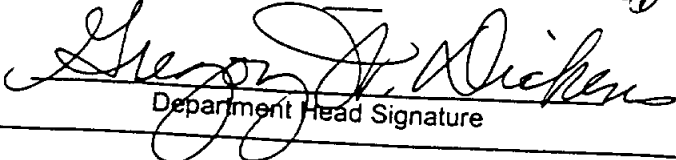
**Recommendation:** To approve Resolution No. 99-43

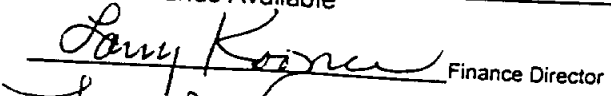

Finance Review

Source of Funds:

Bonds (GO/Rev.)   
Operating Budget   
Other

Account Number 02-23-17-6000;99-02-23-017  
Sufficient Funds Available

  
Department Head Signature

  
Finance Director  
  
City Manager Signature



TRA DCRWS  
DENTON CREEK

TRA CRWS  
BIG BEAR CREEK

SAGINAW

BLUE  
MOUND

WATAUGA

NORTH  
RICHLAND  
HILLS

FORT  
WORTH

STUDY  
AREA

HALTOM  
CITY

RICHLAND  
HILLS

BIG FOSSIL  
OUTFALL

ICVSC BIG FOSSIL  
COFF BIG FOSSIL

COFF 30"/36"  
TRANSMISSION MAIN



- EXISTING ICVSC BIG FOSSIL OUTFALL
- EXISTING COFF BIG FOSSIL DRAINAGE BASIN SANITARY SEWERS
- ..... CITY LIMIT LINES
- DRAINAGE BASIN DIVISION LINES

# CITY OF NORTH RICHLAND HILLS

Public Works

CERTIFIED MAIL Z 187 017 102

July 15, 1999

Texas Water Development Board  
P. O. Box 13231  
1700 N. Congress Avenue  
Austin, Texas 78711-3231  
(512) 463-3154

Attention: Ms. Phyllis Thomas, Research and Planning Fund  
Grants Management Division

RE: TWDB CONTRACT NO. 99-483-308; BIG FOSSIL CREEK  
REGIONAL WASTEWATER PLANNING GRANT

ROUTING  
JOB NO. 3-436  
FILING CORR  
KEE [initials]  
BPF [initials]  
RWA [initials] WS  
DHC [initials] JFP  
MER [initials] RNV  
GRP [initials] LOR  
SAG [initials]  
JCH [initials]  
7/15/99

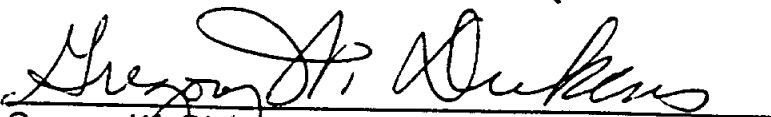
Ms. Thomas:

The City has had to hire an engineering firm other than the one which helped put the application together and had a lot of the background data on the project. Circumstances arose with the first engineering consultant which did not allow us to enter into a contract for their services. This will cause at least a 90-day delay in the project schedule.

The City would appreciate your consideration in extending the "Study Completion Date" from August 31, 1999 to November 31, 1999 and moving the "Final Report Deadline" from October 31, 1999 to January 31, 2000. These are items "K" and "L" on pages 1 and 2 of the contract. No other changes to the contract are requested.

If you have any questions, please contact me. I will await notice of your determination.

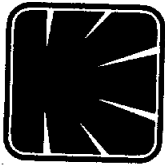
Respectfully,

  
Gregory W. Dickens, P.E.  
Public Works Director

GWD/mfs/pw199251

cc: Steve Norwood, Assistant City Manager  
Frank Crumb, City of Fort Worth  
Greg Van Nieuvenhuize, City of Haltom City  
John Cherry, City of Richland Hills  
Richard Albin, Knowlton-English-Flowers, Inc.

P.O. Box 820609 • North Richland Hills, Texas • 76182-0609  
7301 Northeast Loop 820 • 817-581-5521 • FAX 817-656-7538



**KNOWLTON-ENGLISH-FLOWERS, INC.**  
CONSULTING ENGINEERS / Fort Worth-Dallas

August 13, 1999

Mr. S. Frank Crumb, P.E.,  
Engineering Coordinator  
Engineering Services  
City of Fort Worth  
P.O. Box 870  
Fort Worth, Texas 76101-0870

Re: **3-436, CITY OF NORTH RICHLAND HILLS  
BIG FOSSIL RELIEF SEWER PLANNING  
RETURN OF FORT WORTH SEWER MASTER PLAN DOCUMENTS**

We are returning to you under separate cover Volumes 1, 2, and 3 of the Fort Worth Wastewater Collection System Master Plan, 2000-2020, documents which you loaned to us for use in data gathering associated with the referenced project. The documents were hand-delivered to Mr. Nowzar Dinyarian today.

We made Xerox copies of portions of these documents which were related to the Big Fossil sewer area. We would note that in our review of Volume II - Model Results, of the Master Plan documents, we could not find a printout of Hydroworks model results for the Tarrant County Water Supply Corporation line BF\_CM\_2, which is identified by nodes TCWSC/0000+20 through TCWSC-B/0012+35. We wish to thank Mr. Jim Baddaker, with Freese and Nichols, Inc., consultants for the Master Plan, who furnished us an Excel spreadsheet copy of the model results for line BF\_CM\_2 which was transmitted to our office by email. Attached is a printed copy of this spreadsheet for your files.

Thank you for the data you provided us and for your assistance with this project.

RICHARD W. ALBIN, P.E., Vice-President

RWA/ra/Fwdata.doc

Attachment

Cc: Mr. Steve Norwood, NRH Assistant City Manager  
Mr. Gregory W. Dickens, P.E., NRH Director of Public Works  
Mr. J.R. Baddaker, P.E., Freese and Nichols, Inc.  
Mr. Nowzar Dinyarian, Fort Worth Water Department

# CITY OF NORTH RICHLAND HILLS

Public Works

CERTIFIED MAIL #Z187017138

November 29, 1999

Texas Water Development Board  
P.O. Box 13231  
1700 N. Congress Avenue  
Austin, Texas 78711-3231  
(512) 463-3154

ROUTING  
JOB NO. 3-436  
FILING CORR.  
KEE \_\_\_\_\_ TEN \_\_\_\_\_  
BPF \_\_\_\_\_ GWF \_\_\_\_\_  
RWA [Signature] JVS \_\_\_\_\_  
DHC \_\_\_\_\_ JFP \_\_\_\_\_  
MER \_\_\_\_\_ RMW \_\_\_\_\_  
GRP \_\_\_\_\_ LDR \_\_\_\_\_  
SAG \_\_\_\_\_ JEH \_\_\_\_\_  
JCH \_\_\_\_\_ CLS \_\_\_\_\_

Attention: Ms. Phyllis Thomas, Research and Planning Fund  
Grants Management Division

RE: TWDB CONTRACT NO. 99-483-308; BIG FOSSIL CREEK  
REGIONAL WASTEWATER PLANNING GRANT

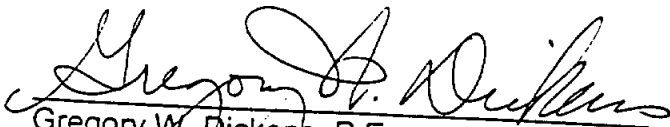
Ms. Thomas:

There have been some unique issues we have had to address in collecting the field data and verifying location of existing wastewater lines. This will cause the study completion to be delayed by one month.

The City would appreciate your consideration in extending the "Study Completion Date" from November 30, 1999 to December 31, 1999 and moving the "Final Report Deadline" from January 31, 2000 to February 29, 2000. These are items "K" and "L" on pages 1 and 2 of the contract. No other changes to the contract are requested.

Please send me the amendment to the contract for my execution in behalf of the City. If you have any questions, please contact me. I will await notice of your determination.

Respectfully,

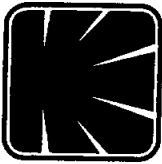
  
Gregory W. Dickens, P.E.  
Public Works Director

GWD/smm/pwl99404

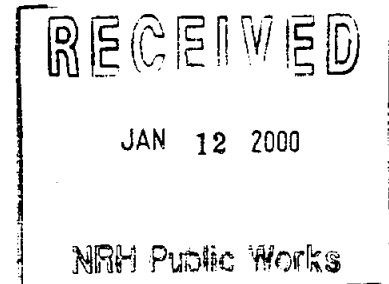
cc: Steve Norwood, Assistant City Manager  
Frank Crumb, City of Fort Worth  
Peter Fu, City of Fort Worth  
Greg Van Nieuvenhuize, City of Haltom City  
John Cherry, City of Richland Hills  
Richard Albin, Knowlton-English-Flowers, Inc.

P.O. Box 820609 • North Richland Hills, Texas • 76182-0609  
7301 Northeast Loop 820 • 817-581-5521 • FAX 817-656-7538

12-3-99



KNOWLTON-ENGLISH-FLOWERS, INC.  
CONSULTING ENGINEERS / Fort Worth-Dallas



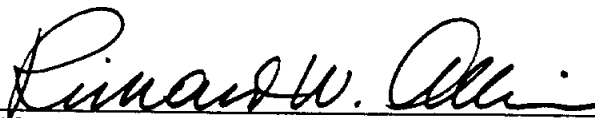
January 10, 2000-

✓  
Mr. Gregory W. Dickens, P.E.  
Public Works Director  
City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, Texas 76180

Re: **3-436, CITY OF NORTH RICHLAND HILLS,  
TWDB CONTRACT NO. 99-483-308, BIG FOSSIL CREEK  
REGIONAL WASTEWATER PLANNING GRANT,  
MINUTES OF PRELIMINARY REPORT PRESENTATION MEETING, 1/07/00**

Attached are minutes of the meeting conducted for the referenced project on January 7, 2000, during which the preliminary report was presented. A list of attendees and a summary of the topics discussed are included. Also enclosed is an exhibit, which will be added to the report, showing the location of the existing and proposed sewer lines. By copy of this letter, we are also transmitting these minutes to the other meeting attendees for their review.

The next meeting is currently scheduled for Friday, January 14, 2000, at 9:30 am, at the NRH City Hall. Please advise if anyone has a conflict with this proposed meeting date. In the meantime, please call if you have any questions or require any additional information concerning this study.

  
\_\_\_\_\_  
RICHARD W. ALBIN, P.E., Vice President

RWA/ra/Minutes 1/07/00.doc

CC: Mr. Kevin B. Miller, P.E., C.F.M., Assistant Director of Public Works/Utilities  
Mr. Frank Crumb, P.E., Fort Worth Engineering Services Coordinator  
Mr. Peter Fu, P.E., Fort Worth Wastewater Facilities Engineer  
Mr. Greg Van Nieuwenhuize, P.E., Haltom City Engineer  
Mr. John Cherry, P.E., Richland Hills Director of Public Works

Addresses and Phone Numbers of City Representatives:

Mr. Gregory W. Dickens, P.E.  
Public Works Director  
City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, Texas 76180  
(817) 427-6405, (817) 427-6404 Fax.

Mr. Kevin B. Miller, P.E., (817) 427-6406

Mr. S. Frank Crumb, P.E., Engineering Services Coordinator  
City of Fort Worth  
P.O. Box 870  
Fort Worth, Texas 76101-0870  
(817) 871-8243, (817) 871-8195 Fax.

Mr. Peter Fu, P.E., (817) 871-8438

Mr. Gregory Van Nieuwenhuize, P.E., City Engineer  
City of Haltom City  
P.O. Box 14246  
Haltom City, Texas 76117  
(817) 222-7750, (817) 834-7237 Fax.

Mr. John Cherry, P.E., Director of Public Works  
City of Richland Hills  
3200 Diana Drive  
Richland Hills, Texas 76118  
(817) 595-6629, (817) 595-6644 Fax.

Minutes of Big Fossil Sewer Study Status Report Meeting, Fri. 1/07/00, 10:00 am.

Attending:

| <u>INDIVIDUAL</u>           | <u>TITLE</u>           | <u>REPRESENTING</u> |
|-----------------------------|------------------------|---------------------|
| Richard Albin, P.E.         | Consultant             | KEF                 |
| Frank Crumb, P.E.           | Eng. Serv. Coordinator | Fort Worth          |
| Greg Van Nieuwenhuize, P.E. | City Engineer          | Haltom City         |
| Chuck Kendrick              | Public Works Director  | Haltom City         |
| Ty Hilton, P.E.             | Engineer               | TNP                 |
| John Cherry, P.E.           | P.W. Director          | Richland Hills      |

This meeting was conducted to present the results of the preliminary "Big Fossil Sewer Study" report prepared by KEF with assistance from staff members from the cities of Fort Worth, Haltom City, North Richland Hills and Richland Hills.

The three main "alternatives" were discussed including the various "options" associated with each alternative. The decision was made to change the order and numbering of the alternatives and include the options as sub-alternatives as follows:

- Option 1 -- Construct a single parallel relief line to serve all Cities
  - Option 1a -- All areas considered in the service area including Haltom City Little Fossil, BFX area, Marine Creek and Intel site.
  - Option 1b -- Same as Option 1a less the Marine Creek area
  - Option 1c -- Same as Option 1b less the Intel Site flow
  - Option 1d -- Same as Option 1c less the Haltom City Little Fossil area
- Option 2 -- Construct a single parallel relief line to serve all Cities except Richland Hills
  - Option 2a -- C.O.F.W. parallel line to serve only Fort Worth, Haltom City (with Little Fossil), and North Richland Hills, including BFX, Marine Creek and Intel site
  - Option 2b -- T.C.W.S.C. existing line with rehab serving Richland Hills only
- Option 3 -- Construct two parallel lines, one adjacent to existing C.O.F.W. line and another adjacent to existing T.C.W.S.C. line.
  - Option 3a -- C.O.F.W. parallel line to serve only Fort Worth and Haltom City (with Little Fossil), including BFX, Marine Creek and Intel site
  - Option 3b -- New parallel T.C.W.S.C. line constructed to serve both NRH and Richland Hills

Big Fossil Meeting Minutes, continued

The additional Haltom City Little Fossil Creek area included in the study, as requested by Peter Fu, was not shown correctly. It was based on the assumption that area LF000570 was the correct area, (see Watershed Area Map 2 of 4, TAB 2). The portion of the correct Little Fossil Creek area is south of the LF000570 area, according to Haltom City representatives. Haltom City will provide a map showing the exact limits of the actual Little Fossil area to be considered for including in the capacity calculations for the C.O.F.W. parallel line. Also, the exact location of the proposed Little Fossil line, which would be replaced by providing capacity in the proposed C.O.F.W. parallel line, will be shown on a map as provided by Haltom City. However, it was determined that the area in acres of the Little Fossil area shown in the study is about the same approximate size as the correct Little Fossil area, so the order of magnitude of the peak flows and cost estimate sharing splits is about the same. Haltom City representatives indicated that cost estimates for the proposed Little Fossil line should be based on a proposed 30-inch line which measures about 5,000 feet in length. We assumed a 5,200 foot length in the preliminary report.

It was agreed that an additional exhibit should be included in the report which shows on one sheet the full length of the existing Big Fossil and T.C.W.S.C. lines from the Fort Worth 96-inch outfall to Broadway Blvd, (which represents the limits of the lines studied in this report). This exhibit will be added to TAB 1 and will also show the approximate location of the proposed C.O.F.W. parallel outfall sewer.

All representatives at the meeting were in general agreement, in principle, with the cost sharing methodology used in the report, which is based on the relative magnitude of approximate peak flows computed from equivalent population and sewer area projections for each participating city included in the City of Fort Worth Sanitary Sewer System Master Plan Report. However, the Richland Hills representative, John Cherry, indicated that participation from Richland Hills should be based only on the portion of the proposed parallel outfall line south of the Richland Hills meter. The cost estimate splits for Richland Hills will be modified to reflect their share of the C.O.F.W. outfall line which would extend from the 96-inch outfall northward to just south of S.H. 121. This modification would also increase the share of estimated costs for the other city participants proportionately. John Cherry also mentioned that the rehab costs for the existing T.C.W.S.C. line would be about \$700,000, which is close to the estimated rehab costs assumed in the study, (see Tables in TAB 7 for Option 5b which show estimated RH costs). Also, see attached letter from John Cherry dated January 6, 2000.

Haltom City representative, Greg Van Nieuwenhuize, was also in general agreement with the cost split methodology presented in the report, assuming that all cities are required by contract to participate in the proposed Big Fossil outfall sewer. However, Greg expressed his view that the issue remains unresolved regarding whether or not Fort Worth should be required by contract to upgrade the Big Fossil line at City of Fort Worth's expense alone, since the C.O.F.W. line may be considered by Haltom City to be a "system" line. Fort Worth would then be "fronting" the improvement costs, and based on this scenario, customer cities would then later pay for their fair share of the improvements through rate increases, if appropriate.



Big Fossil Meeting Minutes, continued

Frank Crumb took the position that it is reasonable and fair for the cities of Haltom City, North Richland Hills and Richland Hills to contribute their fair-share of the engineering and construction costs of the proposed improvements to the system line which serves all of these cities, since Fort Worth will be required to upsize and/or parallel the remaining portion of the Big Fossil ourfall system lines north of Broadway Blvd. at its own considerable expense.

Most of the meeting representatives also agreed that it might be premature, at this time, to send the report to the Texas Water Development Board until the participating cities have had more time to consider the report and come to an agreement on what manner of cost participation is acceptable for each party. However, John Cherry expressed that he was comfortable with sending the preliminary report to the T.W.D.B. just as it is, along with his letter. It was further recommended by the meeting participants that Greg Dickens should contact the T.W.D.B. representative as soon as possible to determine if the preliminary report should be submitted anyway, without full consensus of all participating cities at this time, since the T.W.D.B. is funding half of the report costs.

If there are any additions or corrections to these minutes which need to be made prior to the proposed meeting on Friday, January 14, 2000, at 9:30 am, then please advise.



KNOWLTON-ENGLISH-FLOWERS, INC.  
CONSULTING ENGINEERS / Fort Worth-Dallas

March 12, 2000

Mr. Gregory W. Dickens, P.E.,  
Director of Public Works  
City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, Texas 76180

Re: **3-436, CITY OF NORTH RICHLAND HILLS  
BIG FOSSIL SEWER STUDY REPORT  
REGIONAL FACILITY PLANNING CONTRACT BETWEEN THE  
CITY OF NRH AND THE TWDB, CONTRACT NO. 99-483-308  
REPORT REVISIONS**

We have received review comments for the referenced project by letter from the Texas Water Development Board, dated February 28, 2000, which we received by FAX from your office dated March 10, 2000. A copy of the transmittal letter and review comments is attached, (See Section "1").

The two main comments made by the TWDB concerned (a) justification of population projections, and (b) an evaluation matrix to determine the optimum route of the proposed parallel sanitary sewer. Both of those issues are addressed herein, (See Section "2").

An additional comment by the TWDB concerns "the level of agreement of participants regarding proposed cost participation". We understand that you will address this issue separately since you have been in contact with the participants concerning the recommendations in the Report.

After further review and approval by the TWDB, we will incorporate the revisions in the Final Report. In the meantime, please call if you have any questions.

  
\_\_\_\_\_  
RICHARD W. ALBIN, P.E., Vice President

RWA/ra/Review1.doc

**SECTION 1**

***REVIEW COMMENTS BY TWDB***

City of North Richland Hills  
7301 N.E. Loop 820  
North Richland Hills, Texas 76180  
(817) 427-6400; Fax (817) 427-6404

**Public Works  
Administration**

# Fax

**To:** Richard Albin **From:** Greg Dickens, Public Works Director

---

**Fax:** 354-4389 **Pages:** 4 (including cover sheet)

---

**Phone:** **Date:** 03/10/00

---

**Re:** TWDB **CC:**

---

**Urgent**     **For Review**     **Please Comment**     **Please Reply**     **Please Recycle**

---

● **Comments:**

Please call me when you receive this.

Thanks.  
Greg



**TEXAS WATER DEVELOPMENT BOARD**

William B. Madden, *Chairman*  
 Elaine M. Barrón, M.D., *Member*  
 Charles L. Geren, *Member*

Craig D. Pedersen  
*Executive Administrator*

Noé Fernández, *Vice-Chairman*  
 Jack Hunt, *Member*  
 Wales H. Madden, Jr., *Member*

February 28, 2000

Mr. Gregory W. Dickens, P.E.  
 Public Works Director  
 City of North Richland Hills  
 7301 N.E. Loop 820  
 North Richland Hills, Texas 76180

Re: Regional Facility Planning Contract Between the City of North Richland Hills (City) and the Texas Water Development Board (Board), TWDB Contract No. 99-483-308

Dear Mr. Dickens:

Staff members of the Texas Water Development Board have completed a review of the draft report under TWDB Contract No. 99-483-308 and offer comments shown in Attachment 1.

However, Item 5 in Attachment 1 was not included or addressed in the Draft Final Report and as submitted does not meet contractual requirements. Therefore, please submit this section for review prior to delivery of the Final Report.

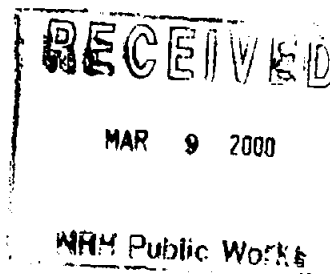
After review comments have been transmitted to the City regarding the above referenced item, the City will consider incorporating all comments from the EXECUTIVE ADMINISTRATOR and other commentors on the draft final report into the Final Report.

Please contact Mr. Ralph Boeker, the Board's designated Contract Manager, at (512) 936-0851, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles, Ph.D., P.E.  
 Deputy Executive Administrator  
 Office of Planning

cc: Ralph Boeker, TWDB



*Our Mission*

*Provide leadership, technical services and financial assistance to support planning, conservation, and responsible development of water for Texas.*

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 URL Address: <http://www.twdb.state.tx.us> • E-Mail Address: [info@twdb.state.tx.us](mailto:info@twdb.state.tx.us)

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**ATTACHMENT 1**

**TEXAS WATER DEVELOPMENT BOARD**  
**Review Comments: "Big Fossil Creek Relief Sewer Planning Report"**  
**Contract No. 99-483-308**

1. The engineering report includes a table titled Big Fossil Sewer Study, Table No. 1 TWDB-1. That table contains out-of-date information from an older version of the TWDB web site. Note the date printed on bottom left corner of the page "12/31/1999". The new 2002 State Water Plan planning data for Region C is posted on TWDB web site as of 2/4/2000.
2. Attachment 2 shows a comparison of growth in the selected cities within the drainage area of the study. The only comparison made is of growth rates since entire cities (total populations) are not contained within the drainage area; however, growth rates in the drainage area may not reflect growth rates for these cities on the whole.
3. According to the report, the cities involved (in the basin) other than Fort Worth has a total population increase of less than 20,000 during the study period. Fort Worth has a total increase in excess of 36,000 (203%) for that part of the City in the drainage area. The TWDB projected growth for all of Fort Worth during the same period is 14%. Perhaps a double check of that particular area of the City could verify the much higher population growth in the Big Fossil drainage area. The report should include additional information supporting this growth rate.
4. Generally, the report's presentation of the projections is acceptable.
5. Task 8 in the Scope of Work has not been addressed. Please show how the objectives of Task 8 were met: "Develop evaluation matrix to select the optimum route for the proposed relief sanitary sewer."
6. Please provide a status of the level of agreement of proposed participants regarding cost participation.

**ATTACHMENT 2**

Comparison of projected growth in selected cities between 2005 and 2025. From 2002 SWP and Chapter 5, Table 2.  
Big Fossil Study

**COMPARISON OF STUDY POPULATION WITH MOST RECENT PROJECTIONS FOR THE 2002 WATER PLAN, PREPARED BY REGION C PLANNING GROUP**

| City           | 1990    | 2000    | 2005    | p2005  | 2010    | 2020    | 2025    | p2025  | 2002 SWP % increase | Big Fossil Study % increase |
|----------------|---------|---------|---------|--------|---------|---------|---------|--------|---------------------|-----------------------------|
| HASLET         | 795     | 1,260   | 1,352   | 3,092  | 1,443   | 1,899   | 2,113   | 9,203  | 56.34%              | 197.64%                     |
| HALTOM CITY    | 32,856  | 38,845  | 40,275  | 17,848 | 41,704  | 43,272  | 43,628  | 19,990 | 8.33%               | 12.00%                      |
| WATAUGA        | 20,009  | 22,233  | 23,254  | 20,372 | 24,274  | 26,157  | 27,063  | 27,090 | 16.38%              | 32.98%                      |
| NORTH RICHLAND | 45,895  | 55,864  | 61,624  | 11,580 | 67,363  | 81,200  | 85,804  | 14,054 | 39.24%              | 21.36%                      |
| RICHLAND HILLS | 7,978   | 8,886   | 9,633   | 9,244  | 10,379  | 12,109  | 12,864  | 9,806  | 33.54%              | 6.08%                       |
| SAGINAW        | 8,551   | 12,172  | 13,047  | 4,639  | 13,922  | 15,878  | 16,481  | 5,888  | 26.32%              | 26.92%                      |
| FORT WORTH     | 447,619 | 496,622 | 514,670 | 17,990 | 532,717 | 580,375 | 588,244 | 54,592 | 14.30%              | 203.46%                     |

p2005 and p2025 population projections provided by consultant. 2005 and 2025 population projections are interpolations of the 2002 State Water Plan.

Percentage increase for projections are compared in columns "% incr" and "p%incr"

**SECTION 2**  
**REPLY TO REVIEW COMMENTS**  
**AND REPORT REVISIONS**



## **REPLY TO TWDB REVIEW COMMENTS**

1. *The engineering report includes a table titled Big Fossil Sewer Study, Table No. 1, TWDB-1. That table contains out-of-date information from an older version of the TWDB web site. Note the date printed on bottom left corner of the page "12/31/1999". The new 2002 State Water planning data for Region C is posted on TWDB web site as of 2/4/2000.*

Table No. 1, TWDB-1, has been updated based on the new population and water demand data provided at the TWDB web site, (See attached Exhibit "A"). The population projections in this table have not been adopted by the participating cities, as far as we know, but are used as a comparison of the growth projection rates included in this report.

2. *Attachment 2 shows a comparison of growth in the selected cities within the drainage area of the study. The only comparison made is of growth rates since entire cities (total populations) are not contained within the drainage area; however, growth rates in the drainage area may not reflect growth rates for these cities on the whole.*

Exhibit "B" is attached which includes a copy of the population projection data provided by the TWDB in Attachment 2. The population projections for years p2005 and p2025 reflect that actual population values used in the Report discharge calculations. The population projections shown in Table 2, "Population and Employment Summaries of cities in the Big Fossil Study", under TAB 5, have been corrected to show the actual populations used in the study, (See Exhibit "F"). Exhibit "C" is a summary table which shows the actual population projections used in this study from the Fort Worth Land Use databases for the years 1990 through 2070. Exhibit "D" shows the employment values used, and Exhibit "E" shows the "equivalent" population values used.

We would note that the population values used in the discharge calculations are based on the "Equivalent Populations" which are equal to the Population Values plus one-half the Employment Values. These Equivalent Population values are the same values used in the approved City of Fort Worth Sanitary Sewer Master Plan. (See further discussion of population projections below).

3. *According to the report, the cities involved (in the basis) other than Fort Worth, has a total population increase of less than 20,000 during the study period. fort Worth has a total increase in excess of 36,000 (203%) for that part of the City in the drainage area. The TWDB projected growth for all of Fort Worth during the same period is 14%. Perhaps a double check of that particular area of the City could verify the much higher population growth in the Big Fossil drainage area. The report should include additional information supporting this growth rate.*

As noted in item 2 above, the population values shown in Table 2, TAB 5, were not correct. They were based on preliminary population projection calculations using North Central Texas Council of Governments forecast district data which do not reflect the final actual population data used in the study. It was determined that the best and most reliable source of population projection data within the Big Fossil Creek service area, for purposes of this study, was the City of Fort Worth Sanitary Sewer Master Plan Data which was prepared by their Land Use Planning consultants and approved by the City of Fort Worth as part of their Land Use Assumptions Plan. This data was determined to be better suited to this study because it is broken down into small sub-areas as shown under TAB 2, Sheets 1, 2, and 3 of 4. (The NCTCOG Forecast District areas proved to be too large for this particular study for the level of precision required).

The population projection database, which also shows these individual watershed basin sub-areas, was furnished to us by the City of Fort Worth Water Department for use in this study. This population database is broken into two separate tables of the Report under TAB 5 listed as Table "LUAPOP-1" and Table "LUAPOP-2". Those tables are reproduced herein under Exhibits "G" and "H" respectively. Summary line items are added in these tables which show the population projection totals for each of the selected cities included in the study based on the sub-area basin totals.

The following is a brief discussion of the population projections for each city included in Exhibit "B" in the order listed:

#### Haslet (Not a Participating City)

Copies of the Sub-basin Area maps are enclosed for reference under Exhibit "I". The portion of the Haslet area in the Big Fossil service area is colored in yellow on Sheet 3 of 4. This exhibit shows the basis for the Haslet population projections within the Big Fossil Service area. Also, please refer to Exhibit "B" which presents the TWDB population projections and the correct year p2005 and p2025 projections for populations within the Big Fossil Service area.

Note that the total city land area of Haslet is 3,205 acres, but only 453 acres of the city are included in the Big Fossil service area. Based on the TWDB projections, the total city population is expected to grow from 1,352 people in 2005 to 2,113 people in 2025, which is a 56.29% increase of 761 people. However, the Big Fossil service area population increase is expected to be from 258 people to 583 people, which is a 125.97% increase of 325 people, based on the Fort Worth Land Use Assumptions plan forecast for sub-basin area no. BFX10-07. This is a reasonable assumption, in our opinion, since the south portion of Haslet is expected to grow faster than the north part of the city due to the availability of sanitary sewer service lines to that portion of the city and the close proximity of a major roadway arterial, U.S. Highway 81.

We would note that since Haslet is not a participating city in this study, and since the City of Fort Worth provides service to this city, the population for Haslet is included with the City of Fort Worth in the cost participation portion of the study. This also applies to the cities of Watauga and Saginaw, which are not participating cities. Their populations are added in with Fort Worth for purposes of calculating Fort Worth's portion of the cost participation.

#### Haltom City (Participating City)

The TWDB projected growth of the whole city from 2005 to 2025 is 3,353 people, or 8.33%. The projected growth in the Big Fossil watershed area based on the City of Fort Worth Land Use Assumptions database, which is used in this report, is 2,120 people, or 16.12%. The Haltom City area included in the Big Fossil watershed is shaded purple and shown on Sheet No. 2 of 4 in Exhibit "I". It is reasonable to project a higher growth rate in the Big Fossil area because most of the future growth will be in the north part of the City, or the Big Fossil watershed area, since the southern part of the city, which lies outside the Big Fossil watershed area, is already more fully developed as the street map indicates.

#### Watauga (Not a Participating City)

The TWDB projected growth of Watauga from 2005 to 2025 is 3,809 people, or 16.38%. The projected growth used in the report is 3,343, or 16.24%, which agrees favorably with the TWDB projection rate. Although the projected population totals differ in the year 2025, the protected totals for the year 2050 are in close agreement of about 29,000 people. The Watauga area is shaded blue on Sheet No. 3 of 4 in Exhibit "I".

#### North Richland Hills (Participating City)

The TWDB projected growth of the whole city from 2005 to 2025 is 24,180 people, or 39.24%. The projected growth in the Big Fossil Watershed area based on the City of Fort Worth Land Use Assumptions database, which is used in this report, is only 2,078 people, or 14.03%. The NRH City area included in the Big Fossil watershed is shaded brown and shown on Sheet No. 2 of 4 in Exhibit "I". This situation is reversed from Haltom City. It is reasonable to project a much lower growth rate in the Big Fossil area because most of the future growth in NRH will be in the north part of the City, which is outside the Big Fossil watershed area. Most of the southern part of the city, which lies within the Big Fossil watershed area, is already almost completely developed.

### Richland Hills (Participating City)

This situation is very similar to NRH. The TWDB projected growth of the whole city of Richland Hills from 2005 to 2025 is 3,231 people, or 33.54%. The projected growth in the Big Fossil Watershed area based on the City of Fort Worth Land Use Assumptions database, which is used in this report, is only 848 people, or 12.30%. The Richland Hills City area included in the Big Fossil watershed is shaded green and shown on Sheet No. 2 of 4 in Exhibit "I". This situation is also reversed from Haltom City. It is reasonable to project a much lower growth rate in the Big Fossil area because most of the future growth in Richland Hills will be in the east part of the City, which is outside the Big Fossil watershed area. Most of the western part of the city, which lies within the Big Fossil watershed area, is already almost completely developed.

### Saginaw (Not a Participating City)

The projected growth in Saginaw is similar to Haslet, in that most of the anticipated growth is in the northeast part of the City where service lines are available for extension. Based on the TWDB projections, the growth from 2005 to 2025 for the whole city is expected to be 3,434 people, or 26.32%. The Fort Worth Land Use Assumptions projected growth in the Big Fossil area of the city is expected to be 930 people, or an increase of 133.81% since that area is expected to jump from 695 people in 2005 to 1,625 people by 2025. The Big Fossil area of Saginaw is shaded orange on Sheet 3 of 4 in Exhibit "I".

### Fort Worth (Participating City)

Projected TWDB population growth for the whole city of Fort Worth from 2005 to 2025 is 73,574 people or 14.30%. The projected growth in the Big Fossil service area (which includes a portion of Marine Creek) during this period is 14,436 people or 59.40%, based on the Fort Worth Land Use Assumptions Plan database used in this report. Most of the northwesterly portion of the Big Fossil Watershed and the Marine Creek areas are sparsely developed currently, and it is reasonable to assume that the growth rate in this area will be higher than the overall growth rate of the city as a whole.

Based on the population projections used in this report as discussed above, the following table lists the population percentage of each participating city in the year 2025, (not including employment population), with the Fort Worth population including customer cities Haslet, Watauga, and Saginaw (\*), and Haltom City not including the Little Fossil area:

|                      |               |               |
|----------------------|---------------|---------------|
| Haltom City          | 15,271        | 14.57%        |
| North Richland Hills | 16,887        | 16.12%        |
| Richland Hills       | 7,745         | 7.39%         |
| Fort Worth (*)       | <u>64,883</u> | <u>61.92%</u> |
| TOTALS               | 104,786       | 100.00%       |

5. *Task 8 in the Scope of Work has not been addressed. Please show how the objectives of Task 8 were met: "Develop evaluation matrix to select the optimum route for the proposed relief sanitary sewer."*

Revised Plan Sheets 1, 2, 3, 4, and 5 of 5 are included herewith under Exhibit "J". These sheets show 3 possible routes for the proposed relief sanitary sewer labeled Alternates 1, 2 and 3. Alternate 1 follows closely the route of the existing Big Fossil Outfall sanitary sewer and was presented in the preliminary report. Alternate 2 also follows the existing Big Fossil outfall route except for the section between the C.R. & G. Railroad (see sheet no. 2) and the TESCO R.O.W. (see sheet no. 4). The third alternate follows closely the alignment of the existing T.C.W.S.C. line. The following is a discussion of the features of each alternate which will be used to develop a matrix required to identify the optimum route.

#### Capital Cost

The following is an estimate of project cost based on an estimate of \$1,134 per linear foot for Option 1a for the 2070 design year:

1. Alternate 2 - 12,227 linear feet x \$1,134/ft. = \$13.87 million
2. Alternate 3 - 13,302 linear feet x \$1,134/ft. = \$15.08 million
3. Alternate 1 - 13,382 linear feet x \$1,134/ft. = \$15.18 million

#### Additional Easements Required

The following is a ranking of each alternative based on the estimated total number of easements required:

1. Alternate 1 - 18 Easements
2. Alternate 2 - 18 Easements
3. Alternate 3 - 28 Easements

#### Construction Impact on Participating Communities

Construction and Community impacts are combined into this single category. This criteria will be based on close proximity to existing homes or businesses which is a measure of the effect dust and noise pollution on each community during construction, and nuisance effects after construction. Ranking is determined based on total number of homes or businesses in close proximity to each alternate route:

1. Alternate 2 - 10 buildings
2. Alternate 1 - 15 buildings
3. Alternate 3 - 54 buildings

Design Considerations (Creek and Road Crossing, Topography)

This criteria will be ranked based on the total number of Creek and Road crossings for each alternative:

1. Alternate 2 - 8 crossings
2. Alternate 1 - 8 crossings
3. Alternate 3 - 13 crossings

Sanitary Sewer Maintenance Requirements

This criteria is generally a function of the total number of manholes or bends on each alternate line which will require periodic cleaning and maintenance. The following ranking is based on total number of bends and/or manholes on each line:

1. Alternate 2 - 25 manholes and/or bends
2. Alternate 1 - 30 manholes and/or bends
3. Alternate 3 - 33 manholes and/or bends

The following is a Ranking Matrix Based on the Criteria Listed above:

|                                | <u>Alt. 1</u> | <u>Alt 2</u> | <u>Alt. 3</u> |
|--------------------------------|---------------|--------------|---------------|
| Capital Cost                   | 3             | 1            | 2             |
| Additional Easements Req'd     | 1             | 1            | 2             |
| Construction/Community Impacts | 2             | 1            | 3             |
| Design Considerations          | 1             | 1            | 2             |
| Maintenance Requirements       | <u>2</u>      | <u>1</u>     | <u>3</u>      |
| TOTALS                         | 9             | 5            | 12            |

Based on the above ranking matrix, the optimum alignment is Alternate No. 2, which is the route recommended by the City of Fort Worth Water Department.

| EXHIBIT "A"  |                 |           |         |        |           |           |         |           |         |           |         |         |       |         |
|--|-----------------|-----------|---------|--------|-----------|-----------|---------|-----------|---------|-----------|---------|---------|-------|---------|
| Big Fossil Sewer Study, Table No. TWDB-1                           |                 |           |         |        |           |           |         |           |         |           |         |         |       |         |
| TEXAS WATER DEVELOPMENT BOARD POPULATION AND WATER USE PROJECTIONS |                 |           |         |        |           |           |         |           |         |           |         |         |       |         |
| CITY   | TOTAL LAND AREA | YEAR 1990 |         |        | YEAR 2000 |           |         | YEAR 2010 |         |           | POP.    | POP/AC. | GPCD  | POP/AC. |
|  |                 | POP.      | AC-FT   | GPCD   | POP/AC.   | POP.      | AC-FT   | GPCD      | POP/AC. | POP.      |         |         |       |         |
| Fort Worth   | 183,796         | 447,619   | 105,420 | 210.24 | 2.44      | 496,622   | 127,946 | 229.98    | 2.70    | 532,717   | 134,262 | 224.98  | 2.90  |         |
| North Richland Hills   | 11,675          | 45,895    | 6,331   | 123.14 | 3.93      | 55,884    | 9,640   | 153.99    | 4.79    | 67,363    | 11,394  | 150.99  | 5.77  |         |
| Haltom City  | 7,935           | 32,856    | 4,575   | 124.30 | 4.14      | 38,845    | 6,309   | 144.98    | 4.90    | 41,704    | 6,633   | 141.98  | 5.26  |         |
| Richland Hills   | 2,007           | 7,978     | 1,301   | 145.57 | 3.98      | 8,886     | 1,334   | 134.01    | 4.43    | 10,379    | 1,523   | 130.99  | 5.17  |         |
| Watauga  | 2,600           | 20,009    | 2,761   | 123.18 | 7.70      | 22,233    | 3,835   | 153.98    | 8.55    | 24,274    | 4,106   | 151.00  | 9.34  |         |
| Haslet   | 3,205           | 795       | 108     | 121.27 | 0.25      | 1,260     | 229     | 162.24    | 0.39    | 1,443     | 267     | 165.17  | 0.45  |         |
| Saginaw  | 4,778           | 8,551     | 1,238   | 129.24 | 1.79      | 12,172    | 2,059   | 151.00    | 2.55    | 13,922    | 2,495   | 159.98  | 2.91  |         |
| Tarrant County   | 574,450         | 1,170,247 | 226,690 | 172.92 | 2.04      | 1,415,759 | 308,195 | 194.33    | 2.46    | 1,594,218 | 341,530 | 191.24  | 2.78  |         |
| CITY   | TOTAL LAND AREA | YEAR 2020 |         |        | YEAR 2030 |           |         | YEAR 2040 |         |           | POP.    | POP/AC. | GPCD  | POP/AC. |
|  |                 | POP.      | AC-FT   | GPCD   | POP/AC.   | POP.      | AC-FT   | GPCD      | POP/AC. | POP.      |         |         |       |         |
| Fort Worth   | 183,796         | 580,375   | 143,673 | 220.99 | 3.16      | 596,112   | 144,230 | 215.99    | 3.24    | 632,480   | 150,195 | 211.99  | 3.44  |         |
| North Richland Hills   | 11,675          | 81,200    | 13,461  | 147.99 | 6.96      | 90,408    | 14,684  | 144.99    | 7.74    | 100,661   | 16,011  | 141.99  | 8.62  |         |
| Haltom City  | 7,935           | 43,272    | 6,737   | 138.98 | 5.45      | 43,983    | 6,700   | 135.98    | 5.54    | 44,197    | 6,584   | 132.98  | 5.57  |         |
| Richland Hills   | 2,007           | 12,109    | 1,750   | 129.01 | 6.03      | 13,618    | 1,922   | 125.99    | 6.79    | 16,497    | 2,273   | 123.00  | 8.22  |         |
| Watauga  | 2,600           | 26,157    | 4,336   | 147.98 | 10.06     | 27,969    | 4,543   | 145.00    | 10.76   | 29,906    | 4,757   | 141.99  | 11.50 |         |
| Haslet   | 3,205           | 1,899     | 372     | 174.87 | 0.59      | 2,327     | 456     | 174.93    | 0.73    | 2,587     | 478     | 164.94  | 0.81  |         |
| Saginaw  | 4,778           | 15,878    | 2,970   | 166.98 | 3.32      | 17,084    | 3,062   | 160.00    | 3.58    | 18,915    | 3,284   | 154.99  | 3.96  |         |
| Tarrant County   | 574,450         | 1,798,894 | 377,333 | 187.25 | 3.13      | 1,915,375 | 391,338 | 182.39    | 3.33    | 2,111,193 | 416,854 | 176.26  | 3.68  |         |
| CITY   | TOTAL LAND AREA | YEAR 2050 |         |        | POP/AC.   |           |         |           |         |           |         |         |       |         |
|  |                 | POP.      | AC-FT   | GPCD   |           |           |         |           |         |           |         |         |       |         |
| Fort Worth   | 183,796         | 671,067   | 155,600 | 206.99 | 3.65      |           |         |           |         |           |         |         |       |         |
| North Richland Hills   | 11,675          | 112,232   | 17,475  | 138.99 | 9.61      |           |         |           |         |           |         |         |       |         |
| Haltom City  | 7,935           | 44,412    | 6,517   | 130.99 | 5.60      |           |         |           |         |           |         |         |       |         |
| Richland Hills   | 2,007           | 19,985    | 2,709   | 121.00 | 9.96      |           |         |           |         |           |         |         |       |         |
| Watauga  | 2,600           | 29,906    | 4,656   | 138.98 | 11.50     |           |         |           |         |           |         |         |       |         |
| Haslet   | 3,205           | 2,808     | 503     | 159.91 | 0.88      |           |         |           |         |           |         |         |       |         |
| Saginaw  | 4,778           | 20,942    | 3,519   | 150.00 | 4.38      |           |         |           |         |           |         |         |       |         |
| Tarrant County   | 574,450         | 2,205,610 | 430,303 | 174.16 | 3.84      |           |         |           |         |           |         |         |       |         |

Notes:

Population Projections Web Site:  
<http://www.twdb.state.tx.us/popwuse/PopulationC.htm>

Water Use Web Site:  
<http://www.twdb.state.tx.us/popwuse/MunicipalC.htm>

GPCD = AC-FT x 43,560 c.f./acre-ft x 7.48 gal/c.f. / 365 days/year / Population

**EXHIBIT "B"**  
**COMPARISON OF PROJECTED GROWTH IN SELECTED CITIES BETWEEN 2005 AND 2025**  
**FROM 2002 SWP AND CHAPTER 5, TABLE 2 (CORRECTED), BIG FOSSIL SEWER STUDY**

| CITY              | 1990    | 2000    | 2005    | P2005  | 2010    | 2020    | 2025    | P2025   | 2002 SWP<br>% INCREASE | BIG FOSSIL STUDY<br>% INCREASE |
|-------------------|---------|---------|---------|--------|---------|---------|---------|---------|------------------------|--------------------------------|
| HASLET            | 795     | 1,260   | 1,352   | 258    | 1,443   | 1,899   | 2,113   | 583     | 56.29%                 | 125.97%                        |
| HALTOM CITY       | 32,856  | 38,845  | 40,275  | 13,151 | 41,704  | 43,272  | 43,628  | 15,271  | 8.33%                  | 16.12%                         |
| WATAUGA           | 20,009  | 22,233  | 23,254  | 20,591 | 24,274  | 26,157  | 27,063  | 23,934  | 16.38%                 | 16.24%                         |
| N. RICHLAND HILLS | 45,895  | 55,884  | 61,624  | 14,809 | 67,363  | 81,200  | 85,804  | 16,887  | 39.24%                 | 14.03%                         |
| RICHLAND HILLS    | 7,978   | 8,886   | 9,633   | 6,897  | 10,379  | 12,109  | 12,864  | 7,745   | 33.54%                 | 12.30%                         |
| SAGINAW           | 8,551   | 12,172  | 13,047  | 695    | 13,922  | 15,878  | 16,481  | 1,625   | 26.32%                 | 133.81%                        |
| FORT WORTH        | 447,619 | 496,622 | 514,670 | 24,305 | 532,717 | 580,375 | 588,244 | 38,741  | 14.30%                 | 59.40%                         |
| TOTALS            | 563,703 | 635,902 | 663,855 | 80,706 | 691,802 | 760,890 | 776,197 | 104,786 | 16.92%                 | 29.84%                         |

NOTES: P2005 AND P2025 POPULATION PROJECTIONS INCLUDE ONLY BIG FOSSIL WATERSHED AREAS  
 SEE EXHIBIT "C" FOR SUMMARY OF POPULATION PROJECTIONS FOR YEARS 1990 THROUGH 2070  
 PERCENT INCREASES BASED ON COMPARISON OF YEARS 2005 AND 2025



**EXHIBIT "C"  
 "POPULATION" PROJECTIONS USED IN THE BIG FOSSIL SEWER STUDY BASED ON  
 DATA FROM THE CITY OF FORT WORTH SANITARY SEWER MASTER PLAN REPORT**

| CITY              | TOTAL CITY AREA (AC.) | TOTAL BIG FOS. SERV. AR. (AC.) | TAB. LUAIPOP-1 PAGE 8 OF 12 |               |               |               | TAB. LUAIPOP-1 PAGE 12 OF 12 |               |               | INTERP.        | TAB. LUAIPOP-2 PAGE 10 OF 20 |                |
|-------------------|-----------------------|--------------------------------|-----------------------------|---------------|---------------|---------------|------------------------------|---------------|---------------|----------------|------------------------------|----------------|
|                   |                       |                                | 1990                        | 1995          | 2000          | 2005          | 2010                         | 2015          | 2020          |                | 2025                         | 2050           |
| Haslet            | 3,205                 | 453                            | 66                          | 130           | 194           | 258           | 322                          | 416           | 509           | 583            | 952                          | 1,247          |
| Haltom City       | 7,935                 | 3,227                          | 11,650                      | 12,151        | 12,651        | 13,151        | 13,651                       | 14,203        | 14,754        | 15,271         | 17,858                       | 19,928         |
| Watauga           | 2,600                 | 2,600                          | 17,955                      | 18,834        | 19,712        | 20,591        | 21,469                       | 22,275        | 23,080        | 23,934         | 28,205                       | 31,622         |
| N. Richland Hills | 11,675                | 2,465                          | 12,652                      | 13,371        | 14,091        | 14,809        | 15,528                       | 15,906        | 16,282        | 16,887         | 19,912                       | 22,332         |
| Richland Hills    | 2,007                 | 1,365                          | 5,797                       | 6,164         | 6,530         | 6,897         | 7,264                        | 7,365         | 7,467         | 7,745          | 9,137                        | 10,250         |
| Saginaw           | 4,778                 | 763                            | 35                          | 255           | 475           | 695           | 915                          | 1,157         | 1,398         | 1,625          | 2,761                        | 3,670          |
| Fort Worth        | 183,796               | 48,363                         | 16,459                      | 19,074        | 21,690        | 24,305        | 26,921                       | 31,239        | 35,558        | 38,741         | 54,657                       | 67,389         |
| <b>TOTALS</b>     | <b>215,996</b>        | <b>59,236</b>                  | <b>64,614</b>               | <b>69,979</b> | <b>75,343</b> | <b>80,706</b> | <b>86,070</b>                | <b>92,561</b> | <b>99,048</b> | <b>104,787</b> | <b>133,482</b>               | <b>156,438</b> |

**NOTES:** Big Fossil Service Area Includes Marine Creek Watershed Area, but not Little Fossil Creek Watershed Area  
 Source of Data: City of Fort Worth Database Tables "LUAIPOP-1" and "LUAIPOP-2"  
 Population Estimates for Year 2025 Interpolated between Years 2020 and 2050

**EXHIBIT "D"**  
**"EMPLOYMENT" PROJECTIONS USED IN THE BIG FOSSIL SEWER STUDY BASED ON**  
**DATA FROM THE CITY OF FORT WORTH SANITARY SEWER MASTER PLAN REPORT**

| CITY              | TOTAL CITY AREA (AC.) | TOTAL BIG FOS. SERV. AR. (AC.) | TAB. LUAPOP-1<br>PAGE 4 OF 12 |               |               |               |               |               |               |               |               |               | TAB. LUAPOP-2<br>PAGE 10 OF 20 |  |
|-------------------|-----------------------|--------------------------------|-------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------------------------|--|
|                   |                       |                                | 1990                          | 1995          | 2000          | 2005          | 2010          | 2015          | 2020          | INTERP.       |               | 2050          | 2070                           |  |
|                   |                       |                                |                               |               |               |               |               |               |               | 2025          | 2050          |               |                                |  |
| Haslet            | 3,205                 | 453                            | 27                            | 47            | 68            | 88            | 108           | 152           | 195           | 223           | 223           | 363           | 475                            |  |
| Haltom City       | 7,935                 | 3,227                          | 1,136                         | 1,870         | 2,605         | 3,339         | 4,074         | 5,035         | 5,995         | 6,805         | 6,805         | 10,855        | 14,095                         |  |
| Watauga           | 2,600                 | 2,600                          | 1,615                         | 1,730         | 1,844         | 1,958         | 2,072         | 2,225         | 2,377         | 2,504         | 2,504         | 3,139         | 3,647                          |  |
| N. Richland Hills | 11,675                | 2,465                          | 3,226                         | 3,565         | 3,904         | 4,244         | 4,583         | 4,963         | 5,343         | 5,696         | 5,696         | 7,461         | 8,873                          |  |
| Richland Hills    | 2,007                 | 1,365                          | 2,256                         | 2,508         | 2,760         | 3,011         | 3,263         | 3,539         | 3,815         | 4,075         | 4,075         | 5,374         | 6,414                          |  |
| Saginaw           | 4,778                 | 763                            | 113                           | 141           | 169           | 196           | 224           | 310           | 396           | 443           | 443           | 679           | 868                            |  |
| Fort Worth        | 183,796               | 48,363                         | 4,135                         | 5,162         | 6,189         | 7,216         | 8,243         | 13,577        | 18,911        | 21,374        | 21,374        | 33,687        | 43,538                         |  |
| <b>TOTALS</b>     | <b>215,996</b>        | <b>59,236</b>                  | <b>12,508</b>                 | <b>15,023</b> | <b>17,539</b> | <b>20,052</b> | <b>22,567</b> | <b>29,801</b> | <b>37,032</b> | <b>41,120</b> | <b>41,120</b> | <b>61,558</b> | <b>77,910</b>                  |  |

**NOTES:** Big Fossil Service Area Includes Marine Creek Watershed Area, but not Little Fossil Creek Watershed Area  
Source of Data: City of Fort Worth Database Tables "LUAPOP-1" and "LUAPOP-2"  
Employment Estimates for Year 2025 Interpolated between Years 2020 and 2050

**EXHIBIT "E"**  
**"EQUIVALENT" POPULATION PROJECTIONS USED IN THE BIG FOSSIL SEWER STUDY BASED ON**  
**DATA FROM THE CITY OF FORT WORTH SANITARY SEWER MASTER PLAN REPORT**

| CITY              | TOTAL CITY AREA (AC.) | TOTAL BIG FOS. SERV. AR. (AC.) | TAB. LUAIPOP-1 PAGE 8 OF 12 |               |               |               | TAB. LUAIPOP-1 PAGE 12 OF 12 |                |                |                | INTERP.        | TAB. LUAIPOP-2 PAGE 10 OF 20 |      |
|-------------------|-----------------------|--------------------------------|-----------------------------|---------------|---------------|---------------|------------------------------|----------------|----------------|----------------|----------------|------------------------------|------|
|                   |                       |                                | 1990                        | 1995          | 2000          | 2005          | 2010                         | 2015           | 2020           | 2025           |                | 2050                         | 2070 |
|                   |                       |                                | Haslet                      | 3,205         | 453           | 80            | 154                          | 228            | 302            | 376            |                | 492                          | 607  |
| Haltom City       | 7,935                 | 3,227                          | 12,218                      | 13,086        | 13,954        | 14,821        | 15,688                       | 16,721         | 17,752         | 18,674         | 23,286         | 26,976                       |      |
| Watauga           | 2,600                 | 2,600                          | 18,763                      | 19,699        | 20,634        | 21,570        | 22,505                       | 23,388         | 24,269         | 25,186         | 29,775         | 33,446                       |      |
| N. Richland Hills | 11,675                | 2,465                          | 14,265                      | 15,154        | 16,043        | 16,931        | 17,820                       | 18,388         | 18,954         | 19,735         | 23,643         | 26,769                       |      |
| Richland Hills    | 2,007                 | 1,365                          | 6,925                       | 7,418         | 7,910         | 8,403         | 8,896                        | 9,135          | 9,375          | 9,783          | 11,824         | 13,457                       |      |
| Saginaw           | 4,778                 | 763                            | 92                          | 326           | 560           | 793           | 1,027                        | 1,312          | 1,596          | 1,847          | 3,101          | 4,104                        |      |
| Fort Worth        | 183,796               | 48,363                         | 18,527                      | 21,655        | 24,785        | 27,913        | 31,043                       | 38,028         | 45,014         | 49,428         | 71,501         | 89,158                       |      |
| <b>TOTALS</b>     | <b>215,996</b>        | <b>59,236</b>                  | <b>70,868</b>               | <b>77,491</b> | <b>84,113</b> | <b>90,732</b> | <b>97,354</b>                | <b>107,462</b> | <b>117,564</b> | <b>125,347</b> | <b>164,261</b> | <b>195,393</b>               |      |

**NOTES:**  
 Big Fossil Service Area Includes Marine Creek Watershed Area, but not Little Fossil Creek Watershed Area  
 Source of Data: City of Fort Worth Database Tables "LUAIPOP-1" and "LUAIPOP-2"  
 Equivalent Population Estimate for Year 2025 Interpolated between Years 2020 and 2050  
 Equivalent Population = Population (Exhibit "B") + 0.5 x Employment (Exhibit "C")

In order to determine future population and employment data, a systematic method was developed incorporating census tracts, forecast districts, and city boundaries. Each city lies within the boundary of several forecast districts and census tracts. A map was developed of each city showing the corresponding census tracts and forecast districts for that certain city. From this map the population per house density of each of the contributing forecast districts was computed by defining the census tracts contained in each forecast district. These forecast district densities were then used to figure population data for the years: 1995, 2005, & 2025. A similar method was then used to determine population and employment data for areas in each city, which contribute to the Big Fossil watershed. The employment and population numbers were factored for each census tract and forecast district in order to determine the population and employment data for the study. This preliminary analysis was used for comparison purposes only.

The following table shows population and employment data for the cities located in the Big Fossil watershed area which were developed from the City of Fort Worth Sanitary Sewer Master Plan and Land Use Assumptions Plan furnished by the City of Fort Worth Water Department for use in this study.

**EXHIBIT "F"**  
**Table 2.**  
**(Revised)**  
**Population and Employment Summaries**  
**of Cities in the Big Fossil Study**

| CITY                 | Service Area (Ac.) | POPULATION    |               |                | EMPLOYMENT    |               |               |
|----------------------|--------------------|---------------|---------------|----------------|---------------|---------------|---------------|
|                      |                    | 1995          | 2005          | 2025           | 1995          | 2005          | 2025          |
| Fort Worth           | 48,363             | 19,074        | 24,305        | 38,741         | 5,162         | 7,216         | 21,374        |
| Haltom City          | 3,227              | 12,151        | 13,151        | 15,271         | 1,870         | 3,339         | 6,805         |
| Haslet               | 453                | 130           | 258           | 583            | 47            | 88            | 223           |
| North Richland Hills | 2,465              | 13,371        | 14,809        | 16,887         | 3,565         | 4,244         | 5,696         |
| Richland Hills       | 1,365              | 6,164         | 6,897         | 7,745          | 2,508         | 3,011         | 4,075         |
| Saginaw              | 763                | 255           | 695           | 1,625          | 141           | 196           | 443           |
| Watauga              | 2,600              | 18,834        | 20,591        | 23,934         | 1,730         | 1,958         | 2,504         |
| <b>TOTAL</b>         | <b>59,236</b>      | <b>69,979</b> | <b>80,706</b> | <b>104,786</b> | <b>15,023</b> | <b>20,052</b> | <b>41,120</b> |

Note: Source of Population Data: City of Fort Worth Sanitary Sewer Master Plan  
 See Database Tables "LUAPOP-1" and "LUAPOP-2", under TAB 5.  
 City of Fort Worth area also includes unincorporated Tarrant County Areas in Watershed

***EXHIBIT "G"***

***FORT WORTH POPULATION PROJECTIONS***

***TABLE "LUAPOP-1"***

| SUBAREA    | AREA_AC  | Easting      | EMP_1990                               | EMP_1995 | EMP_2000 | EMP_2005 | EMP_2010 | EMP_2015 | EMP_2020 | Flood Cont.0 | HD Resid.0 | Industrial0 |
|------------|----------|--------------|--|----------|----------|----------|----------|----------|----------|--------------|------------|-------------|
|            |          |              | <b>BIG FOSSIL CURRENT SERVICE AREA</b> |          |          |          |          |          |          |              |            |             |
| BF000350-S | 1,365.37 | 2,355,216.25 | 2,256.00                               | 2,508.00 | 2,760.00 | 3,011.00 | 3,263.00 | 3,539.00 | 3,815.00 | 0.00         | 34.96      | 81.82       |
| BF000350-N | 1,643.38 | 2,355,216.25 | 2,715.00                               | 3,018.00 | 3,321.00 | 3,625.00 | 3,928.00 | 4,260.00 | 4,592.00 | 0.00         | 42.07      | 98.47       |
| BF000380   | 3,058.33 | 2,346,512.75 | 1,031.00                               | 1,758.00 | 2,485.00 | 3,212.00 | 3,939.00 | 4,890.00 | 5,841.00 | 0.00         | 166.71     | 125.33      |
| BF000890-N | 2,600.04 | 2,350,886.25 | 1,615.43                               | 1,729.67 | 1,843.93 | 1,958.18 | 2,072.43 | 2,224.89 | 2,377.36 | 0.00         | 6.93       | 64.29       |
| BF000890-S | 821.81   | 2,350,886.25 | 510.60                                 | 546.71   | 582.82   | 618.93   | 655.04   | 703.24   | 751.43   | 0.00         | 2.60       | 24.13       |
| BF000890-W | 168.88   | 2,350,886.25 | 104.93                                 | 112.35   | 119.77   | 127.19   | 134.61   | 144.51   | 154.41   | 0.00         | 0.53       | 4.96        |
| BF001150   | 86.85    | 2,339,210.75 | 92.00                                  | 114.00   | 136.00   | 158.00   | 180.00   | 265.50   | 351.00   | 0.00         | 0.00       | 5.51        |
| BF001230   | 211.03   | 2,336,926.75 | 86.00                                  | 110.25   | 134.50   | 158.75   | 183.00   | 278.00   | 373.00   | 0.00         | 0.00       | 0.00        |
| BF001330   | 71.91    | 2,337,067.00 | 8.00                                   | 8.75     | 9.50     | 10.25    | 11.00    | 11.50    | 12.00    | 0.00         | 0.00       | 0.00        |
| BF001380   | 33.88    | 2,336,149.50 | 4.00                                   | 4.25     | 4.50     | 4.75     | 5.00     | 5.50     | 6.00     | 0.00         | 0.00       | 0.00        |
| BF001420   | 22.35    | 2,335,175.50 | 2.00                                   | 2.25     | 2.50     | 2.75     | 3.00     | 3.50     | 4.00     | 0.00         | 0.00       | 0.00        |
| BF001440   | 343.58   | 2,334,048.25 | 4.00                                   | 17.50    | 31.00    | 44.50    | 58.00    | 111.50   | 165.00   | 0.00         | 0.00       | 7.99        |
| BF001520   | 98.70    | 2,336,266.75 | 4.00                                   | 6.00     | 8.00     | 10.00    | 12.00    | 16.00    | 20.00    | 0.00         | 0.00       | 0.00        |
| BF001650   | 80.52    | 2,335,319.00 | 2.00                                   | 4.00     | 6.00     | 8.00     | 10.00    | 18.00    | 26.00    | 0.00         | 0.00       | 0.00        |
| BF001750   | 175.51   | 2,335,061.00 | 2.00                                   | 12.25    | 22.50    | 32.75    | 43.00    | 71.00    | 99.00    | 0.00         | 0.00       | 0.00        |
| BF001970   | 75.55    | 2,344,510.25 | 4.00                                   | 5.50     | 7.00     | 8.50     | 10.00    | 14.00    | 18.00    | 0.00         | 0.00       | 4.11        |
| BF002000   | 55.13    | 2,344,042.75 | 3.00                                   | 4.25     | 5.50     | 6.75     | 8.00     | 11.00    | 14.00    | 0.00         | 0.00       | 0.00        |
| BF002030   | 98.50    | 2,343,247.50 | 5.00                                   | 7.00     | 9.00     | 11.00    | 13.00    | 17.50    | 22.00    | 0.00         | 0.00       | 0.00        |
| BF002110   | 655.15   | 2,341,326.25 | 0.00                                   | 21.25    | 42.50    | 63.75    | 85.00    | 132.00   | 179.00   | 0.00         | 0.00       | 0.00        |
| BF002170   | 1,808.64 | 2,346,034.50 | 1,067.00                               | 1,139.75 | 1,212.50 | 1,285.25 | 1,358.00 | 1,507.50 | 1,657.00 | 0.00         | 0.00       | 106.10      |
| BF002260   | 203.84   | 2,346,618.75 | 23.00                                  | 32.75    | 42.50    | 52.25    | 62.00    | 83.50    | 105.00   | 0.00         | 0.00       | 0.00        |
| BF002270   | 124.51   | 2,345,136.00 | 7.00                                   | 13.00    | 19.00    | 25.00    | 31.00    | 44.00    | 57.00    | 0.00         | 0.00       | 0.00        |
| BF002560   | 285.98   | 2,347,455.00 | 0.00                                   | 13.90    | 27.79    | 41.69    | 55.58    | 85.90    | 116.22   | 0.00         | 0.00       | 0.00        |
| BF002630   | 25.83    | 2,342,396.25 | 0.00                                   | 1.00     | 2.00     | 3.00     | 4.00     | 6.00     | 8.00     | 0.00         | 0.00       | 0.00        |
| BF002650   | 43.15    | 2,343,705.00 | 0.00                                   | 2.00     | 4.00     | 6.00     | 8.00     | 12.50    | 17.00    | 0.00         | 0.00       | 0.00        |
| BF002690   | 38.32    | 2,342,377.25 | 0.00                                   | 1.25     | 2.50     | 3.75     | 5.00     | 8.00     | 11.00    | 0.00         | 0.00       | 0.00        |
| BF002750   | 75.12    | 2,339,397.00 | 14.00                                  | 19.00    | 24.00    | 29.00    | 34.00    | 55.00    | 76.00    | 0.00         | 0.00       | 0.00        |
| BF002770   | 69.73    | 2,338,738.00 | 8.00                                   | 8.50     | 9.00     | 9.50     | 10.00    | 11.00    | 12.00    | 0.00         | 0.00       | 0.00        |
| BF002840   | 49.22    | 2,339,896.75 | 3.00                                   | 3.50     | 4.00     | 4.50     | 5.00     | 6.00     | 7.00     | 0.00         | 0.00       | 0.00        |
| BF002860   | 67.40    | 2,341,704.50 | 2.00                                   | 3.25     | 4.50     | 5.75     | 7.00     | 9.50     | 12.00    | 0.00         | 0.00       | 0.00        |
| BF002990   | 118.57   | 2,341,817.25 | 4.00                                   | 6.00     | 8.00     | 10.00    | 12.00    | 16.50    | 21.00    | 0.00         | 0.00       | 0.00        |
| BF003000   | 32.30    | 2,340,122.75 | 1.00                                   | 1.50     | 2.00     | 2.50     | 3.00     | 4.00     | 5.00     | 0.00         | 0.00       | 0.00        |
| BF003060   | 97.71    | 2,341,543.25 | 4.00                                   | 5.50     | 7.00     | 8.50     | 10.00    | 13.50    | 17.00    | 0.00         | 0.00       | 0.00        |
| BF003170   | 166.69   | 2,340,764.75 | 2.00                                   | 6.75     | 11.50    | 16.25    | 21.00    | 32.00    | 43.00    | 0.00         | 0.00       | 0.00        |
| BF003280   | 82.67    | 2,343,341.50 | 3.00                                   | 4.25     | 5.50     | 6.75     | 8.00     | 11.00    | 14.00    | 0.00         | 0.00       | 0.00        |
| BF003310   | 84.18    | 2,337,519.25 | 90.00                                  | 111.25   | 132.50   | 153.75   | 175.00   | 257.50   | 340.00   | 0.00         | 0.00       | 0.05        |
| BF003410   | 207.26   | 2,335,414.25 | 159.00                                 | 198.00   | 237.00   | 276.00   | 315.00   | 467.00   | 619.00   | 0.00         | 0.00       | 0.00        |
| BF003500   | 105.61   | 2,334,097.75 | 0.00                                   | 5.00     | 10.00    | 15.00    | 20.00    | 41.00    | 62.00    | 0.00         | 0.00       | 0.00        |
| BF003530   | 382.87   | 2,331,868.00 | 163.00                                 | 201.75   | 240.50   | 279.25   | 318.00   | 492.50   | 667.00   | 0.00         | 0.00       | 1.37        |
| BF003600   | 399.14   | 2,329,002.50 | 108.00                                 | 140.50   | 173.00   | 205.50   | 238.00   | 389.50   | 541.00   | 0.00         | 0.00       | 68.38       |
| BF003640   | 123.27   | 2,324,675.75 | 55.00                                  | 67.75    | 80.50    | 93.25    | 106.00   | 157.00   | 208.00   | 0.00         | 0.00       | 6.67        |
| BF003660   | 923.79   | 2,325,880.25 | 67.00                                  | 103.75   | 140.50   | 177.25   | 214.00   | 524.00   | 834.00   | 0.00         | 0.00       | 13.97       |
| BF003740   | 140.57   | 2,324,677.75 | 27.00                                  | 37.00    | 47.00    | 57.00    | 67.00    | 117.00   | 167.00   | 0.00         | 0.00       | 0.00        |

| SUBAREA          | AREA_AC   | Easting      | EMP_1990  | EMP_1995  | EMP_2000  | EMP_2005  | EMP_2010  | EMP_2015  | EMP_2020  | Flood Cont.0 | HD Resid.0 | Industrial0 |
|------------------|-----------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------|------------|-------------|
| BF003760         | 897.71    | 2,319,783.00 | 0.00      | 14.75     | 29.50     | 44.25     | 59.00     | 196.50    | 334.00    | 0.00         | 0.00       | 14.83       |
| BF003820         | 53.66     | 2,322,882.00 | 9.00      | 10.00     | 11.00     | 12.00     | 13.00     | 35.50     | 58.00     | 0.00         | 0.00       | 18.25       |
| BF003860         | 86.37     | 2,335,858.75 | 92.00     | 113.75    | 135.50    | 157.25    | 179.00    | 264.00    | 349.00    | 0.00         | 0.00       | 0.00        |
| BF003960         | 81.36     | 2,333,815.50 | 85.00     | 105.50    | 126.00    | 146.50    | 167.00    | 247.00    | 327.00    | 0.00         | 12.69      | 0.00        |
| BF004230         | 87.30     | 2,325,657.00 | 39.00     | 48.25     | 57.50     | 66.75     | 76.00     | 112.00    | 148.00    | 0.00         | 0.00       | 0.00        |
| BF004330         | 223.60    | 2,322,394.50 | 43.00     | 49.75     | 56.50     | 63.25     | 70.00     | 94.00     | 118.00    | 0.00         | 0.00       | 23.59       |
| BF004350         | 150.02    | 2,325,431.00 | 67.00     | 82.75     | 98.50     | 114.25    | 130.00    | 192.00    | 254.00    | 0.00         | 0.00       | 0.00        |
| BF004370         | 763.78    | 2,321,593.25 | 113.00    | 140.75    | 168.50    | 196.25    | 224.00    | 310.00    | 396.00    | 0.00         | 0.00       | 26.95       |
| BF004380         | 83.77     | 2,320,687.50 | 0.00      | 3.00      | 6.00      | 9.00      | 12.00     | 48.50     | 85.00     | 0.00         | 0.00       | 0.39        |
| BF004420         | 94.65     | 2,319,701.25 | 0.00      | 3.25      | 6.50      | 9.75      | 13.00     | 54.50     | 96.00     | 0.00         | 0.00       | 0.00        |
| BF004500         | 1,275.13  | 2,322,494.75 | 93.00     | 128.75    | 164.50    | 200.25    | 236.00    | 580.50    | 925.00    | 0.00         | 0.00       | 110.08      |
| BF004590         | 151.50    | 2,337,446.75 | 6.00      | 9.00      | 12.00     | 15.00     | 18.00     | 24.50     | 31.00     | 0.00         | 0.00       | 0.00        |
| BF004720         | 76.32     | 2,339,430.00 | 3.00      | 4.50      | 6.00      | 7.50      | 9.00      | 12.00     | 15.00     | 0.00         | 0.00       | 0.00        |
| BF004760         | 71.71     | 2,339,084.00 | 3.00      | 4.25      | 5.50      | 6.75      | 8.00      | 11.00     | 14.00     | 0.00         | 0.00       | 0.00        |
| BF004800         | 49.57     | 2,338,556.00 | 2.00      | 3.00      | 4.00      | 5.00      | 6.00      | 8.00      | 10.00     | 0.00         | 0.00       | 0.00        |
| BF004860         | 181.38    | 2,338,246.75 | 8.00      | 11.50     | 15.00     | 18.50     | 22.00     | 30.00     | 38.00     | 0.00         | 0.00       | 1.43        |
| BF005040         | 267.34    | 2,336,680.25 | 7.00      | 11.50     | 16.00     | 20.50     | 25.00     | 35.00     | 45.00     | 0.00         | 0.00       | 0.00        |
| BF005080         | 54.53     | 2,335,422.50 | 6.00      | 6.25      | 6.50      | 6.75      | 7.00      | 8.50      | 10.00     | 0.00         | 0.00       | 0.00        |
| BF005130         | 235.46    | 2,329,502.00 | 172.00    | 204.50    | 237.00    | 269.50    | 302.00    | 436.00    | 570.00    | 0.00         | 0.00       | 38.22       |
| <b>SUB-TOTAL</b> | 22,208.01 |              | 11,003.96 | 13,071.88 | 15,139.81 | 17,207.73 | 19,275.66 | 23,767.54 | 28,259.43 | 0.00         | 266.49     | 846.89      |

**BIG FOSSIL EXTRA 2020 SERVICE AREA**

|                   |           |              |           |           |           |           |           |           |           |      |        |          |
|-------------------|-----------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|--------|----------|
| BFX10-01          | 417.04    | 2,057,143.32 | 10.00     | 51.75     | 93.50     | 135.25    | 177.00    | 285.00    | 393.00    | 0.00 | 0.00   | 0.00     |
| BFX10-02          | 802.86    | 2,054,539.54 | 39.00     | 86.75     | 134.50    | 182.25    | 230.00    | 440.50    | 651.00    | 0.00 | 0.00   | 30.33    |
| BFX10-03          | 1,389.38  | 2,063,399.64 | 1.00      | 51.50     | 102.00    | 152.50    | 203.00    | 313.50    | 424.00    | 0.00 | 0.00   | 5.27     |
| BFX10-04          | 1,068.25  | 2,060,892.43 | 3.00      | 77.25     | 151.50    | 225.75    | 300.00    | 462.00    | 624.00    | 0.00 | 0.00   | 2.71     |
| BFX10-05          | 775.34    | 2,056,421.39 | 86.00     | 166.50    | 247.00    | 327.50    | 408.00    | 582.50    | 757.00    | 0.00 | 0.00   | 21.29    |
| BFX10-06          | 459.88    | 2,051,691.20 | 54.00     | 84.75     | 115.50    | 146.25    | 177.00    | 259.50    | 342.00    | 0.00 | 0.00   | 13.80    |
| BFX10-07          | 452.71    | 2,053,953.18 | 27.00     | 47.25     | 67.50     | 87.75     | 108.00    | 151.50    | 195.00    | 0.00 | 0.00   | 30.56    |
| BFX10-10          | 1,256.81  | 2,037,756.83 | 45.00     | 49.25     | 53.50     | 57.75     | 62.00     | 124.50    | 187.00    | 0.00 | 0.00   | 18.51    |
| BFX10-11          | 1,734.47  | 2,042,783.05 | 13.00     | 36.25     | 59.50     | 82.75     | 106.00    | 575.50    | 1,045.00  | 0.00 | 0.00   | 19.05    |
| BFX10-12          | 1,234.82  | 2,034,732.29 | 78.00     | 83.50     | 89.00     | 94.50     | 100.00    | 174.50    | 249.00    | 0.00 | 0.00   | 92.63    |
| BFX10-13          | 1,000.10  | 2,034,063.37 | 92.00     | 94.50     | 97.00     | 99.50     | 102.00    | 137.50    | 173.00    | 0.00 | 0.00   | 47.44    |
| BFX10-15          | 787.89    | 2,042,040.00 | 4.00      | 27.75     | 51.50     | 75.25     | 99.00     | 408.00    | 717.00    | 0.00 | 0.00   | 17.74    |
| BFX10-16          | 440.21    | 2,035,050.89 | 7.00      | 7.75      | 8.50      | 9.25      | 10.00     | 85.50     | 161.00    | 0.00 | 0.00   | 0.00     |
| BFX10-17          | 1,318.38  | 2,029,294.17 | 48.00     | 49.00     | 50.00     | 51.00     | 52.00     | 102.00    | 152.00    | 0.00 | 0.00   | 28.35    |
| <b>SUB-TOTAL</b>  | 13,138.13 |              | 507.00    | 913.75    | 1,320.50  | 1,727.25  | 2,134.00  | 4,102.00  | 6,070.00  | 0.00 | 0.00   | 327.68   |
| <b>TOTAL B.F.</b> | 35,346.13 |              | 11,510.96 | 13,985.63 | 16,460.31 | 18,934.98 | 21,409.66 | 27,869.54 | 34,329.43 | 0.00 | 266.49 | 1,174.57 |

| SUBAREA  | AREA_AC          | Easting      | EMP_1990         | EMP_1995         | EMP_2000         | EMP_2005         | EMP_2010         | EMP_2015         | EMP_2020         | Flood Cont.0 | HD Resid.0    | Industrial0     |
|--|------------------|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|--------------|---------------|-----------------|
| <b>MARINE CREEK AREA TO BE PUMPED TO BIG FOSSIL AREA</b> |                  |              |                  |                  |                  |                  |                  |                  |                  |              |               |                 |
| MCX20-01   | 271.29           | 2,020,647.80 | 120.00           | 124.00           | 128.00           | 132.00           | 136.00           | 208.50           | 281.00           | 0.00         | 0.00          | 5.15            |
| MCX10-03   | 21.77            | 2,017,711.01 | 1.00             | 1.25             | 1.50             | 1.75             | 2.00             | 10.50            | 19.00            | 0.00         | 0.00          | 0.00            |
| MCX10-04   | 61.40            | 2,016,014.58 | 3.00             | 4.25             | 5.50             | 6.75             | 8.00             | 33.00            | 58.00            | 0.00         | 0.00          | 0.00            |
| MCX10-05   | 32.56            | 2,015,014.88 | 1.00             | 1.75             | 2.50             | 3.25             | 4.00             | 17.00            | 30.00            | 0.00         | 0.00          | 0.00            |
| MCX10-06   | 145.58           | 2,013,328.79 | 8.00             | 11.25            | 14.50            | 17.75            | 21.00            | 82.00            | 143.00           | 0.00         | 0.00          | 5.88            |
| MCX10-07   | 300.25           | 2,010,763.18 | 39.00            | 44.75            | 50.50            | 56.25            | 62.00            | 171.50           | 281.00           | 0.00         | 0.00          | 0.00            |
| MCX10-08   | 415.46           | 2,007,321.71 | 134.00           | 138.50           | 143.00           | 147.50           | 152.00           | 240.00           | 328.00           | 0.00         | 0.00          | 0.00            |
| MCX10-09   | 1,122.80         | 2,024,973.99 | 0.00             | 1.25             | 2.50             | 3.75             | 5.00             | 26.50            | 48.00            | 0.65         | 9.78          | 44.56           |
| MCX10-10   | 372.16           | 2,019,653.64 | 13.00            | 14.00            | 15.00            | 16.00            | 17.00            | 34.00            | 51.00            | 0.00         | 0.00          | 82.20           |
| MCX10-11   | 623.92           | 2,017,114.30 | 0.00             | 0.75             | 1.50             | 2.25             | 3.00             | 20.00            | 37.00            | 0.00         | 0.00          | 11.97           |
| MCX10-12   | 415.80           | 2,014,066.40 | 35.00            | 35.50            | 36.00            | 36.50            | 37.00            | 50.00            | 63.00            | 0.00         | 0.00          | 54.44           |
| MCX10-13   | 739.89           | 2,010,622.90 | 175.00           | 175.75           | 176.50           | 177.25           | 178.00           | 197.50           | 217.00           | 11.47        | 0.00          | 55.97           |
| MCX10-14   | 1,035.04         | 2,027,719.48 | 2.00             | 2.75             | 3.50             | 4.25             | 5.00             | 27.50            | 50.00            | 0.00         | 0.00          | 232.66          |
| MCX10-15   | 942.90           | 2,025,280.83 | 9.00             | 10.00            | 11.00            | 12.00            | 13.00            | 33.00            | 53.00            | 0.00         | 0.00          | 54.87           |
| MCX10-16   | 383.73           | 2,022,120.51 | 0.00             | 0.25             | 0.50             | 0.75             | 1.00             | 9.00             | 17.00            | 0.00         | 0.00          | 126.68          |
| MCX10-17   | 758.58           | 2,018,409.48 | 0.00             | 0.75             | 1.50             | 2.25             | 3.00             | 19.00            | 35.00            | 0.00         | 0.00          | 0.00            |
| MCX10-18   | 754.09           | 2,022,612.78 | 48.00            | 48.75            | 49.50            | 50.25            | 51.00            | 58.50            | 66.00            | 0.00         | 0.00          | 0.00            |
| MCX10-19   | 527.57           | 2,017,207.11 | 39.00            | 39.50            | 40.00            | 40.50            | 41.00            | 46.00            | 51.00            | 0.00         | 0.00          | 2.92            |
| MCX10-20   | 616.82           | 2,016,230.95 | 9.00             | 9.50             | 10.00            | 10.50            | 11.00            | 21.00            | 31.00            | 0.00         | 0.00          | 7.67            |
| MCX10-21   | 599.73           | 2,011,594.53 | 6.00             | 6.25             | 6.50             | 6.75             | 7.00             | 17.00            | 27.00            | 0.00         | 0.00          | 11.60           |
| MCX10-22   | 812.15           | 2,008,200.96 | 0.00             | 0.50             | 1.00             | 1.50             | 2.00             | 32.00            | 62.00            | 0.00         | 0.00          | 1.32            |
| MCX10-23   | 750.41           | 2,011,401.29 | 55.00            | 55.75            | 56.50            | 57.25            | 58.00            | 65.00            | 72.00            | 0.00         | 0.00          | 0.00            |
| MCX10-24   | 1,382.77         | 2,004,626.95 | 26.00            | 27.00            | 28.00            | 29.00            | 30.00            | 53.00            | 76.00            | 0.00         | 0.00          | 4.76            |
| MCX20-01a  | 1,503.44         | 2,024,698.49 | 23.00            | 24.25            | 25.50            | 26.75            | 28.00            | 58.50            | 89.00            | 0.00         | 0.00          | 206.75          |
| MCX20-02   | 635.28           | 2,017,453.04 | 9.00             | 9.75             | 10.50            | 11.25            | 12.00            | 24.00            | 36.00            | 0.00         | 23.48         | 3.11            |
| MCX20-03   | 978.26           | 2,013,547.69 | 68.00            | 69.00            | 70.00            | 71.00            | 72.00            | 81.00            | 90.00            | 0.00         | 0.00          | 0.00            |
| MCX20-04   | 881.55           | 2,006,888.77 | 26.00            | 26.75            | 27.50            | 28.25            | 29.00            | 41.50            | 54.00            | 0.00         | 0.00          | 13.13           |
| MCX20-05   | 3,226.10         | 2,001,238.29 | 84.00            | 86.50            | 89.00            | 91.50            | 94.00            | 125.50           | 157.00           | 0.00         | 0.00          | 124.47          |
| MCX20-06   | 1,278.94         | 2,023,876.31 | 16.00            | 16.75            | 17.50            | 18.25            | 19.00            | 37.00            | 55.00            | 0.00         | 0.00          | 159.42          |
| MCX20-07   | 455.17           | 2,019,046.01 | 16.00            | 16.50            | 17.00            | 17.50            | 18.00            | 24.50            | 31.00            | 0.00         | 169.72        | 0.00            |
| MCX20-08   | 712.98           | 2,014,215.71 | 22.00            | 22.50            | 23.00            | 23.50            | 24.00            | 35.00            | 46.00            | 0.00         | 28.73         | 0.00            |
| MCX20-09   | 959.06           | 2,010,207.58 | 10.00            | 11.00            | 12.00            | 13.00            | 14.00            | 32.00            | 50.00            | 0.00         | 0.00          | 18.23           |
| <b>SUB-TOTAL</b>   | <b>23,717.45</b> |              | <b>997.00</b>    | <b>1,037.00</b>  | <b>1,077.00</b>  | <b>1,117.00</b>  | <b>1,157.00</b>  | <b>1,930.50</b>  | <b>2,704.00</b>  | <b>12.12</b> | <b>231.71</b> | <b>1,227.76</b> |
| <b>B.F. CUR. + MC</b>                                    | <b>45,925.46</b> |              | <b>12,000.96</b> | <b>14,108.88</b> | <b>16,216.81</b> | <b>18,324.73</b> | <b>20,432.66</b> | <b>25,698.04</b> | <b>30,963.43</b> | <b>12.12</b> | <b>498.20</b> | <b>2,074.65</b> |
| <b>B.F. TOT. + MC</b>                                    | <b>59,063.58</b> |              | <b>12,507.96</b> | <b>15,022.63</b> | <b>17,597.31</b> | <b>20,051.98</b> | <b>22,566.66</b> | <b>29,800.04</b> | <b>37,033.43</b> | <b>12.12</b> | <b>498.20</b> | <b>2,402.33</b> |



| SUBAREA               | AREA_AC   | Easting | EMP_1990 | EMP_1995 | EMP_2000 | EMP_2005 | EMP_2010 | EMP_2015 | EMP_2020 | Flood Cont.0 | HD Resid.0 | Industrial0 |
|-----------------------|-----------|---------|----------|----------|----------|----------|----------|----------|----------|--------------|------------|-------------|
| TOTALS BY CITY        |           |         |          |          |          |          |          |          |          |              |            |             |
| (1) Haslet            | 452.71    |         | 27       | 47       | 68       | 88       | 108      | 152      | 195      |              |            |             |
| (2) Haltom City       | 3,227.21  |         | 1,136    | 1,870    | 2,605    | 3,339    | 4,074    | 5,035    | 5,995    |              |            |             |
| (3) Watauga           | 2,600.04  |         | 1,615    | 1,730    | 1,844    | 1,958    | 2,072    | 2,225    | 2,377    |              |            |             |
| (4) N. Richland Hills | 2,465.19  |         | 3,226    | 3,565    | 3,904    | 4,244    | 4,583    | 4,963    | 5,343    |              |            |             |
| (5) Richland Hills    | 1,365.37  |         | 2,256    | 2,508    | 2,760    | 3,011    | 3,263    | 3,539    | 3,815    |              |            |             |
| (6) Saginaw           | 763.78    |         | 113      | 141      | 169      | 196      | 224      | 310      | 396      |              |            |             |
| (7) Fort Worth        | 48,189.29 |         | 4,135    | 5,162    | 6,189    | 7,216    | 8,243    | 13,577   | 18,911   |              |            |             |

- Notes:
- (1) Haslet = BFX10-07 (M825X-03)
  - (2) Haltom City = BF000380 + BF000890-W
  - (3) Watauga = BF000890-N x 1.1874
  - (4) N. Richland Hills = BF000890-S + BF000350-N
  - (5) Richland Hills = BF000350-S
  - (6) Saginaw = BF004370
  - (7) Fort Worth = B.F. TOT. + MC - (1) - (2) - (3) - (4) - (5) - (6)

| SUBAREA    | Institutional | MAPSCO | MBASIN     | Non-Sew | Nothing      | Office/Retail | Parks & Rec | POP_1990  | POP_1995  | POP_2000  | POP_2005  |
|------------|---------------|--------|------------|---------|--------------|---------------|-------------|-----------|-----------|-----------|-----------|
| BF000350-S | 56.19         | 51T    | Big Fossil | 110.38  | 6,982,905.00 | 69.11         | 58.77       | 5,797.00  | 6,164.00  | 6,530.00  | 6,897.00  |
| BF000350-N | 67.64         | 51T    | Big Fossil | 132.86  | 6,982,905.00 | 83.18         | 70.74       | 6,977.00  | 7,418.00  | 7,860.00  | 8,301.00  |
| BF000380   | 119.39        | 50B    | Big Fossil | 382.86  | 6,989,645.50 | 92.35         | 253.99      | 10,484.00 | 10,927.25 | 11,370.50 | 11,813.75 |
| BF000890-N | 57.83         | 37J    | Big Fossil | 116.59  | 4,819,244.57 | 78.43         | 102.69      | 17,955.30 | 18,833.73 | 19,712.16 | 20,590.60 |
| BF000890-S | 21.70         | 37J    | Big Fossil | 36.85   | 6,999,629.00 | 24.79         | 32.46       | 5,675.24  | 5,952.89  | 6,230.54  | 6,508.19  |
| BF000890-W | 4.46          | 37J    | Big Fossil | 7.57    | 6,999,629.00 | 5.09          | 6.67        | 1,166.24  | 1,223.29  | 1,280.35  | 1,337.40  |
| BF001150   | 0.00          | 50A    | Big Fossil | 13.07   | 6,994,408.00 | 0.00          | 13.07       | 29.00     | 29.75     | 30.50     | 31.25     |
| BF001230   | 0.00          | 49D    | Big Fossil | 117.60  | 6,997,353.50 | 0.53          | 109.06      | 29.00     | 32.25     | 35.50     | 38.75     |
| BF001330   | 0.00          | 35Z    | Big Fossil | 0.00    | 6,999,272.00 | 0.00          | 0.00        | 418.00    | 470.25    | 522.50    | 574.75    |
| BF001380   | 0.00          | 35V    | Big Fossil | 0.00    | 7,000,566.00 | 0.00          | 0.00        | 197.00    | 221.50    | 246.00    | 270.50    |
| BF001420   | 0.00          | 35U    | Big Fossil | 0.00    | 7,000,324.50 | 0.00          | 0.00        | 118.00    | 132.50    | 147.00    | 161.50    |
| BF001440   | 0.00          | 35U    | Big Fossil | 2.85    | 7,002,896.00 | 0.00          | 0.00        | 595.00    | 628.00    | 661.00    | 694.00    |
| BF001520   | 14.99         | 35R    | Big Fossil | 1.97    | 7,004,707.00 | 0.00          | 0.00        | 590.00    | 616.50    | 643.00    | 669.50    |
| BF001650   | 0.00          | 35L    | Big Fossil | 1.14    | 7,006,605.50 | 0.00          | 0.00        | 327.00    | 342.25    | 357.50    | 372.75    |
| BF001750   | 1.98          | 35L    | Big Fossil | 0.00    | 7,008,340.00 | 0.00          | 0.00        | 332.00    | 360.00    | 388.00    | 416.00    |
| BF001970   | 0.00          | 36Y    | Big Fossil | 0.00    | 6,999,396.50 | 0.00          | 0.00        | 377.00    | 363.75    | 350.50    | 337.25    |
| BF002000   | 0.00          | 36T    | Big Fossil | 0.00    | 7,001,587.50 | 0.00          | 0.00        | 255.00    | 246.75    | 238.50    | 230.25    |
| BF002030   | 0.00          | 36P    | Big Fossil | 0.00    | 7,003,814.50 | 0.00          | 0.00        | 466.00    | 453.75    | 441.50    | 429.25    |
| BF002110   | 0.00          | 22X    | Big Fossil | 0.00    | 7,010,853.00 | 0.00          | 0.00        | 146.00    | 432.00    | 718.00    | 1,004.00  |
| BF002170   | 0.00          | 22Y    | Big Fossil | 0.00    | 7,012,285.50 | 0.00          | 0.00        | 381.00    | 874.75    | 1,368.50  | 1,862.25  |
| BF002260   | 1.21          | 36U    | Big Fossil | 0.00    | 7,002,121.00 | 0.00          | 0.00        | 37.00     | 93.50     | 150.00    | 206.50    |
| BF002270   | 4.51          | 36Q    | Big Fossil | 0.00    | 7,003,735.50 | 0.00          | 0.00        | 37.00     | 83.00     | 129.00    | 175.00    |
| BF002560   | 6.30          | 36M    | Big Fossil | 0.00    | 7,006,153.00 | 0.00          | 0.00        | 123.80    | 260.02    | 396.24    | 532.47    |
| BF002630   | 0.00          | 36P    | Big Fossil | 0.00    | 7,004,819.50 | 0.00          | 0.00        | 2.00      | 15.75     | 29.50     | 43.25     |
| BF002650   | 0.00          | 36P    | Big Fossil | 0.00    | 7,005,519.50 | 0.00          | 0.00        | 18.00     | 38.50     | 59.00     | 79.50     |
| BF002690   | 0.00          | 36P    | Big Fossil | 0.00    | 7,005,555.50 | 0.00          | 0.00        | 1.00      | 21.75     | 42.50     | 63.25     |
| BF002750   | 0.00          | 50A    | Big Fossil | 22.52   | 6,996,938.50 | 19.99         | 12.44       | 5.00      | 6.25      | 7.50      | 8.75      |
| BF002770   | 10.39         | 36W    | Big Fossil | 9.78    | 6,999,656.00 | 0.00          | 9.78        | 406.00    | 456.75    | 507.50    | 558.25    |
| BF002840   | 0.00          | 36W    | Big Fossil | 0.00    | 6,999,618.50 | 2.52          | 0.00        | 287.00    | 296.25    | 305.50    | 314.75    |
| BF002860   | 0.00          | 36X    | Big Fossil | 0.00    | 6,998,827.00 | 0.00          | 0.00        | 397.00    | 381.25    | 365.50    | 349.75    |
| BF002990   | 0.00          | 36T    | Big Fossil | 11.08   | 7,000,927.00 | 0.00          | 11.08       | 711.00    | 681.75    | 652.50    | 623.25    |
| BF003000   | 0.72          | 36S    | Big Fossil | 0.00    | 7,001,354.00 | 0.00          | 0.00        | 193.00    | 185.00    | 177.00    | 169.00    |
| BF003170   | 0.00          | 36T    | Big Fossil | 0.00    | 7,002,699.00 | 0.00          | 0.00        | 586.00    | 561.75    | 537.50    | 513.25    |
| BF003280   | 0.00          | 36N    | Big Fossil | 0.00    | 7,004,906.50 | 0.00          | 0.00        | 328.00    | 376.75    | 425.50    | 474.25    |
| BF003310   | 0.00          | 36X    | Big Fossil | 0.00    | 6,999,289.00 | 0.00          | 0.00        | 493.00    | 473.00    | 453.00    | 433.00    |
| BF003410   | 0.00          | 49D    | Big Fossil | 33.45   | 6,994,705.50 | 0.02          | 33.45       | 28.00     | 28.75     | 29.50     | 30.25     |
| BF003500   | 0.00          | 49C    | Big Fossil | 73.74   | 6,996,978.00 | 0.00          | 51.58       | 59.00     | 61.75     | 64.50     | 67.25     |
| BF003500   | 0.00          | 35Y    | Big Fossil | 0.00    | 6,999,564.50 | 0.00          | 0.00        | 0.00      | 2.50      | 5.00      | 7.50      |
| BF003530   | 19.62         | 49B    | Big Fossil | 61.45   | 6,997,074.00 | 0.00          | 0.00        | 247.00    | 263.25    | 279.50    | 295.75    |
| BF003600   | 0.00          | 35S    | Big Fossil | 0.00    | 7,000,615.00 | 11.43         | 0.00        | 4.00      | 35.00     | 66.00     | 97.00     |
| BF003640   | 0.00          | 34V    | Big Fossil | 0.00    | 7,002,797.50 | 0.00          | 0.00        | 2.00      | 15.50     | 29.00     | 42.50     |
| BF003660   | 0.00          | 34H    | Big Fossil | 44.81   | 7,008,647.00 | 0.00          | 0.00        | 6.00      | 56.75     | 107.50    | 158.25    |
| BF003740   | 0.00          | 34R    | Big Fossil | 0.00    | 7,004,542.50 | 0.00          | 0.00        | 1.00      | 11.00     | 21.00     | 31.00     |

| SUBAREA           | Institutional | MAPSCO | MBASIN         | Non-Sew.0       | Northing      | Office/Retail0 | Parks & Rec.0    | POP_1990         | POP_1995         | POP_2000         | POP_2005 |
|-------------------|---------------|--------|----------------|-----------------|---------------|----------------|------------------|------------------|------------------|------------------|----------|
| BF0003760         | 0.00          | 34K    | Big Fossil     | 21.22           | 7,008,704.00  | 0.00           | 0.00             | 3.00             | 17.00            | 31.00            | 45.00    |
| BF0003820         | 0.00          | 34G    | Big Fossil     | 0.00            | 7,011,036.00  | 0.00           | 0.00             | 0.00             | 0.00             | 0.00             | 0.00     |
| BF0003860         | 0.00          | 49C    | Big Fossil     | 14.09           | 6,994,433.50  | 0.00           | 14.09            | 29.00            | 29.75            | 30.50            | 31.25    |
| BF0003960         | 0.00          | 49C    | Big Fossil     | 25.17           | 6,994,432.50  | 0.00           | 14.76            | 28.00            | 28.75            | 29.50            | 30.25    |
| BF0004230         | 0.00          | 34V    | Big Fossil     | 0.00            | 7,001,173.00  | 0.00           | 0.00             | 1.00             | 10.75            | 20.50            | 30.25    |
| BF0004330         | 0.00          | 34Y    | Big Fossil     | 0.00            | 7,000,511.00  | 0.12           | 0.00             | 16.00            | 82.25            | 148.50           | 214.75   |
| BF0004350         | 0.00          | 34Z    | Big Fossil     | 0.00            | 6,999,622.00  | 0.00           | 0.00             | 2.00             | 18.75            | 35.50            | 52.25    |
| BF0004370         | 0.00          | 34P    | Big Fossil     | 0.00            | 7,004,410.50  | 0.00           | 0.00             | 35.00            | 255.00           | 475.00           | 695.00   |
| BF0004380         | 0.00          | 34F    | Big Fossil     | 0.00            | 7,011,244.00  | 0.00           | 0.00             | 1.00             | 2.25             | 3.50             | 4.75     |
| BF0004420         | 0.00          | 34B    | Big Fossil     | 0.00            | 7,013,388.00  | 0.00           | 0.00             | 1.00             | 2.25             | 3.50             | 4.75     |
| BF0004500         | 0.00          | 20U    | Big Fossil     | 55.70           | 7,017,572.50  | 9.59           | 0.00             | 79.00            | 225.00           | 371.00           | 517.00   |
| BF0004590         | 1.16          | 35V    | Big Fossil     | 0.00            | 7,002,176.50  | 1.18           | 0.00             | 905.00           | 948.25           | 991.50           | 1,034.75 |
| BF0004720         | 0.00          | 36N    | Big Fossil     | 0.00            | 7,003,217.00  | 0.00           | 0.00             | 456.00           | 475.75           | 495.50           | 515.25   |
| BF0004760         | 5.52          | 36S    | Big Fossil     | 0.00            | 7,001,336.00  | 0.00           | 0.00             | 427.00           | 447.00           | 467.00           | 487.00   |
| BF0004800         | 1.34          | 36N    | Big Fossil     | 4.02            | 7,004,688.00  | 0.00           | 4.02             | 292.00           | 305.25           | 318.50           | 331.75   |
| BF0004860         | 0.00          | 36N    | Big Fossil     | 21.13           | 7,005,929.50  | 0.00           | 21.13            | 1,082.00         | 1,130.50         | 1,179.00         | 1,227.50 |
| BF0005040         | 10.60         | 35M    | Big Fossil     | 0.00            | 7,009,453.00  | 0.00           | 0.00             | 924.00           | 977.50           | 1,031.00         | 1,084.50 |
| BF0005080         | 0.00          | 35Y    | Big Fossil     | 0.00            | 6,999,666.50  | 0.00           | 0.00             | 299.00           | 336.25           | 373.50           | 410.75   |
| BF0005130         | 0.00          | 35W    | Big Fossil     | 4.77            | 6,997,163.00  | 9.49           | 0.00             | 242.00           | 257.00           | 272.00           | 287.00   |
| <b>SUB-TOTAL</b>  | <b>405.55</b> |        |                | <b>1,326.67</b> | <b>410.17</b> | <b>819.78</b>  | <b>61,108.58</b> | <b>65,678.18</b> | <b>70,247.79</b> | <b>74,817.40</b> |          |
| BFX10-01          | 0.00          | 35F    | Big Fossil X10 | 33.93           | 446,121.47    | 0.00           | 0.00             | 3.00             | 55.00            | 107.00           | 159.00   |
| BFX10-02          | 0.00          | 35E    | Big Fossil X10 | 120.74          | 445,957.72    | 0.00           | 0.00             | 4.00             | 69.75            | 135.50           | 201.25   |
| BFX10-03          | 0.00          | 21V    | Big Fossil X10 | 20.84           | 454,648.67    | 0.20           | 0.00             | 241.00           | 463.00           | 685.00           | 907.00   |
| BFX10-04          | 0.12          | 21Y    | Big Fossil X10 | 26.36           | 451,091.89    | 0.00           | 0.00             | 154.00           | 315.75           | 477.50           | 639.25   |
| BFX10-05          | 0.00          | 35B    | Big Fossil X10 | 66.21           | 452,946.51    | 4.11           | 0.00             | 8.00             | 121.50           | 235.00           | 348.50   |
| BFX10-06          | 0.00          | 35A    | Big Fossil X10 | 0.00            | 454,157.45    | 0.00           | 0.00             | 14.00            | 100.50           | 187.00           | 273.50   |
| BFX10-07          | 0.00          | 21N    | Big Fossil X10 | 10.17           | 459,207.05    | 15.15          | 0.00             | 66.00            | 130.00           | 194.00           | 258.00   |
| BFX10-10          | 0.00          | 33G    | Big Fossil X10 | 15.03           | 446,683.36    | 0.00           | 0.00             | 24.00            | 25.75            | 27.50            | 29.25    |
| BFX10-11          | 0.00          | 20K    | Big Fossil X10 | 94.22           | 453,189.94    | 2.80           | 0.00             | 68.00            | 92.50            | 117.00           | 141.50   |
| BFX10-12          | 0.00          | 33B    | Big Fossil X10 | 10.33           | 450,642.85    | 0.00           | 0.00             | 18.00            | 19.75            | 21.50            | 23.25    |
| BFX10-13          | 0.00          | 19S    | Big Fossil X10 | 5.60            | 455,391.94    | 0.00           | 0.00             | 12.00            | 12.25            | 12.50            | 12.75    |
| BFX10-15          | 0.00          | 20W    | Big Fossil X10 | 0.00            | 460,292.32    | 0.00           | 0.00             | 11.00            | 20.25            | 29.50            | 38.75    |
| BFX10-16          | 0.00          | 19P    | Big Fossil X10 | 0.00            | 459,809.82    | 0.00           | 0.00             | 5.00             | 5.25             | 5.50             | 5.75     |
| BFX10-17          | 0.00          | 18H    | Big Fossil X10 | 0.00            | 463,341.07    | 20.22          | 0.00             | 15.00            | 15.50            | 16.00            | 16.50    |
| <b>SUB-TOTAL</b>  | <b>0.12</b>   |        |                | <b>403.43</b>   | <b>42.48</b>  | <b>0.00</b>    | <b>643.00</b>    | <b>1,446.75</b>  | <b>2,250.50</b>  | <b>3,054.25</b>  |          |
| <b>TOTAL B.F.</b> | <b>405.67</b> |        |                | <b>1,730.10</b> | <b>452.65</b> | <b>819.78</b>  | <b>61,751.58</b> | <b>67,124.93</b> | <b>72,498.29</b> | <b>77,871.65</b> |          |

| SUBAREA               | Institutional0 | MAPSCO | MBASIN           | Non-Sew.0       | Northing   | Office/Retail0 | Parks & Rec.0 | POP_1990         | POP_1995         | POP_2000         | POP_2005         |
|-----------------------|----------------|--------|------------------|-----------------|------------|----------------|---------------|------------------|------------------|------------------|------------------|
| MCX20-01              | 11.28          |        | Marine Creek X10 | 0.72            | 444,660.36 | 0.13           | 0.00          | 745.00           | 735.25           | 725.50           | 715.75           |
| MCX10-03              | 0.00           |        | Marine Creek X10 | 5.20            | 445,884.78 | 0.00           | 4.03          | 34.00            | 33.50            | 33.00            | 32.50            |
| MCX10-04              | 0.00           |        | Marine Creek X10 | 0.27            | 446,588.04 | 0.00           | 0.00          | 102.00           | 101.00           | 100.00           | 99.00            |
| MCX10-05              | 0.00           |        | Marine Creek X10 | 2.08            | 447,682.35 | 0.00           | 0.00          | 54.00            | 53.50            | 53.00            | 52.50            |
| MCX10-06              | 0.00           |        | Marine Creek X10 | 0.19            | 447,217.10 | 7.28           | 0.00          | 251.00           | 248.50           | 246.00           | 243.50           |
| MCX10-07              | 0.00           |        | Marine Creek X10 | 10.57           | 448,642.64 | 0.00           | 0.00          | 284.00           | 281.75           | 279.50           | 277.25           |
| MCX10-08              | 6.76           |        | Marine Creek X10 | 8.62            | 448,819.28 | 0.00           | 2.93          | 173.00           | 171.75           | 170.50           | 169.25           |
| MCX10-09              | 0.00           |        | Marine Creek X10 | 0.00            | 447,509.80 | 0.00           | 0.00          | 9.00             | 11.00            | 13.00            | 15.00            |
| MCX10-10              | 0.00           |        | Marine Creek X10 | 0.00            | 447,555.34 | 0.00           | 0.00          | 95.00            | 94.75            | 94.50            | 94.25            |
| MCX10-11              | 0.00           |        | Marine Creek X10 | 0.44            | 450,937.04 | 0.00           | 0.44          | 25.00            | 25.75            | 26.50            | 27.25            |
| MCX10-12              | 12.17          |        | Marine Creek X10 | 0.00            | 450,615.12 | 2.38           | 0.00          | 23.00            | 23.50            | 24.00            | 24.50            |
| MCX10-13              | 0.00           |        | Marine Creek X10 | 20.76           | 453,416.13 | 0.00           | 0.00          | 31.00            | 30.50            | 30.00            | 29.50            |
| MCX10-14              | 0.00           |        | Marine Creek X10 | 5.18            | 452,489.74 | 0.00           | 0.00          | 7.00             | 8.50             | 10.00            | 11.50            |
| MCX10-15              | 0.00           |        | Marine Creek X10 | 20.10           | 458,613.39 | 0.00           | 0.00          | 9.00             | 10.25            | 11.50            | 12.75            |
| MCX10-16              | 0.00           |        | Marine Creek X10 | 0.00            | 456,222.72 | 0.00           | 0.00          | 3.00             | 3.75             | 4.50             | 5.25             |
| MCX10-17              | 0.00           |        | Marine Creek X10 | 0.00            | 456,029.31 | 0.00           | 0.00          | 6.00             | 7.50             | 9.00             | 10.50            |
| MCX10-18              | 0.00           |        | Marine Creek X10 | 0.24            | 464,145.15 | 0.00           | 0.00          | 16.00            | 16.75            | 17.50            | 18.25            |
| MCX10-19              | 0.00           |        | Marine Creek X10 | 9.01            | 464,388.59 | 0.00           | 0.00          | 13.00            | 13.50            | 14.00            | 14.50            |
| MCX10-20              | 0.00           |        | Marine Creek X10 | 0.00            | 460,409.74 | 0.00           | 0.00          | 6.00             | 6.75             | 7.50             | 8.25             |
| MCX10-21              | 0.00           |        | Marine Creek X10 | 0.00            | 460,044.85 | 0.00           | 0.00          | 6.00             | 6.75             | 7.50             | 8.25             |
| MCX10-22              | 0.00           |        | Marine Creek X10 | 8.96            | 457,452.58 | 0.00           | 0.00          | 128.00           | 127.00           | 126.00           | 125.00           |
| MCX10-23              | 0.00           |        | Marine Creek X10 | 0.00            | 465,143.86 | 0.00           | 0.00          | 18.00            | 18.75            | 19.50            | 20.25            |
| MCX10-24              | 1.17           |        | Marine Creek X10 | 31.67           | 465,479.85 | 0.00           | 14.60         | 199.00           | 196.75           | 194.50           | 192.25           |
| MCX20-01a             | 0.00           |        | Marine Creek X20 | 96.28           | 471,283.90 | 15.61          | 0.00          | 96.00            | 95.00            | 94.00            | 93.00            |
| MCX20-02              | 0.00           |        | Marine Creek X20 | 0.00            | 473,649.71 | 0.00           | 0.00          | 4.00             | 5.00             | 6.00             | 7.00             |
| MCX20-03              | 0.00           |        | Marine Creek X20 | 15.74           | 470,049.56 | 0.00           | 0.00          | 22.00            | 23.00            | 24.00            | 25.00            |
| MCX20-04              | 0.00           |        | Marine Creek X20 | 5.67            | 470,947.90 | 0.00           | 0.00          | 32.00            | 32.50            | 33.00            | 33.50            |
| MCX20-05              | 0.00           |        | Marine Creek X20 | 1,342.75        | 476,603.28 | 19.55          | 0.00          | 70.00            | 72.25            | 74.50            | 76.75            |
| MCX20-06              | 0.00           |        | Marine Creek X20 | 57.50           | 477,661.31 | 2.12           | 0.00          | 269.00           | 265.25           | 261.50           | 257.75           |
| MCX20-07              | 0.00           |        | Marine Creek X20 | 1.03            | 480,232.85 | 0.00           | 0.00          | 94.00            | 93.00            | 92.00            | 91.00            |
| MCX20-08              | 0.00           |        | Marine Creek X20 | 0.00            | 477,867.04 | 0.00           | 0.00          | 21.00            | 21.75            | 22.50            | 23.25            |
| MCX20-09              | 0.00           |        | Marine Creek X20 | 0.00            | 477,404.16 | 0.00           | 0.00          | 18.00            | 18.75            | 19.50            | 20.25            |
| <b>SUB-TOTAL</b>      | <b>31.38</b>   |        |                  | <b>1,642.98</b> |            | <b>47.07</b>   | <b>22.00</b>  | <b>2,863.00</b>  | <b>2,853.50</b>  | <b>2,844.00</b>  | <b>2,834.50</b>  |
| <b>B.F. CUR. + MC</b> | <b>436.93</b>  |        |                  | <b>2,969.65</b> |            | <b>457.24</b>  | <b>841.78</b> | <b>63,971.58</b> | <b>68,531.68</b> | <b>73,091.79</b> | <b>77,651.90</b> |
| <b>B.F. TOT. + MC</b> | <b>437.05</b>  |        |                  | <b>3,373.08</b> |            | <b>499.72</b>  | <b>841.78</b> | <b>64,614.58</b> | <b>69,978.43</b> | <b>75,342.29</b> | <b>80,706.15</b> |

BIG FULTON COUNTY SEWER STUDY

POPULATION PROJECTIONS - PART 1

TABLE - JAJAPOP-1

| SUBAREA               | Institutional | MAPSCO | MBASIN | Non-Sew.0 | Northing | Office/Retail | Parks & Rec.0 | POP_1990 | POP_1995 | POP_2000 | POP_2005 |
|-----------------------|---------------|--------|--------|-----------|----------|---------------|---------------|----------|----------|----------|----------|
| TOTALS BY CITY        |               |        |        |           |          |               |               |          |          |          |          |
| (1) Haslet            |               |        |        |           |          |               |               | 66       | 130      | 194      | 258      |
| (2) Haltom City       |               |        |        |           |          |               |               | 11,650   | 12,151   | 12,651   | 13,151   |
| (3) Watauga           |               |        |        |           |          |               |               | 17,955   | 18,834   | 19,712   | 20,591   |
| (4) N. Richland Hills |               |        |        |           |          |               |               | 12,652   | 13,371   | 14,091   | 14,809   |
| (5) Richland Hills    |               |        |        |           |          |               |               | 5,797    | 6,164    | 6,530    | 6,897    |
| (6) Saginaw           |               |        |        |           |          |               |               | 35       | 255      | 475      | 695      |
| (7) Fort Worth        |               |        |        |           |          |               |               | 16,459   | 19,074   | 21,690   | 24,305   |

Notes:

| SUBAREA    | POP_2010  | POP_2015  | POP_2020  | Roadway0 | Single Fam.0 | SNAP Subarea | SUBBASIN      | Transp.0 | Under Const.0 | Vacant0  | Water0 |
|------------|-----------|-----------|-----------|----------|--------------|--------------|---------------|----------|---------------|----------|--------|
| BF000350-S | 7,264.00  | 7,365.00  | 7,467.00  | 40.94    | 771.00       | BF000350-S   | CDUAL         | 4.36     | 0.05          | 240.97   | 6.32   |
| BF000350-N | 8,742.00  | 8,865.00  | 8,987.00  | 49.27    | 928.55       | BF000350-N   | CDUAL         | 5.24     | 0.07          | 290.03   | 7.60   |
| BF000380   | 12,257.00 | 12,756.00 | 13,255.00 | 71.12    | 685.48       | BF000380     | HALTOM CITY-A | 39.47    | 0.00          | 1,486.22 | 18.28  |
| BF000890-N | 21,469.02 | 22,274.70 | 23,080.36 | 13.11    | 1,350.75     | BF000890-N   | WATAUGA       | 0.80     | 216.68        | 684.30   | 0.00   |
| BF000890-S | 6,785.84  | 7,040.50  | 7,295.15  | 4.14     | 426.94       | BF000890-S   | NRH           | 0.25     | 68.49         | 216.29   | 0.00   |
| BF000890-W | 1,394.46  | 1,446.79  | 1,499.12  | 0.85     | 87.73        | BF000890-W   | HALTOM CITY   | 0.05     | 14.07         | 44.45    | 0.00   |
| BF001150   | 32.00     | 33.00     | 34.00     | 0.00     | 0.00         | BF001150     | M347          | 0.00     | 0.00          | 68.27    | 0.00   |
| BF001230   | 42.00     | 45.50     | 49.00     | 0.00     | 4.14         | BF001230     | M347          | 0.00     | 0.00          | 88.76    | 8.54   |
| BF001330   | 627.00    | 704.50    | 782.00    | 0.00     | 67.39        | BF001330     | M347          | 0.00     | 0.00          | 4.51     | 0.00   |
| BF001380   | 295.00    | 332.00    | 369.00    | 0.00     | 26.59        | BF001380     | M347          | 0.00     | 0.00          | 7.29     | 0.00   |
| BF001420   | 176.00    | 198.00    | 220.00    | 0.00     | 0.00         | BF001420     | M347          | 0.00     | 0.00          | 22.35    | 0.00   |
| BF001440   | 727.00    | 807.00    | 887.00    | 1.75     | 0.68         | BF001440     | M347          | 0.00     | 0.89          | 331.15   | 1.10   |
| BF001520   | 696.00    | 765.50    | 835.00    | 0.00     | 46.90        | BF001520     | M347          | 0.00     | 21.48         | 13.35    | 1.97   |
| BF001650   | 388.00    | 427.50    | 467.00    | 0.00     | 0.00         | BF001650     | M347          | 0.00     | 0.38          | 79.00    | 1.14   |
| BF001750   | 444.00    | 503.00    | 562.00    | 0.00     | 15.96        | BF001750     | M347          | 0.00     | 0.00          | 157.56   | 0.00   |
| BF001970   | 324.00    | 327.50    | 331.00    | 0.00     | 0.02         | BF001970     | M473          | 0.00     | 2.59          | 68.83    | 0.00   |
| BF002000   | 222.00    | 225.00    | 228.00    | 0.00     | 7.72         | BF002000     | M473          | 0.00     | 9.60          | 37.81    | 0.00   |
| BF002030   | 417.00    | 425.50    | 434.00    | 0.00     | 10.35        | BF002030     | CM402A-A      | 0.00     | 0.00          | 88.16    | 0.00   |
| BF002110   | 1,290.00  | 1,698.00  | 2,106.00  | 0.00     | 0.00         | BF002110     | NEWBF         | 0.00     | 0.00          | 655.15   | 0.00   |
| BF002170   | 2,356.00  | 3,068.00  | 3,780.00  | 0.00     | 24.87        | BF002170     | NEWBF         | 0.00     | 7.68          | 1,669.99 | 0.00   |
| BF002260   | 263.00    | 344.00    | 425.00    | 0.00     | 24.79        | BF002260     | M473          | 0.00     | 83.51         | 94.34    | 0.00   |
| BF002270   | 221.00    | 287.50    | 354.00    | 0.00     | 47.64        | BF002270     | M473          | 0.00     | 40.18         | 32.17    | 0.00   |
| BF002560   | 668.69    | 866.18    | 1,063.67  | 0.00     | 3.08         | BF002560     | CM402A-A      | 0.00     | 35.86         | 240.74   | 0.00   |
| BF002630   | 57.00     | 77.00     | 97.00     | 0.00     | 0.00         | BF002630     | CM402A-A      | 0.00     | 0.00          | 25.83    | 0.00   |
| BF002650   | 100.00    | 130.00    | 160.00    | 0.00     | 0.00         | BF002650     | CM402A-A      | 0.00     | 0.64          | 42.51    | 0.00   |
| BF002690   | 84.00     | 114.00    | 144.00    | 0.00     | 0.00         | BF002690     | CM402A-A      | 0.00     | 0.00          | 38.32    | 0.00   |
| BF002750   | 10.00     | 12.00     | 14.00     | 0.00     | 0.07         | BF002750     | NEWBF         | 0.00     | 0.00          | 32.56    | 10.08  |
| BF002770   | 609.00    | 684.00    | 759.00    | 0.00     | 42.27        | BF002770     | M347          | 0.00     | 0.00          | 7.28     | 0.00   |
| BF002840   | 324.00    | 347.00    | 370.00    | 0.00     | 0.00         | BF002840     | M359          | 0.00     | 0.00          | 46.70    | 0.00   |
| BF002860   | 334.00    | 334.50    | 335.00    | 0.00     | 58.54        | BF002860     | M359          | 0.00     | 0.00          | 8.86     | 0.00   |
| BF002990   | 594.00    | 593.00    | 592.00    | 0.00     | 99.90        | BF002990     | M359          | 0.00     | 0.00          | 7.60     | 0.00   |
| BF003000   | 161.00    | 160.50    | 160.00    | 0.00     | 0.09         | BF003000     | M359          | 0.00     | 0.00          | 31.49    | 0.00   |
| BF003060   | 489.00    | 488.50    | 488.00    | 0.00     | 70.07        | BF003060     | M359          | 0.00     | 0.00          | 27.63    | 0.00   |
| BF003170   | 523.00    | 610.00    | 697.00    | 0.00     | 39.03        | BF003170     | M347          | 0.00     | 0.00          | 127.66   | 0.00   |
| BF003280   | 413.00    | 412.50    | 412.00    | 0.00     | 53.39        | BF003280     | M359          | 0.00     | 16.68         | 12.59    | 0.00   |
| BF003310   | 31.00     | 32.00     | 33.00     | 0.00     | 0.00         | BF003310     | M347          | 0.00     | 0.00          | 50.66    | 0.00   |
| BF003410   | 70.00     | 73.50     | 77.00     | 22.16    | 0.00         | BF003410     | CM402A        | 0.00     | 0.00          | 131.17   | 0.00   |
| BF003500   | 10.00     | 13.50     | 17.00     | 0.00     | 0.00         | BF003500     | CM402A        | 0.00     | 0.00          | 105.61   | 0.00   |
| BF003530   | 312.00    | 337.00    | 362.00    | 61.45    | 2.14         | BF003530     | CM402A        | 0.00     | 0.00          | 298.29   | 0.00   |
| BF003600   | 128.00    | 171.50    | 215.00    | 0.00     | 0.00         | BF003600     | CM402A        | 0.00     | 58.00         | 261.34   | 0.00   |
| BF003640   | 56.00     | 75.50     | 95.00     | 0.00     | 0.00         | BF003640     | NEWBF         | 0.00     | 0.00          | 116.61   | 0.00   |
| BF003660   | 209.00    | 281.50    | 354.00    | 44.81    | 0.00         | BF003660     | NEWBF         | 0.00     | 0.00          | 865.02   | 0.00   |
| BF003740   | 41.00     | 56.00     | 71.00     | 0.00     | 0.00         | BF003740     | NEWBF         | 0.00     | 0.00          | 140.57   | 0.00   |

POPULATION PROJECTIONS - PART 1

BIG FLORENCE SEWER STUDY

| SUBAREA           | POP_2010  | POP_2015  | POP_2020  | Roadway0 | Single Fam.0 | SNAP Subarea    | SUBBASIN | Transp.0 | Under Const.0 | Vacant0   | Water0 |
|-------------------|-----------|-----------|-----------|----------|--------------|-----------------|----------|----------|---------------|-----------|--------|
| BF003760          | 59.00     | 80.50     | 102.00    | 0.00     | 0.00         | 0.00 BF003760   | NEWBF    | 0.00     | 0.00          | 861.66    | 21.22  |
| BF003820          | 0.00      | 0.50      | 1.00      | 0.00     | 0.00         | 0.00 BF003820   | NEWBF    | 0.00     | 0.00          | 35.41     | 0.00   |
| BF003860          | 32.00     | 33.00     | 34.00     | 0.00     | 0.00         | 0.00 BF003860   | M863     | 0.00     | 0.00          | 72.28     | 0.00   |
| BF003960          | 31.00     | 32.00     | 33.00     | 10.41    | 0.00         | 0.00 BF003960   | M863     | 0.00     | 0.00          | 43.49     | 0.00   |
| BF004230          | 40.00     | 54.00     | 68.00     | 0.00     | 0.00         | 0.00 BF004230   | M422     | 0.00     | 0.00          | 87.30     | 0.00   |
| BF004330          | 281.00    | 354.00    | 427.00    | 0.00     | 0.00         | 0.00 BF004330   | M422     | 0.00     | 10.04         | 189.84    | 0.00   |
| BF004350          | 69.00     | 92.50     | 116.00    | 0.00     | 0.00         | 0.00 BF004350   | M422     | 0.00     | 13.70         | 136.32    | 0.00   |
| BF004370          | 915.00    | 1,156.50  | 1,398.00  | 0.00     | 0.00         | 12.04 BF004370  | NEWBF    | 0.00     | 93.81         | 630.99    | 0.00   |
| BF004380          | 6.00      | 7.50      | 9.00      | 0.00     | 0.00         | 0.00 BF004380   | NEWBF    | 0.00     | 0.00          | 83.38     | 0.00   |
| BF004420          | 6.00      | 8.00      | 10.00     | 0.00     | 0.00         | 0.00 BF004420   | NEWBF    | 0.00     | 0.00          | 94.65     | 0.00   |
| BF004500          | 663.00    | 873.50    | 1,084.00  | 0.00     | 55.70        | 237.02 BF004500 | M347     | 0.00     | 0.00          | 18.37     | 0.00   |
| BF004590          | 1,078.00  | 1,187.00  | 1,296.00  | 0.00     | 0.00         | 130.81 BF004590 | M347     | 0.00     | 0.00          | 21.32     | 0.00   |
| BF004720          | 535.00    | 588.50    | 642.00    | 0.00     | 0.00         | 55.00 BF004720  | M347     | 0.00     | 0.00          | 20.89     | 0.00   |
| BF004760          | 507.00    | 558.50    | 610.00    | 0.00     | 0.00         | 45.30 BF004760  | M347     | 0.00     | 0.00          | 0.66      | 0.00   |
| BF004800          | 345.00    | 380.00    | 415.00    | 0.00     | 0.00         | 43.55 BF004800  | M347     | 0.00     | 0.00          | 18.69     | 0.00   |
| BF004860          | 1,276.00  | 1,404.50  | 1,533.00  | 0.00     | 0.00         | 105.50 BF004860 | M347     | 0.00     | 34.64         | 18.69     | 0.00   |
| BF005040          | 448.00    | 503.50    | 559.00    | 0.00     | 0.00         | 19.77 BF005040  | M347     | 0.00     | 0.00          | 236.97    | 0.00   |
| BF005080          | 302.00    | 325.00    | 348.00    | 0.00     | 0.00         | 0.00 BF005080   | M347     | 0.00     | 0.00          | 54.53     | 0.00   |
| BF005130          | 79,387.01 | 84,712.67 | 90,038.30 | 375.71   | 5,546.23     | 1.16 BF005130   | M391A    | 50.17    | 729.70        | 12,650.63 | 81.02  |
| <b>SUB-TOTAL</b>  |           |           |           |          |              |                 |          |          |               |           |        |
| BFX10-01          | 211.00    | 283.00    | 355.00    | 28.78    | 0.00         | 9.56 M825X-01   | 825X     | 0.00     | 0.00          | 373.55    | 5.15   |
| BFX10-02          | 267.00    | 359.00    | 451.00    | 120.74   | 0.00         | 0.00 M911X-01   | 911X     | 0.00     | 0.00          | 651.79    | 0.00   |
| BFX10-03          | 1,129.00  | 1,452.50  | 1,776.00  | 10.90    | 0.00         | 0.00 M822X-04   | 822X     | 0.00     | 0.00          | 1,363.08  | 9.94   |
| BFX10-04          | 801.00    | 1,036.00  | 1,271.00  | 17.05    | 0.00         | 10.02 M822X-03  | 822X     | 0.00     | 0.00          | 1,029.03  | 9.31   |
| BFX10-05          | 462.00    | 621.50    | 781.00    | 63.21    | 0.00         | 0.00 M825X-02   | 825X     | 0.00     | 0.00          | 683.73    | 3.00   |
| BFX10-06          | 360.00    | 482.50    | 605.00    | 0.00     | 0.00         | 31.02 M911X-02  | 911X     | 0.00     | 0.00          | 415.06    | 0.00   |
| BFX10-07          | 322.00    | 415.50    | 509.00    | 0.00     | 0.00         | 236.96 M825X-03 | 825X     | 0.00     | 0.00          | 159.87    | 10.17  |
| BFX10-10          | 31.00     | 33.00     | 35.00     | 0.00     | 0.00         | 0.00 M391X-05   | 391X     | 13.60    | 0.00          | 1,223.26  | 1.43   |
| BFX10-11          | 166.00    | 204.00    | 242.00    | 82.17    | 0.00         | 0.00 M391X-06   | 910X     | 0.00     | 0.00          | 1,408.81  | 12.05  |
| BFX10-12          | 25.00     | 28.50     | 32.00     | 0.00     | 0.00         | 0.00 M391X-07   | 391X     | 10.33    | 0.00          | 1,131.85  | 0.00   |
| BFX10-13          | 13.00     | 13.50     | 14.00     | 0.00     | 0.00         | 0.00 M391X-08   | 391X     | 0.00     | 0.00          | 947.06    | 5.60   |
| BFX10-15          | 48.00     | 62.00     | 76.00     | 0.00     | 0.00         | 0.00 M910X-02   | 910X     | 0.00     | 0.00          | 770.15    | 0.00   |
| BFX10-16          | 6.00      | 6.50      | 7.00      | 0.00     | 0.00         | 0.00 M391X-08   | 391X     | 0.00     | 0.00          | 440.21    | 0.00   |
| BFX10-17          | 17.00     | 17.00     | 17.00     | 0.00     | 0.00         | 0.00 M391X-09   | 391X     | 0.00     | 0.00          | 1,269.81  | 0.00   |
| <b>SUB-TOTAL</b>  | 3,858.00  | 5,014.50  | 6,171.00  | 322.85   | 497.15       |                 |          | 23.93    | 0.00          | 11,867.26 | 56.65  |
| <b>TOTAL B.F.</b> | 83,245.01 | 89,727.17 | 96,209.30 | 698.56   | 6,043.38     |                 |          | 74.10    | 729.70        | 24,517.89 | 137.67 |

| SUBAREA               | POP_2010         | POP_2015         | POP_2020         | Roadway0      | Single Fam.0    | SNAP Subarea | SUBBASIN | Transp.0     | Under Const.0 | Vacant0          | Water0          |
|-----------------------|------------------|------------------|------------------|---------------|-----------------|--------------|----------|--------------|---------------|------------------|-----------------|
| MCX20-01              | 706.00           | 698.50           | 691.00           | 0.00          | 9.39            | M981X-06     | 981X     | 0.00         | 1.28          | 243.34           | 0.72            |
| MCX10-03              | 32.00            | 32.00            | 32.00            | 0.00          | 13.66           | M983X-03     | 983X     | 0.00         | 2.84          | 0.06             | 1.17            |
| MCX10-04              | 98.00            | 97.00            | 96.00            | 0.00          | 32.49           | M983X-04     | 983X     | 0.00         | 13.17         | 15.48            | 0.27            |
| MCX10-05              | 52.00            | 51.50            | 51.00            | 0.00          | 0.02            | M405X-05     | 405X     | 0.00         | 0.00          | 30.47            | 2.08            |
| MCX10-06              | 241.00           | 239.50           | 238.00           | 0.00          | 61.73           | M405X-04     | 405X     | 0.00         | 0.00          | 70.49            | 0.19            |
| MCX10-07              | 275.00           | 274.00           | 273.00           | 0.00          | 147.11          | M405X-06     | 405X     | 0.00         | 0.00          | 142.57           | 10.57           |
| MCX10-08              | 168.00           | 168.00           | 168.00           | 0.00          | 63.46           | M405X-02     | 405X     | 0.00         | 0.00          | 282.25           | 5.04            |
| MCX10-09              | 17.00            | 20.00            | 23.00            | 0.00          | 0.00            | M981X-02     | 981X     | 0.00         | 0.00          | 1,040.59         | 0.00            |
| MCX10-10              | 94.00            | 93.00            | 92.00            | 0.00          | 0.10            | M981X-01     | 981X     | 0.00         | 0.04          | 360.05           | 0.00            |
| MCX10-11              | 28.00            | 29.50            | 31.00            | 0.00          | 1.15            | M983X-01     | 983X     | 0.00         | 0.68          | 567.24           | 0.00            |
| MCX10-12              | 25.00            | 26.00            | 27.00            | 0.00          | 1.16            | M405X-01     | 405X     | 0.00         | 0.00          | 344.11           | 0.00            |
| MCX10-13              | 29.00            | 29.50            | 30.00            | 0.00          | 0.00            | M405X-03     | 405X     | 0.00         | 0.00          | 486.50           | 9.29            |
| MCX10-14              | 13.00            | 15.00            | 17.00            | 0.00          | 0.00            | M981X-03     | 981X     | 1.01         | 0.00          | 975.00           | 4.17            |
| MCX10-15              | 14.00            | 15.50            | 17.00            | 0.00          | 0.00            | M981X-05     | 981X     | 15.43        | 0.00          | 796.13           | 4.67            |
| MCX10-16              | 6.00             | 7.00             | 8.00             | 0.00          | 0.00            | M981X-04     | 981X     | 0.00         | 0.00          | 383.73           | 0.00            |
| MCX10-17              | 12.00            | 14.00            | 16.00            | 0.00          | 0.00            | M983X-02     | 983X     | 0.00         | 0.00          | 758.58           | 0.00            |
| MCX10-18              | 19.00            | 20.00            | 21.00            | 0.00          | 0.00            | M984X-06     | 984X     | 0.24         | 0.00          | 750.93           | 0.00            |
| MCX10-19              | 15.00            | 15.50            | 16.00            | 0.00          | 0.00            | M984X-05     | 984X     | 0.00         | 0.00          | 510.88           | 9.01            |
| MCX10-20              | 9.00             | 10.50            | 12.00            | 0.00          | 0.00            | M984X-04     | 984X     | 0.00         | 0.00          | 605.22           | 0.00            |
| MCX10-21              | 9.00             | 9.50             | 10.00            | 0.00          | 0.00            | M984X-03     | 981X     | 0.00         | 0.00          | 598.41           | 0.00            |
| MCX10-22              | 124.00           | 123.00           | 122.00           | 0.00          | 0.00            | M988X-01     | 988X     | 0.00         | 0.00          | 803.18           | 8.96            |
| MCX10-23              | 21.00            | 22.00            | 23.00            | 0.00          | 0.00            | M984X-02     | 984X     | 0.00         | 0.00          | 745.65           | 0.00            |
| MCX10-24              | 190.00           | 189.00           | 188.00           | 0.00          | 168.61          | M984X-01     | 984X     | 0.00         | 0.00          | 974.56           | 17.07           |
| MCX20-01a             | 92.00            | 92.00            | 92.00            | 88.57         | 0.00            | 20927X-07    | 20297X   | 0.00         | 0.00          | 1,364.96         | 7.71            |
| MCX20-02              | 8.00             | 10.00            | 12.00            | 0.00          | 0.00            | 20927X-06    | 20297X   | 0.00         | 0.00          | 635.29           | 0.00            |
| MCX20-03              | 26.00            | 27.50            | 29.00            | 0.00          | 0.00            | 20927X-03    | 20297X   | 0.00         | 0.00          | 949.40           | 15.74           |
| MCX20-04              | 34.00            | 35.00            | 36.00            | 0.00          | 50.39           | 20927X-02    | 20297X   | 0.00         | 0.00          | 701.03           | 5.67            |
| MCX20-05              | 79.00            | 82.50            | 86.00            | 0.00          | 47.86           | 20927X-01    | 20297X   | 0.00         | 0.00          | 1,656.49         | 1,342.75        |
| MCX20-06              | 254.00           | 251.50           | 249.00           | 57.50         | 22.12           | 20927X-08    | 20297X   | 0.00         | 0.00          | 1,072.22         | 0.00            |
| MCX20-07              | 90.00            | 88.50            | 87.00            | 1.03          | 65.91           | 20927X-09    | 20297X   | 0.00         | 0.00          | 381.49           | 0.00            |
| MCX20-08              | 24.00            | 23.50            | 23.00            | 0.00          | 0.00            | 20927X-05    | 20297X   | 0.00         | 0.00          | 703.99           | 0.00            |
| MCX20-09              | 21.00            | 22.00            | 23.00            | 0.00          | 0.00            | 20927X-04    | 20297X   | 0.00         | 0.00          | 962.56           | 0.00            |
| <b>SUB-TOTAL</b>      | <b>2,825.00</b>  | <b>2,832.00</b>  | <b>2,839.00</b>  | <b>147.10</b> | <b>685.16</b>   |              |          | <b>16.68</b> | <b>18.01</b>  | <b>19,912.85</b> | <b>1,445.08</b> |
| <b>B.F. CUR. + MC</b> | <b>82,212.01</b> | <b>87,544.67</b> | <b>92,877.30</b> | <b>522.81</b> | <b>6,231.39</b> |              |          | <b>66.85</b> | <b>747.71</b> | <b>32,563.48</b> | <b>1,526.10</b> |
| <b>B.F. TOT. + MC</b> | <b>86,070.01</b> | <b>92,559.17</b> | <b>99,048.30</b> | <b>845.66</b> | <b>6,728.54</b> |              |          | <b>90.78</b> | <b>747.71</b> | <b>44,430.74</b> | <b>1,582.75</b> |



| SUBAREA               | POP_2010 | POP_2015 | POP_2020 | Roadway0 | Single Fam.0 | SNAP Subarea | SUBBASIN | Transp.0 | Under Const.0 | Vacant0 | Water0 |
|-----------------------|----------|----------|----------|----------|--------------|--------------|----------|----------|---------------|---------|--------|
| TOTALS BY CITY        |          |          |          |          |              |              |          |          |               |         |        |
| (1) Haslet            | 322      | 416      | 509      |          |              |              |          |          |               |         |        |
| (2) Haltom City       | 13,651   | 14,203   | 14,754   |          |              |              |          |          |               |         |        |
| (3) Watauga           | 21,469   | 22,275   | 23,080   |          |              |              |          |          |               |         |        |
| (4) N. Richland Hills | 15,528   | 15,906   | 16,282   |          |              |              |          |          |               |         |        |
| (5) Richland Hills    | 7,264    | 7,365    | 7,467    |          |              |              |          |          |               |         |        |
| (6) Saginaw           | 915      | 1,157    | 1,398    |          |              |              |          |          |               |         |        |
| (7) Fort Worth        | 26,921   | 31,239   | 35,558   |          |              |              |          |          |               |         |        |

Notes:

***EXHIBIT "H"***

***FORT WORTH POPULATION PROJECTIONS***

***TABLE "LUAPOP-2"***

| SUBAREA | 90 Sewer Acres | 95 Equiv Pop | 1995 Sewer Acres | 00 Equiv Pop | 2000 Sewer Acres | 05 Equiv Pop | 2005 Sewer Acres | 10 Equiv Pop | 2010 Sewer Acres | 15 Equiv Pop | 2015 Sewer Acres |
|---------|----------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|
|---------|----------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|

BIG FOSSIL CURRENT SERVICE AREA

|            |          |           |          |           |          |           |          |           |          |           |          |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| BF003960   | 12.69    | 81.50     | 14.67    | 92.50     | 16.65    | 103.50    | 18.63    | 114.50    | 20.61    | 155.50    | 27.99    |
| BF000380   | 1,189.26 | 11,806.25 | 1,276.49 | 12,613.00 | 1,363.71 | 13,419.75 | 1,450.94 | 14,226.50 | 1,538.16 | 15,201.00 | 1,643.52 |
| BF001150   | 5.51     | 86.75     | 6.37     | 98.50     | 7.24     | 110.25    | 8.10     | 122.00    | 8.96     | 165.75    | 12.18    |
| BF001440   | 9.56     | 636.75    | 12.74    | 676.50    | 13.53    | 716.25    | 14.33    | 756.00    | 15.12    | 862.75    | 17.26    |
| BF001970   | 6.72     | 366.50    | 7.33     | 354.00    | 7.33     | 341.50    | 7.33     | 329.00    | 7.33     | 334.50    | 7.33     |
| BF002170   | 138.65   | 1,444.63  | 219.02   | 1,974.75  | 299.40   | 2,504.88  | 379.77   | 3,035.00  | 460.15   | 3,821.75  | 579.43   |
| BF003310   | 0.07     | 84.38     | 1.69     | 95.75     | 1.92     | 107.13    | 2.14     | 118.50    | 2.37     | 160.75    | 3.22     |
| BF003600   | 137.81   | 105.25    | 250.08   | 152.50    | 362.35   | 199.75    | 399.15   | 247.00    | 399.15   | 366.25    | 399.15   |
| BF003640   | 6.67     | 49.38     | 11.16    | 69.25     | 15.66    | 89.13     | 20.15    | 109.00    | 24.65    | 154.00    | 34.82    |
| BF003660   | 13.97    | 108.63    | 38.42    | 177.75    | 62.87    | 246.88    | 87.31    | 316.00    | 111.76   | 543.50    | 192.22   |
| BF003760   | 14.83    | 24.38     | 120.49   | 45.75     | 226.16   | 67.13     | 331.82   | 88.50     | 437.49   | 178.75    | 876.49   |
| BF003820   | 18.25    | 5.00      | 20.28    | 5.50      | 22.31    | 6.00      | 24.33    | 6.50      | 26.36    | 18.25     | 53.66    |
| BF004330   | 33.75    | 107.13    | 96.41    | 176.75    | 159.08   | 246.38    | 221.74   | 316.00    | 223.59   | 401.00    | 223.59   |
| BF004380   | 0.39     | 3.75      | 1.46     | 6.50      | 2.54     | 9.25      | 3.61     | 12.00     | 4.68     | 31.75     | 12.38    |
| BF005130   | 49.53    | 359.25    | 54.25    | 390.50    | 58.97    | 421.75    | 63.69    | 453.00    | 68.41    | 543.00    | 82.00    |
| BF004500   | 356.69   | 289.38    | 822.45   | 453.25    | 1,219.42 | 617.13    | 1,219.42 | 781.00    | 1,219.42 | 1,163.75  | 1,219.42 |
| BF003000   | 0.81     | 185.75    | 3.72     | 178.00    | 3.72     | 170.25    | 3.72     | 162.50    | 3.72     | 162.50    | 3.72     |
| BF003530   | 23.13    | 364.13    | 25.64    | 399.75    | 28.15    | 435.38    | 30.66    | 471.00    | 33.16    | 583.25    | 41.07    |
| BF001520   | 83.37    | 619.50    | 87.24    | 647.00    | 91.12    | 674.50    | 94.99    | 702.00    | 96.72    | 773.50    | 96.72    |
| BF005040   | 30.37    | 983.25    | 32.20    | 1,039.00  | 34.02    | 1,094.75  | 35.85    | 1,150.50  | 37.67    | 1,282.00  | 41.98    |
| BF001750   | 17.94    | 366.13    | 19.72    | 399.25    | 21.51    | 432.38    | 23.29    | 465.50    | 25.08    | 538.50    | 29.01    |
| BF002770   | 52.66    | 461.00    | 59.21    | 512.00    | 59.94    | 563.00    | 59.94    | 614.00    | 59.94    | 689.50    | 59.94    |
| BF004760   | 50.82    | 449.13    | 53.27    | 469.75    | 55.71    | 490.38    | 58.16    | 511.00    | 60.60    | 564.00    | 66.89    |
| BF001420   | 13.00    | 133.63    | 14.60    | 148.25    | 16.20    | 162.88    | 17.79    | 177.50    | 19.39    | 199.75    | 21.82    |
| BF001650   | 0.38     | 344.25    | 6.89     | 360.50    | 7.21     | 376.75    | 7.54     | 393.00    | 7.86     | 436.50    | 8.73     |
| BF002000   | 17.32    | 248.88    | 17.32    | 241.25    | 17.32    | 233.63    | 17.32    | 226.00    | 17.32    | 230.50    | 17.32    |
| BF002110   | 15.00    | 442.63    | 45.48    | 739.25    | 75.95    | 1,035.88  | 106.43   | 1,332.50  | 136.90   | 1,764.00  | 181.23   |
| BF002260   | 109.51   | 109.88    | 203.85   | 171.25    | 203.85   | 232.63    | 203.85   | 294.00    | 203.85   | 385.75    | 203.85   |
| BF002560   | 45.24    | 266.97    | 97.56    | 410.14    | 149.88   | 553.31    | 202.20   | 696.48    | 254.52   | 909.13    | 285.98   |
| BF002630   | 0.20     | 16.25     | 1.63     | 30.50     | 3.05     | 44.75     | 4.48     | 59.00     | 5.90     | 80.00     | 8.00     |
| BF002850   | 0.64     | 39.50     | 1.40     | 61.00     | 2.17     | 82.50     | 2.93     | 104.00    | 3.70     | 136.25    | 4.84     |
| BF002690   | 0.10     | 22.38     | 2.24     | 43.75     | 4.38     | 65.13     | 6.51     | 86.50     | 8.65     | 118.00    | 11.80    |
| BF003500   | 0.10     | 5.00      | 0.63     | 10.00     | 1.25     | 15.00     | 1.88     | 20.00     | 2.50     | 34.00     | 4.25     |
| BF003740   | 5.00     | 29.50     | 10.17    | 44.50     | 15.34    | 59.50     | 20.52    | 74.50     | 25.69    | 114.50    | 39.48    |
| BF003860   | 10.00    | 86.63     | 11.55    | 98.25     | 13.10    | 109.88    | 14.65    | 121.50    | 16.20    | 165.00    | 22.00    |
| BF004230   | 7.00     | 34.88     | 11.91    | 49.25     | 16.82    | 63.63     | 21.73    | 78.00     | 26.63    | 110.00    | 37.56    |
| BF004350   | 13.70    | 60.13     | 23.20    | 84.75     | 32.71    | 109.38    | 42.21    | 134.00    | 51.71    | 188.50    | 72.75    |
| BF004370   | 132.80   | 325.38    | 472.24   | 559.25    | 763.79   | 793.13    | 763.79   | 1,027.00  | 763.79   | 1,311.50  | 763.79   |
| BF004420   | 0.10     | 3.88      | 0.39     | 6.75      | 0.68     | 9.63      | 0.96     | 12.50     | 1.25     | 35.25     | 3.53     |
| BF005080   | 45.00    | 339.38    | 50.57    | 376.75    | 54.53    | 414.13    | 54.53    | 451.50    | 54.53    | 507.75    | 54.53    |
| BF002270   | 92.33    | 89.50     | 124.50   | 138.50    | 124.50   | 187.50    | 124.50   | 236.50    | 124.50   | 309.50    | 124.50   |
| BF004860   | 141.57   | 1,136.25  | 148.12   | 1,186.50  | 154.67   | 1,236.75  | 160.26   | 1,287.00  | 160.26   | 1,419.50  | 160.26   |
| BF000350-S | 1,013.39 | 7,417.36  | 1,085.47 | 7,909.96  | 1,157.66 | 8,402.56  | 1,229.65 | 8,895.16  | 1,254.35 | 9,134.77  | 1,254.35 |
| BF000350-N | 1,219.72 | 8,927.64  | 1,306.49 | 9,520.54  | 1,393.26 | 10,113.44 | 1,480.02 | 10,706.34 | 1,509.76 | 10,994.73 | 1,509.76 |
| BF000890-N | 1,799.08 | 19,698.57 | 1,888.78 | 20,634.12 | 1,978.49 | 21,569.68 | 2,068.19 | 22,505.23 | 2,157.90 | 23,387.14 | 2,242.46 |
| BF000890-S | 568.65   | 6,226.24  | 597.00   | 6,521.95  | 625.35   | 6,817.66  | 653.71   | 7,113.36  | 682.06   | 7,392.11  | 708.79   |
| BF000890-W | 116.85   | 1,279.46  | 122.68   | 1,340.23  | 128.51   | 1,401.00  | 134.33   | 1,461.76  | 140.16   | 1,519.04  | 145.65   |
| BF003280   | 70.07    | 475.13    | 70.07    | 455.75    | 70.07    | 436.38    | 70.07    | 417.00    | 70.07    | 418.00    | 70.07    |
| BF002750   | 20.06    | 15.75     | 26.33    | 19.50     | 32.60    | 23.25     | 38.87    | 27.00     | 45.14    | 39.50     | 52.62    |
| BF002840   | 2.52     | 298.00    | 5.96     | 307.50    | 6.15     | 317.00    | 6.34     | 326.50    | 6.53     | 350.00    | 7.00     |
| BF003410   | 2.35     | 160.75    | 3.22     | 183.00    | 3.66     | 205.25    | 4.11     | 227.50    | 4.55     | 307.00    | 6.14     |
| BF001230   | 4.67     | 87.38     | 5.67     | 102.75    | 6.66     | 118.13    | 7.66     | 133.50    | 8.66     | 184.50    | 11.97    |
| BF001330   | 67.39    | 474.63    | 71.90    | 527.25    | 71.90    | 579.88    | 71.90    | 632.50    | 71.90    | 710.25    | 71.90    |
| BF001380   | 26.59    | 223.63    | 29.88    | 248.25    | 33.17    | 272.88    | 33.88    | 297.50    | 33.88    | 334.75    | 33.88    |

| SUBAREA                                   | 90 Sewer Acres  | 95 Equiv Pop     | 1995 Sewer Acres | 00 Equiv Pop     | 2000 Sewer Acres | 05 Equiv Pop     | 2005 Sewer Acres | 10 Equiv Pop     | 2010 Sewer Acres | 15 Equiv Pop      | 2015 Sewer Acres |
|---|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-------------------|------------------|
| BF002030                                  | 10.35           | 457.25           | 10.35            | 446.00           | 10.35            | 434.75           | 10.35            | 423.50           | 10.35            | 434.25            | 10.35            |
| BF002860                                  | 58.54           | 382.88           | 58.54            | 367.75           | 58.54            | 352.63           | 58.54            | 337.50           | 58.54            | 339.25            | 58.54            |
| BF002990                                  | 99.90           | 684.75           | 99.90            | 656.50           | 99.90            | 628.25           | 99.90            | 600.00           | 99.90            | 601.25            | 99.90            |
| BF003060                                  | 70.07           | 564.50           | 70.07            | 541.00           | 70.07            | 517.50           | 70.07            | 494.00           | 70.07            | 495.25            | 70.07            |
| BF003170                                  | 39.03           | 380.13           | 39.03            | 431.25           | 39.03            | 482.38           | 39.03            | 533.50           | 39.03            | 626.00            | 39.03            |
| BF004590                                  | 133.15          | 952.75           | 139.71           | 997.50           | 146.27           | 1,042.25         | 151.52           | 1,087.00         | 151.52           | 1,199.25          | 151.52           |
| BF004720                                  | 55.00           | 478.00           | 57.46            | 498.50           | 59.93            | 519.00           | 62.39            | 539.50           | 64.86            | 594.50            | 71.47            |
| BF004800                                  | 44.89           | 306.75           | 45.55            | 320.50           | 45.55            | 334.25           | 45.55            | 348.00           | 45.55            | 384.00            | 45.55            |
| <b>SUB-TOTAL 1</b>                        | <b>8,324.71</b> | <b>72,214.12</b> | <b>10,218.66</b> | <b>77,817.70</b> | <b>11,839.80</b> | <b>83,421.27</b> | <b>12,687.40</b> | <b>89,024.84</b> | <b>13,319.28</b> | <b>98,596.43</b>  | <b>14,446.44</b> |
| <b>BIG FOSSIL EXTRA 2020 SERVICE AREA</b> |                 |                  |                  |                  |                  |                  |                  |                  |                  |                   |                  |
| BFX10-01                                  | 9.56            | 80.88            | 96.65            | 153.75           | 183.73           | 226.63           | 270.82           | 299.50           | 357.90           | 425.50            | 375.34           |
| BFX10-02                                  | 30.33           | 113.13           | 146.00           | 202.75           | 261.68           | 292.38           | 377.35           | 382.00           | 493.02           | 579.25            | 722.57           |
| BFX10-05                                  | 25.40           | 204.75           | 101.97           | 358.50           | 178.55           | 512.25           | 255.12           | 666.00           | 331.69           | 912.75            | 454.59           |
| BFX10-06                                  | 44.82           | 142.88           | 156.19           | 244.75           | 267.55           | 346.63           | 378.92           | 448.50           | 413.89           | 612.25            | 413.89           |
| BFX10-07                                  | 282.67          | 153.63           | 407.44           | 227.75           | 407.44           | 301.88           | 407.44           | 376.00           | 407.44           | 491.25            | 407.44           |
| BFX10-03                                  | 5.47            | 488.75           | 11.07            | 736.00           | 16.67            | 983.25           | 22.27            | 1,230.50         | 27.87            | 1,609.25          | 36.45            |
| BFX10-04                                  | 12.85           | 354.38           | 29.26            | 553.25           | 45.72            | 752.13           | 62.15            | 951.00           | 78.59            | 1,267.00          | 104.70           |
| BFX10-15                                  | 17.74           | 34.13            | 46.57            | 55.25            | 75.40            | 76.38            | 104.22           | 97.50            | 133.05           | 266.00            | 362.99           |
| BFX10-16                                  | 1.00            | 9.13             | 1.07             | 9.75             | 1.15             | 10.38            | 1.22             | 11.00            | 1.29             | 49.25             | 5.79             |
| BFX10-10                                  | 18.51           | 50.38            | 20.05            | 54.25            | 21.60            | 58.13            | 23.14            | 62.00            | 24.68            | 95.25             | 37.92            |
| BFX10-11                                  | 231.44          | 110.63           | 343.67           | 146.75           | 455.89           | 182.88           | 568.12           | 219.00           | 680.34           | 491.75            | 1,527.66         |
| BFX10-12                                  | 92.63           | 61.50            | 99.94            | 66.00            | 107.26           | 70.50            | 114.57           | 75.00            | 121.88           | 115.75            | 188.10           |
| BFX10-13                                  | 47.44           | 59.50            | 48.67            | 61.00            | 49.89            | 62.50            | 51.12            | 64.00            | 52.35            | 82.25             | 67.27            |
| BFX10-17                                  | 48.57           | 40.00            | 49.82            | 41.00            | 51.06            | 42.00            | 52.31            | 43.00            | 53.55            | 68.00             | 84.69            |
| <b>SUB-TOTAL 2</b>                        | <b>868.43</b>   | <b>1,903.63</b>  | <b>1,558.39</b>  | <b>2,910.75</b>  | <b>2,123.57</b>  | <b>3,917.88</b>  | <b>2,688.76</b>  | <b>4,925.00</b>  | <b>3,177.56</b>  | <b>7,065.50</b>   | <b>4,789.40</b>  |
| <b>TOTAL B.F.</b>                         | <b>9,193.14</b> | <b>74,117.75</b> | <b>11,777.05</b> | <b>80,728.45</b> | <b>13,963.37</b> | <b>87,339.14</b> | <b>15,376.16</b> | <b>93,949.84</b> | <b>16,496.83</b> | <b>103,661.93</b> | <b>19,235.84</b> |

**MARINE CREEK AREA TO BE PUMPED TO BIG FOSSIL AREA**

|          |        |        |        |        |        |        |        |        |        |        |        |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| MCX20-01 | 42.20  | 107.13 | 42.20  | 106.75 | 42.20  | 106.38 | 42.20  | 106.00 | 42.20  | 121.25 | 47.60  |
| MCX20-03 | 13.13  | 57.50  | 13.48  | 59.00  | 13.83  | 60.50  | 14.19  | 62.00  | 14.54  | 68.00  | 15.94  |
| MCX20-04 | 174.86 | 45.88  | 178.26 | 46.75  | 181.66 | 47.63  | 185.06 | 48.50  | 188.46 | 55.75  | 216.63 |
| MCX20-05 | 226.83 | 115.50 | 233.92 | 119.00 | 241.01 | 122.50 | 248.10 | 126.00 | 255.18 | 145.25 | 294.17 |
| MCX20-06 | 193.96 | 273.63 | 193.96 | 270.25 | 193.96 | 266.88 | 193.96 | 263.50 | 193.96 | 270.00 | 193.96 |
| MCX20-07 | 94.64  | 101.25 | 94.64  | 100.50 | 94.64  | 99.75  | 94.64  | 99.00  | 94.64  | 100.75 | 94.64  |
| MCX20-08 | 18.23  | 33.00  | 18.80  | 34.00  | 19.37  | 35.00  | 19.94  | 36.00  | 20.51  | 41.00  | 23.35  |
| MCX20-09 | 0.00   | 24.25  | 3.03   | 25.50  | 3.19   | 26.75  | 3.34   | 28.00  | 3.50   | 38.00  | 4.75   |
| MCX20-10 | 12.11  | 101.75 | 12.14  | 102.00 | 12.17  | 102.25 | 12.20  | 102.50 | 12.23  | 110.00 | 13.12  |
| MCX20-11 | 56.27  | 26.13  | 58.80  | 27.25  | 61.33  | 28.38  | 63.87  | 29.50  | 66.40  | 39.50  | 88.91  |
| MCX20-12 | 71.68  | 41.25  | 73.01  | 42.00  | 74.33  | 42.75  | 75.66  | 43.50  | 76.99  | 51.00  | 90.26  |
| MCX20-13 | 232.66 | 118.38 | 232.66 | 118.25 | 232.66 | 118.13 | 232.66 | 118.00 | 232.66 | 128.25 | 251.80 |
| MCX20-16 | 0.00   | 3.88   | 0.48   | 4.75   | 0.59   | 5.63   | 0.70   | 6.50   | 0.81   | 11.50  | 1.44   |
| MCX20-17 | 0.00   | 7.88   | 0.98   | 9.75   | 1.22   | 11.63  | 1.45   | 13.50  | 1.69   | 23.50  | 2.94   |
| MCX20-19 | 7.67   | 33.25  | 7.85   | 34.00  | 8.02   | 34.75  | 8.20   | 35.50  | 8.38   | 38.50  | 9.09   |
| MCX20-20 | 11.60  | 11.50  | 12.70  | 12.50  | 13.81  | 13.50  | 14.91  | 14.50  | 16.02  | 21.00  | 23.20  |
| MCX20-21 | 1.32   | 9.88   | 1.45   | 10.75  | 1.58   | 11.63  | 1.71   | 12.50  | 1.83   | 18.00  | 2.64   |
| MCX20-22 | 0.00   | 127.25 | 15.91  | 126.50 | 15.91  | 125.75 | 15.91  | 125.00 | 15.91  | 139.00 | 17.38  |
| MCX20-23 | 4.76   | 46.63  | 4.88   | 47.75  | 5.00   | 48.88  | 5.11   | 50.00  | 5.23   | 54.50  | 5.70   |
| MCX20-24 | 376.53 | 210.25 | 376.53 | 208.50 | 376.53 | 206.75 | 376.53 | 205.00 | 376.53 | 215.50 | 382.75 |
| MCX10-02 | 27.23  | 797.25 | 27.23  | 789.50 | 27.23  | 781.75 | 27.23  | 774.00 | 27.23  | 802.75 | 27.23  |

SUBAREA POPULATION PROJECTIONS - PART 2

BIG FOSSIL SEWER STUDY

| SUBAREA | 90 Sewer Acres | 95 Equiv Pop | 1995 Sewer Acres | 00 Equiv Pop | 2000 Sewer Acres | 05 Equiv Pop | 2005 Sewer Acres | 10 Equiv Pop | 2010 Sewer Acres | 15 Equiv Pop | 2015 Sewer Acres |
|---------|----------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|
|---------|----------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|

NOTES:

BIG FOSSIL CURRENT SERVICE AREA = Year 2000 Watershed Area, Including Area Served by TCWSC Line, but not including Marine Creek or BFX Areas

Refer to Drain. Area Map titled "Lower Big Fossil Watershed" included in TAB 1 of the report.

BIG FOSSIL EXTRA 2020 SERVICE AREA = Area within the Natural Big Fossil Watershed not currently served by the Big Fossil System but Expected to be Served by Year 2020

TOTAL B.F. = SUB-TOTAL 1 + SUB-TOTAL 2 = Big Fossil Current Service Area + Big Fossil Extra 2020 Service Area

MARINE CREEK AREA TO BE PUMPED TO BIG FOSSIL AREA = This is the portion of the Marine Creek Watershed currently proposed by the Ft. Worth Master Plan to be Served by the Big Fossil System

B.F. CUR. + MC = Current Big Fossil Service Area + Marine Creek Area (Does not include BFX area)

B.F. TOT + MC = Current Big Fossil Service Area + BFX Area + Marine Creek Area

TCWSC LINE = Areas served by the TSWSC Line as presented in the Fort Worth Master Plan. However, NRH Area BF000890-S is not included, but is included in TCWSC (REV.)

BF - TCWSC = Total Big Fossil Area less TCWSC Area

BF - M.C. = Total Big Fossil Area less Marine Creek Area

BF - MC - BFX = Total Big Fossil Area less Marine Creek and BFX Areas

TCWSC (REV.) = This is the corrected TCWSC area which serves Richland Hills and NRH

NRH (BF) = This is the total portion of NRH in the Big Fossil Watershed area currently served by the TCWSC Line

HALTOM (BF) = This is the total portion of Haltom City in the Big Fossil Watershed area currently served by the C.O.F.W. Line

HALTOM (BF+LF) = This is the total portion of Haltom City in the Big Fossil Watershed plus a portion of the Little Fossil watershed area which could be diverted to the Big Fossil Area and served by the proposed C.O.F.W. parallel line.

DESIGN OPTIONS:

|                     |           |           |           |           |           |            |           |            |           |            |           |
|---------------------|-----------|-----------|-----------|-----------|-----------|------------|-----------|------------|-----------|------------|-----------|
| 1a TOTAL BIG FOSSIL | 11,434.23 | 77,489.75 | 14,117.54 | 84,110.95 | 16,375.53 | 90,732.14  | 17,859.97 | 97,353.34  | 19,052.31 | 107,459.18 | 22,332.45 |
| LITTLE FOSSIL       | 1,995.25  | 14,487.98 | 1,995.25  | 14,419.86 | 1,995.25  | 14,351.78  | 1,995.25  | 14,283.68  | 1,995.25  | 14,275.34  | 1,995.25  |
| TOTAL               | 13,429.47 | 91,977.73 | 16,112.79 | 98,530.83 | 18,370.77 | 105,083.92 | 19,855.22 | 111,637.02 | 21,047.55 | 121,734.52 | 24,327.69 |
| 1b LESS MARINE CK.  | 11,188.38 | 88,605.73 | 13,772.29 | 95,148.33 | 15,958.62 | 101,690.92 | 17,371.40 | 108,233.52 | 18,492.08 | 117,937.27 | 21,231.08 |
| 1c LESS INTEL       | 11,188.38 | 88,605.73 | 13,772.29 | 95,148.33 | 15,958.62 | 101,690.92 | 17,371.40 | 108,233.52 | 18,492.08 | 117,937.27 | 21,231.08 |
| 1d LESS LITTLE FOS. | 11,434.23 | 77,489.75 | 14,117.54 | 84,110.95 | 16,375.53 | 90,732.14  | 17,859.97 | 97,353.34  | 19,052.31 | 107,459.18 | 22,332.45 |
| 2a LESS R. HILLS    | 12,416.09 | 84,560.37 | 15,027.32 | 90,620.86 | 17,213.21 | 96,681.36  | 18,625.57 | 102,741.86 | 19,793.20 | 112,599.75 | 23,073.34 |
| 2b TCWSC (RH)       | 1,013.39  | 7,417.36  | 1,085.47  | 7,909.96  | 1,157.56  | 8,402.56   | 1,229.65  | 8,895.16   | 1,254.35  | 9,134.77   | 1,254.35  |
| 3a F.W. _ H.C. ONLY | 10,627.72 | 69,406.48 | 13,123.83 | 74,578.37 | 15,194.60 | 79,750.27  | 16,491.84 | 84,922.16  | 17,601.38 | 94,212.90  | 20,854.79 |
| 3b TCWSC (NRH,RH)   | 2,801.76  | 22,571.24 | 2,988.96  | 23,952.45 | 3,176.17  | 25,333.66  | 3,363.38  | 26,714.86  | 3,446.17  | 27,521.61  | 3,472.90  |

NOTE: Options Which include Intel Facility -- a constant Flow of 6.0 MGD is added to the model for each design year

SUBAREA POPULATION PROJECTIONS - PART 2

BIG FOS... SEWER STUDY

| SUBAREA               | 90 Sewer Acres | 95 Equiv Pop | 1995 Sewer Acres | 00 Equiv Pop | 2000 Sewer Acres | 05 Equiv Pop | 2005 Sewer Acres | 10 Equiv Pop | 2010 Sewer Acres | 15 Equiv Pop | 2015 Sewer Acres |
|-----------------------|----------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|--------------|------------------|
| TOTALS BY CITY        |                |              |                  |              |                  |              |                  |              |                  |              |                  |
| (1) Haslet            | 283            | 154          | 407              | 228          | 407              | 302          | 407              | 376          | 407              | 491          | 407              |
| (2) Haltom City       | 1,306          | 13,086       | 1,399            | 13,953       | 1,492            | 14,821       | 1,585            | 15,688       | 1,678            | 16,720       | 1,789            |
| (3) Watauga           | 1,799          | 19,699       | 1,889            | 20,634       | 1,978            | 21,570       | 2,068            | 22,505       | 2,158            | 23,387       | 2,242            |
| (4) N. Richland Hills | 1,788          | 15,154       | 1,903            | 16,042       | 2,019            | 16,931       | 2,134            | 17,820       | 2,192            | 18,387       | 2,219            |
| (5) Richland Hills    | 1,013          | 7,417        | 1,085            | 7,910        | 1,158            | 8,403        | 1,230            | 8,895        | 1,254            | 9,135        | 1,254            |
| (6) Saginaw           | 133            | 325          | 472              | 559          | 764              | 793          | 764              | 1,027        | 764              | 1,312        | 764              |
| (7) Fort Worth        | 5,112          | 21,655       | 6,961            | 24,784       | 8,557            | 27,913       | 9,672            | 31,042       | 10,599           | 38,028       | 13,657           |

- Notes:
- (1) Haslet = BFX10-07 (M825X-03)
  - (2) Haltom City = BF000380 + BF000890-W
  - (3) Watauga = BF000890-N x 1.1874
  - (4) N. Richland Hills = BF000890-S + BF000350-N
  - (5) Richland Hills = BF000350-S
  - (6) Saginaw = BF004370
  - (7) Fort Worth = B.F. TOT. + MC - (1) - (2) - (3) - (4) - (5) - (6)

| SUBAREA    | 20 Equiv Pop | 2020 Sewer Acres | POP_2050  | EMP_2050  | 2050 Equiv Pop | POP_2060  | EMP_2060  | 2060 Sewer Acres | 2060 Equiv Pop | POP_2070  | EMP_2070  |
|------------|--------------|------------------|-----------|-----------|----------------|-----------|-----------|------------------|----------------|-----------|-----------|
| BF003960   | 196.50       | 35.37            | 38.00     | 569.00    | 322.50         | 39.67     | 649.67    | 56.18            | 364.50         | 41.33     | 730.33    |
| BF000380   | 16,175.50    | 1,748.89         | 16,026.00 | 10,651.00 | 21,351.50      | 16,949.67 | 12,254.33 | 2,495.05         | 23,076.83      | 17,873.33 | 13,857.67 |
| BF001150   | 209.50       | 15.39            | 39.00     | 610.00    | 344.00         | 40.67     | 696.33    | 28.57            | 388.83         | 42.33     | 782.67    |
| BF001440   | 969.50       | 19.39            | 1,179.00  | 326.00    | 1,342.00       | 1,276.33  | 379.67    | 29.32            | 1,466.17       | 1,373.67  | 433.33    |
| BF001970   | 340.00       | 7.33             | 285.00    | 32.00     | 301.00         | 269.67    | 36.67     | 7.33             | 288.00         | 254.33    | 41.33     |
| BF002170   | 4,608.50     | 698.71           | 7,179.00  | 2,247.00  | 8,302.50       | 8,312.00  | 2,443.67  | 1,445.45         | 9,533.83       | 9,445.00  | 2,640.33  |
| BF003310   | 203.00       | 4.06             | 38.00     | 590.00    | 333.00         | 39.67     | 673.33    | 7.53             | 376.33         | 41.33     | 756.67    |
| BF003600   | 485.50       | 399.15           | 426.00    | 974.00    | 913.00         | 1,118.33  | 1,118.33  | 399.15           | 1,055.50       | 566.67    | 1,262.67  |
| BF003640   | 199.00       | 44.99            | 188.00    | 361.00    | 368.50         | 219.00    | 412.00    | 96.09            | 425.00         | 250.00    | 463.00    |
| BF003660   | 771.00       | 272.68           | 702.00    | 1,601.00  | 1,502.50       | 818.00    | 1,856.67  | 617.63           | 1,746.33       | 934.00    | 2,112.33  |
| BF003760   | 269.00       | 876.49           | 201.00    | 668.00    | 535.00         | 234.00    | 779.33    | 876.49           | 623.67         | 267.00    | 890.67    |
| BF003820   | 30.00        | 53.66            | 2.00      | 107.00    | 55.50          | 2.33      | 123.33    | 53.66            | 64.00          | 2.67      | 139.67    |
| BF004330   | 486.00       | 223.59           | 838.00    | 193.00    | 934.50         | 975.00    | 218.00    | 223.59           | 1,084.00       | 1,112.00  | 243.00    |
| BF004380   | 51.50        | 20.09            | 17.00     | 170.00    | 102.00         | 19.67     | 198.33    | 46.35            | 118.83         | 22.33     | 226.67    |
| BF005130   | 633.00       | 95.59            | 454.00    | 968.00    | 938.00         | 489.33    | 1,100.67  | 157.00           | 1,039.67       | 524.67    | 1,233.33  |
| BF004500   | 1,546.50     | 1,219.42         | 2,089.00  | 1,757.00  | 2,967.50       | 2,424.00  | 2,034.33  | 1,219.42         | 3,441.17       | 2,759.00  | 2,311.67  |
| BF003000   | 162.50       | 3.72             | 127.00    | 9.00      | 131.50         | 116.00    | 10.33     | 3.72             | 121.17         | 105.00    | 11.67     |
| BF003530   | 695.50       | 48.97            | 477.00    | 1,171.00  | 1,062.50       | 515.33    | 1,339.00  | 83.43            | 1,184.83       | 553.67    | 1,507.00  |
| BF001520   | 845.00       | 96.72            | 1,080.00  | 36.00     | 845.00         | 1,161.67  | 41.33     | 96.72            | 845.00         | 1,243.33  | 46.67     |
| BF005040   | 1,413.50     | 46.28            | 1,858.00  | 83.00     | 1,899.50       | 2,013.67  | 95.67     | 67.50            | 2,061.50       | 2,169.33  | 108.33    |
| BF001750   | 611.50       | 32.94            | 792.00    | 196.00    | 890.00         | 868.67    | 228.33    | 52.95            | 982.83         | 945.33    | 260.67    |
| BF002770   | 765.00       | 59.94            | 1,112.00  | 16.00     | 765.00         | 1,229.67  | 17.33     | 59.94            | 765.00         | 1,347.33  | 18.67     |
| BF004760   | 617.00       | 71.71            | 793.00    | 25.00     | 617.00         | 854.00    | 28.67     | 71.71            | 617.00         | 915.00    | 32.33     |
| BF001420   | 222.00       | 22.35            | 322.00    | 6.00      | 222.00         | 356.00    | 6.67      | 22.35            | 222.00         | 390.00    | 7.33      |
| BF001650   | 480.00       | 9.60             | 607.00    | 50.00     | 632.00         | 653.67    | 58.00     | 13.65            | 635.04         | 700.33    | 66.00     |
| BF002000   | 235.00       | 17.32            | 201.00    | 25.00     | 213.50         | 192.00    | 28.67     | 17.32            | 206.33         | 183.00    | 32.33     |
| BF002110   | 2,195.50     | 225.57           | 4,066.00  | 358.00    | 4,245.00       | 4,719.33  | 417.67    | 203.82           | 4,928.17       | 5,372.67  | 477.33    |
| BF002260   | 477.50       | 203.85           | 813.00    | 187.00    | 906.50         | 942.33    | 214.33    | 203.85           | 1,049.50       | 1,071.67  | 241.67    |
| BF002560   | 1,121.78     | 285.98           | 2,003.54  | 232.44    | 2,119.78       | 2,316.83  | 271.18    | 285.98           | 2,287.82       | 2,630.12  | 309.92    |
| BF002630   | 101.00       | 10.10            | 192.00    | 16.00     | 200.00         | 223.67    | 18.67     | 10.10            | 206.64         | 255.33    | 21.33     |
| BF002650   | 168.50       | 5.99             | 302.00    | 34.00     | 319.00         | 349.33    | 39.67     | 5.99             | 345.20         | 396.67    | 45.33     |
| BF002690   | 149.50       | 14.95            | 287.00    | 22.00     | 298.00         | 334.67    | 25.67     | 13.13            | 306.56         | 382.33    | 29.33     |
| BF003500   | 48.00        | 6.00             | 34.00     | 124.00    | 96.00          | 39.67     | 144.67    | 14.00            | 112.00         | 45.33     | 165.33    |
| BF003740   | 154.50       | 53.28            | 141.00    | 307.00    | 294.50         | 164.33    | 353.67    | 117.64           | 341.17         | 187.67    | 400.33    |
| BF003860   | 208.50       | 27.80            | 39.00     | 606.00    | 342.00         | 40.67     | 691.67    | 51.53            | 386.50         | 42.33     | 777.33    |
| BF004230   | 142.00       | 48.49            | 135.00    | 257.00    | 263.50         | 157.33    | 293.33    | 87.30            | 304.00         | 179.67    | 329.67    |
| BF004350   | 243.00       | 93.78            | 230.00    | 441.00    | 450.50         | 268.00    | 503.33    | 150.02           | 519.67         | 306.00    | 565.67    |
| BF004370   | 1,596.00     | 763.79           | 2,761.00  | 679.00    | 3,100.50       | 3,215.33  | 773.33    | 763.79           | 3,602.00       | 3,669.67  | 867.67    |
| BF004420   | 58.00        | 5.80             | 19.00     | 192.00    | 115.00         | 22.00     | 224.00    | 13.40            | 134.00         | 25.00     | 256.00    |
| BF005080   | 564.00       | 54.53            | 819.00    | 14.00     | 564.00         | 905.67    | 15.33     | 54.53            | 564.00         | 992.33    | 16.67     |
| BF002270   | 382.50       | 124.50           | 671.00    | 107.00    | 724.50         | 776.67    | 123.67    | 124.50           | 838.50         | 882.33    | 140.33    |
| BF004860   | 1,552.00     | 160.26           | 1,984.00  | 68.00     | 1,552.00       | 2,134.33  | 78.00     | 160.26           | 1,552.00       | 2,284.67  | 88.00     |
| BF000350-S | 9,374.37     | 1,254.35         | 9,136.81  | 5,374.35  | 11,289.18      | 9,693.47  | 5,894.11  | 1,254.35         | 11,289.18      | 10,250.13 | 6,413.86  |
| BF000350-N | 11,283.13    | 1,509.76         | 10,997.19 | 6,468.65  | 13,587.81      | 11,667.20 | 7,094.23  | 1,509.76         | 13,587.81      | 12,337.20 | 7,719.81  |
| BF000890-N | 24,269.04    | 2,327.02         | 28,205.43 | 3,139.30  | 24,269.04      | 29,913.78 | 3,393.27  | 2,483.44         | 24,269.04      | 31,622.14 | 3,647.25  |
| BF000890-S | 7,670.86     | 735.52           | 8,915.06  | 992.26    | 7,670.86       | 9,455.03  | 1,072.53  | 784.95           | 7,670.86       | 9,995.00  | 1,152.81  |
| BF000890-W | 1,576.33     | 151.14           | 1,832.00  | 203.90    | 1,576.33       | 1,942.96  | 220.40    | 161.30           | 1,576.33       | 2,053.93  | 236.90    |
| BF003280   | 419.00       | 70.07            | 331.00    | 192.00    | 343.50         | 304.00    | 28.67     | 70.07            | 318.33         | 277.00    | 32.33     |
| BF002750   | 52.00        | 52.62            | 23.00     | 138.00    | 92.00          | 26.00     | 158.67    | 52.62            | 105.33         | 29.00     | 179.33    |
| BF002840   | 373.50       | 7.47             | 453.00    | 11.00     | 458.50         | 480.67    | 12.33     | 9.74             | 486.83         | 508.33    | 13.67     |
| BF003410   | 386.50       | 7.73             | 95.00     | 1,079.00  | 634.50         | 101.00    | 1,232.33  | 14.34            | 717.17         | 107.00    | 1,385.67  |
| BF001230   | 235.50       | 15.27            | 69.00     | 660.00    | 399.00         | 75.67     | 755.67    | 29.41            | 453.50         | 82.33     | 851.33    |
| BF001330   | 788.00       | 71.90            | 1,146.00  | 16.00     | 788.00         | 1,267.33  | 17.33     | 71.90            | 788.00         | 1,388.67  | 18.67     |
| BF001380   | 372.00       | 33.88            | 541.00    | 8.00      | 372.00         | 598.33    | 8.67      | 33.88            | 372.00         | 655.67    | 9.33      |

| SUBAREA            | 20 Equiv Pop | 2020 Sewer Acres | POP_2050   | EMP_2050  | 2050 Sewer Acres | 2050 Equiv Pop | POP_2060   | EMP_2060  | 2060 Sewer Acres | 2060 Equiv Pop | POP_2070   | EMP_2070  |
|--------------------|--------------|------------------|------------|-----------|------------------|----------------|------------|-----------|------------------|----------------|------------|-----------|
| BF002030           | 445.00       | 10.35            | 402.00     | 39.00     | 10.35            | 421.50         | 391.33     | 44.67     | 10.35            | 413.67         | 380.67     | 50.33     |
| BF002860           | 341.00       | 58.54            | 273.00     | 22.00     | 58.54            | 284.00         | 252.33     | 25.33     | 58.54            | 265.00         | 231.67     | 28.67     |
| BF002990           | 602.50       | 99.90            | 473.00     | 38.00     | 99.90            | 492.00         | 433.33     | 43.67     | 99.90            | 455.17         | 393.67     | 49.33     |
| BF003060           | 496.50       | 70.07            | 390.00     | 30.00     | 70.07            | 405.00         | 357.33     | 34.33     | 70.07            | 374.50         | 324.67     | 38.67     |
| BF003170           | 718.50       | 85.24            | 1,066.00   | 84.00     | 131.44           | 1,108.00       | 1,189.00   | 97.67     | 146.85           | 1,237.83       | 1,312.00   | 111.33    |
| BF004590           | 1,311.50     | 151.52           | 1,687.00   | 56.00     | 151.52           | 1,311.50       | 1,817.33   | 64.33     | 151.52           | 1,311.50       | 1,947.67   | 72.67     |
| BF004720           | 649.50       | 76.32            | 828.00     | 27.00     | 76.32            | 649.50         | 890.00     | 31.00     | 76.32            | 649.50         | 952.00     | 35.00     |
| BF004800           | 420.00       | 45.55            | 538.00     | 18.00     | 45.55            | 420.00         | 579.00     | 20.67     | 45.55            | 420.00         | 620.00     | 23.33     |
| <b>SUB-TOTAL 1</b> | 104,168.01   | 15,063.22        | 118,968.03 | 45,514.90 | 17,339.22        | 130,053.98     | 128,611.27 | 51,266.72 | 17,987.25        | 136,972.65     | 136,254.51 | 57,018.54 |
| BFX10-01           | 551.50       | 375.34           | 707.00     | 776.00    | 375.34           | 1,095.00       | 824.33     | 903.67    | 375.34           | 1,276.17       | 941.67     | 1,031.33  |
| BFX10-02           | 776.50       | 722.57           | 898.00     | 1,263.00  | 722.57           | 1,529.50       | 1,047.00   | 1,467.00  | 722.57           | 1,780.50       | 1,196.00   | 1,671.00  |
| BFX10-05           | 1,159.50     | 577.48           | 1,554.00   | 1,428.00  | 697.81           | 2,268.00       | 1,811.67   | 1,651.67  | 697.81           | 2,637.50       | 2,069.33   | 1,875.33  |
| BFX10-06           | 776.00       | 413.89           | 1,196.00   | 630.00    | 413.89           | 1,511.00       | 1,393.00   | 726.00    | 413.89           | 1,756.00       | 1,590.00   | 822.00    |
| BFX10-07           | 606.50       | 407.44           | 952.00     | 363.00    | 407.44           | 1,133.50       | 1,099.67   | 419.00    | 407.44           | 1,309.17       | 1,247.33   | 475.00    |
| BFX10-03           | 1,988.00     | 45.03            | 3,311.00   | 847.00    | 84.59            | 3,734.50       | 3,822.67   | 988.00    | 97.77            | 4,316.67       | 4,334.33   | 1,129.00  |
| BFX10-04           | 1,583.00     | 130.81           | 2,388.00   | 1,245.00  | 248.78           | 3,010.50       | 2,760.33   | 1,452.00  | 288.10           | 3,486.33       | 3,132.67   | 1,659.00  |
| BFX10-15           | 434.50       | 592.93           | 141.00     | 1,430.00  | 709.10           | 856.00         | 162.67     | 1,667.67  | 709.10           | 996.50         | 184.33     | 1,905.33  |
| BFX10-10           | 87.50        | 10.29            | 9.00       | 315.00    | 19.59            | 166.50         | 9.67       | 366.33    | 22.69            | 192.83         | 10.33      | 417.67    |
| BFX10-11           | 128.50       | 51.15            | 46.00      | 329.00    | 83.79            | 210.50         | 49.67      | 376.33    | 94.67            | 237.83         | 53.33      | 423.67    |
| BFX10-12           | 764.50       | 1,561.02         | 416.00     | 2,077.00  | 1,561.02         | 1,454.50       | 474.00     | 2,421.00  | 1,561.02         | 1,684.50       | 532.00     | 2,765.00  |
| BFX10-13           | 156.50       | 254.33           | 46.00      | 420.00    | 416.02           | 256.00         | 50.67      | 477.00    | 489.92           | 289.17         | 55.33      | 534.00    |
| BFX10-17           | 100.50       | 82.20            | 16.00      | 254.00    | 116.96           | 143.00         | 16.67      | 281.00    | 128.55           | 157.17         | 17.33      | 308.00    |
| BFX10-18           | 93.00        | 115.82           | 19.00      | 256.00    | 183.07           | 147.00         | 19.67      | 290.67    | 205.49           | 165.00         | 20.33      | 325.33    |
| <b>SUB-TOTAL 2</b> | 9,206.00     | 5,340.30         | 11,699.00  | 11,633.00 | 6,039.97         | 17,515.50      | 13,541.67  | 13,487.33 | 6,194.36         | 20,285.33      | 15,384.33  | 15,341.67 |
| <b>TOTAL B.F.</b>  | 113,374.01   | 20,403.52        | 130,667.03 | 57,147.90 | 23,379.19        | 147,569.48     | 142,152.93 | 64,754.05 | 24,181.62        | 157,257.99     | 153,638.84 | 72,360.21 |

|          |        |        |        |        |        |        |        |        |        |        |        |        |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| MCX20-01 | 136.50 | 53.58  | 88.00  | 155.00 | 64.97  | 165.50 | 86.67  | 177.00 | 68.76  | 175.17 | 85.33  | 199.00 |
| MCX20-03 | 74.00  | 17.35  | 36.00  | 112.00 | 21.57  | 92.00  | 38.33  | 119.33 | 22.98  | 98.00  | 40.67  | 126.67 |
| MCX20-04 | 63.00  | 244.80 | 40.00  | 82.00  | 314.75 | 81.00  | 41.33  | 91.33  | 338.06 | 87.00  | 42.67  | 100.67 |
| MCX20-05 | 164.50 | 333.16 | 102.00 | 230.00 | 439.48 | 217.00 | 107.33 | 254.33 | 474.93 | 234.50 | 112.67 | 278.67 |
| MCX20-06 | 276.50 | 193.96 | 229.00 | 94.00  | 193.96 | 276.00 | 222.33 | 107.00 | 193.96 | 275.83 | 215.67 | 120.00 |
| MCX20-07 | 102.50 | 95.10  | 80.00  | 46.00  | 95.57  | 103.00 | 77.67  | 51.00  | 95.72  | 103.17 | 75.33  | 56.00  |
| MCX20-08 | 46.00  | 26.21  | 25.00  | 70.00  | 34.18  | 60.00  | 25.67  | 78.00  | 36.84  | 64.67  | 26.33  | 86.00  |
| MCX20-09 | 48.00  | 6.00   | 28.00  | 90.00  | 9.13   | 73.00  | 29.67  | 103.33 | 10.17  | 81.33  | 31.33  | 116.67 |
| MCX20-10 | 117.50 | 14.02  | 89.00  | 89.00  | 15.93  | 133.50 | 88.00  | 101.67 | 16.56  | 138.83 | 87.00  | 114.33 |
| MCX20-11 | 49.50  | 111.41 | 37.00  | 74.00  | 166.56 | 74.00  | 39.00  | 86.33  | 184.94 | 82.17  | 41.00  | 98.67  |
| MCX20-12 | 58.50  | 103.54 | 31.00  | 91.00  | 135.40 | 76.50  | 32.33  | 100.33 | 146.01 | 82.50  | 33.67  | 109.67 |
| MCX20-13 | 138.50 | 271.93 | 29.00  | 259.00 | 311.20 | 158.50 | 28.67  | 273.00 | 324.28 | 165.17 | 28.33  | 287.00 |
| MCX20-16 | 16.50  | 2.06   | 13.00  | 34.00  | 3.75   | 30.00  | 14.67  | 39.67  | 4.31   | 34.50  | 16.33  | 45.33  |
| MCX20-17 | 33.50  | 4.19   | 26.00  | 70.00  | 7.63   | 61.00  | 29.33  | 81.67  | 8.77   | 70.17  | 32.67  | 93.33  |
| MCX20-19 | 41.50  | 9.79   | 19.00  | 63.00  | 11.92  | 50.50  | 20.00  | 67.00  | 12.63  | 53.50  | 21.00  | 71.00  |
| MCX20-20 | 27.50  | 30.38  | 18.00  | 53.00  | 49.16  | 44.50  | 20.00  | 60.33  | 55.42  | 50.17  | 22.00  | 67.67  |
| MCX20-21 | 23.50  | 3.45   | 14.00  | 48.00  | 5.57   | 38.00  | 15.33  | 55.00  | 6.28   | 42.83  | 16.67  | 62.00  |
| MCX20-22 | 153.00 | 19.13  | 116.00 | 124.00 | 22.25  | 178.00 | 114.00 | 144.67 | 23.29  | 186.33 | 112.00 | 165.33 |
| MCX20-23 | 59.00  | 6.17   | 28.00  | 89.00  | 7.58   | 72.50  | 29.67  | 94.67  | 8.06   | 77.00  | 31.33  | 100.33 |
| MCX20-24 | 226.00 | 401.40 | 177.00 | 126.00 | 426.26 | 240.00 | 173.33 | 142.67 | 434.55 | 244.67 | 169.67 | 159.33 |
| MCX20-02 | 831.50 | 28.13  | 637.00 | 442.00 | 29.02  | 858.00 | 619.00 | 495.67 | 29.32  | 866.83 | 601.00 | 549.33 |



| SUBAREA               | 20 Equiv Pop      | 2020 Sewer Acres | POP_2050          | EMP_2050         | 2050 Sewer Acres | 2050 Equiv Pop    | POP_2060          | EMP_2060         | 2060 Sewer Acres | 2060 Equiv Pop    | POP_2070          | EMP_2070         |
|-----------------------|-------------------|------------------|-------------------|------------------|------------------|-------------------|-------------------|------------------|------------------|-------------------|-------------------|------------------|
| MCX10-03              | 41.50             | 19.58            | 30.00             | 37.00            | 19.58            | 48.50             | 29.33             | 39.33            | 43.00            | 50.83             | 28.67             | 49.00            |
| MCX10-04              | 125.00            | 55.14            | 90.00             | 113.00           | 55.27            | 146.50            | 86.00             | 131.33           | 131.33           | 153.67            | 86.00             | 149.67           |
| MCX10-05              | 66.00             | 8.25             | 48.00             | 59.00            | 9.69             | 77.50             | 47.00             | 68.67            | 68.67            | 81.33             | 46.00             | 78.33            |
| MCX10-06              | 309.50            | 90.90            | 225.00            | 278.00           | 106.90           | 364.00            | 220.67            | 323.00           | 112.24           | 382.17            | 216.33            | 368.00           |
| MCX10-07              | 413.50            | 200.43           | 262.00            | 523.00           | 253.75           | 523.50            | 258.33            | 603.67           | 270.23           | 560.17            | 254.67            | 684.33           |
| MCX10-08              | 332.00            | 172.31           | 163.00            | 522.00           | 220.06           | 424.00            | 151.33            | 586.67           | 235.97           | 454.67            | 159.67            | 651.33           |
| MCX10-09              | 47.00             | 429.27           | 37.00             | 96.00            | 776.33           | 85.00             | 41.67             | 112.00           | 892.02           | 97.67             | 46.33             | 128.00           |
| MCX10-14              | 42.00             | 288.07           | 27.00             | 98.00            | 521.27           | 76.00             | 30.33             | 114.00           | 599.00           | 87.33             | 33.67             | 130.00           |
| MCX10-15              | 43.50             | 408.19           | 25.00             | 97.00            | 689.70           | 73.50             | 27.67             | 111.67           | 783.54           | 83.50             | 30.33             | 126.33           |
| MCX10-18              | 54.00             | 3.94             | 26.00             | 84.00            | 4.96             | 68.00             | 27.67             | 90.00            | 5.30             | 72.67             | 29.33             | 96.00            |
| MCX20-02              | 30.00             | 3.75             | 20.00             | 63.00            | 6.44             | 51.50             | 22.67             | 72.00            | 7.33             | 58.67             | 25.33             | 81.00            |
| <b>SUB-TOTALS</b>     | <b>4,191.00</b>   | <b>3,655.58</b>  | <b>2,815.00</b>   | <b>4,411.00</b>  | <b>5,029.77</b>  | <b>5,020.50</b>   | <b>2,807.00</b>   | <b>4,980.00</b>  | <b>5,486.50</b>  | <b>5,297.00</b>   | <b>2,799.00</b>   | <b>5,549.00</b>  |
| <b>B.F. CUR. + MC</b> | <b>108,359.01</b> | <b>18,718.80</b> | <b>121,783.03</b> | <b>49,925.90</b> | <b>22,368.99</b> | <b>135,074.48</b> | <b>131,418.27</b> | <b>56,246.72</b> | <b>23,473.76</b> | <b>142,269.65</b> | <b>141,053.51</b> | <b>62,567.54</b> |
| <b>B.F. TOT + MC</b>  | <b>117,565.01</b> | <b>24,059.11</b> | <b>133,482.03</b> | <b>61,558.90</b> | <b>28,408.97</b> | <b>152,589.98</b> | <b>144,959.93</b> | <b>69,734.05</b> | <b>29,668.12</b> | <b>162,554.99</b> | <b>156,437.84</b> | <b>77,909.21</b> |
| BF000350-S            | 9,374.37          | 1,254.35         | 9,136.81          | 5,374.35         | 1,254.35         | 11,289.18         | 9,693.47          | 5,894.11         | 1,254.35         | 11,289.18         | 10,250.13         | 6,413.86         |
| BF000350-N            | 11,283.13         | 1,509.76         | 10,997.19         | 6,468.65         | 1,509.76         | 13,587.81         | 11,667.20         | 7,094.23         | 1,509.76         | 13,587.81         | 12,337.20         | 7,719.81         |
| TCWSC LINE            | 20,657.50         | 2,764.11         | 20,134.00         | 11,843.00        | 2,764.11         | 24,876.99         | 21,360.67         | 12,988.33        | 2,764.11         | 24,876.99         | 22,587.33         | 14,133.67        |
| BF - TCWSC            | 96,907.51         | 21,295.00        | 113,348.03        | 49,715.90        | 25,644.86        | 127,712.99        | 123,599.27        | 56,745.72        | 26,904.01        | 137,678.00        | 133,850.51        | 63,775.54        |
| BF - M.C.             | 92,716.51         | 17,639.41        | 110,533.03        | 45,304.90        | 20,615.08        | 122,692.49        | 120,792.27        | 51,765.72        | 21,417.51        | 132,381.00        | 131,051.51        | 58,226.54        |
| BF - MC - BFX         | 83,510.51         | 12,299.11        | 98,834.03         | 33,671.90        | 14,575.11        | 105,176.99        | 107,250.60        | 38,278.39        | 15,223.14        | 112,095.66        | 115,667.18        | 42,884.88        |
| BF000350-S            | 9,374.37          | 1,254.35         | 9,136.81          | 5,374.35         | 1,254.35         | 11,289.18         | 9,693.47          | 5,894.11         | 1,254.35         | 11,289.18         | 10,250.13         | 6,413.86         |
| BF000350-N            | 11,283.13         | 1,509.76         | 10,997.19         | 6,468.65         | 1,509.76         | 13,587.81         | 11,667.20         | 7,094.23         | 1,509.76         | 13,587.81         | 12,337.20         | 7,719.81         |
| BF000890-S            | 7,670.86          | 735.52           | 8,915.06          | 992.26           | 784.95           | 7,670.86          | 9,455.03          | 1,072.53         | 784.95           | 7,670.86          | 9,995.00          | 1,152.81         |
| TCWSC (REV.)          | 28,328.36         | 3,499.63         | 29,049.06         | 12,835.26        | 3,549.06         | 32,547.85         | 30,815.69         | 14,060.87        | 3,549.06         | 32,547.85         | 32,582.33         | 15,286.48        |
| BF000350-N            | 11,283.13         | 1,509.76         | 10,997.19         | 6,468.65         | 1,509.76         | 13,587.81         | 11,667.20         | 7,094.23         | 1,509.76         | 13,587.81         | 12,337.20         | 7,719.81         |
| BF000890-S            | 7,670.86          | 735.52           | 8,915.06          | 992.26           | 784.95           | 7,670.86          | 9,455.03          | 1,072.53         | 784.95           | 7,670.86          | 9,995.00          | 1,152.81         |
| NRH (BF)              | 18,953.99         | 2,245.27         | 19,912.25         | 7,460.90         | 2,294.71         | 21,258.67         | 21,122.22         | 8,166.76         | 2,294.71         | 21,258.67         | 22,332.20         | 8,872.62         |
| BF000380              | 16,175.50         | 1,748.89         | 16,026.00         | 10,651.00        | 2,308.51         | 21,351.50         | 16,949.67         | 12,254.33        | 2,495.05         | 23,076.83         | 17,873.33         | 13,857.67        |
| BF000890-W            | 1,576.33          | 151.14           | 1,832.00          | 203.90           | 161.30           | 1,576.33          | 1,942.96          | 220.40           | 161.30           | 1,576.33          | 2,053.93          | 236.90           |
| HALTOM (BF)           | 17,751.83         | 1,900.03         | 17,858.00         | 10,854.90        | 2,469.82         | 22,927.83         | 18,892.63         | 12,474.73        | 2,656.36         | 24,653.16         | 19,927.26         | 14,094.56        |
| LF000410              | 12,832.00         | 1,794.56         | 9,982.00          | 5,180.00         | 1,794.56         | 12,572.00         | 9,724.00          | 5,522.67         | 1,794.56         | 12,485.33         | 9,466.00          | 5,865.33         |
| EXTRA LF AREA         | 14,267.00         | 1,995.25         | 11,098.29         | 5,759.28         | 1,995.25         | 13,977.93         | 10,811.43         | 6,140.27         | 1,995.25         | 13,881.57         | 10,524.58         | 6,521.25         |
| HALTOM (BF+LF)        | 32,018.83         | 3,895.28         | 28,956.29         | 16,614.18        | 4,465.06         | 36,905.75         | 29,704.07         | 18,615.00        | 4,651.60         | 38,534.73         | 30,451.84         | 20,615.82        |

| SUBAREA | 2020 Equiv Pop | 2020 Sewer Acres | POP_2050 | EMP_2050 | 2050 Sewer Acres | 2050 Equiv Pop | POP_2060 | EMP_2060 | 2060 Sewer Acres | 2060 Equiv Pop | POP_2070 | EMP_2070 |
|---------|----------------|------------------|----------|----------|------------------|----------------|----------|----------|------------------|----------------|----------|----------|
|---------|----------------|------------------|----------|----------|------------------|----------------|----------|----------|------------------|----------------|----------|----------|

NOTES:

Refer to Drain Area Map titled "Lower Big Fossils Watershed" included in TAB 1 of the report.

DESIGN OPTIONS:

|   |                                       |                                    |                                       |                                    |                                    |                                       |                                       |                                    |                                    |                                       |                                       |                                    |
|---|---------------------------------------|------------------------------------|---------------------------------------|------------------------------------|------------------------------------|---------------------------------------|---------------------------------------|------------------------------------|------------------------------------|---------------------------------------|---------------------------------------|------------------------------------|
| 1a TOTAL BIG FOSSIL LITTLE FOSSIL TOTAL | 117,565.01<br>14,267.00<br>131,832.01 | 24,059.11<br>1,995.25<br>26,054.35 | 133,482.03<br>11,098.29<br>144,580.31 | 61,558.90<br>5,759.28<br>67,318.18 | 28,408.97<br>1,995.25<br>30,404.21 | 152,589.98<br>13,977.93<br>166,567.91 | 144,959.93<br>10,811.43<br>155,771.37 | 69,734.05<br>6,140.27<br>75,874.32 | 29,668.12<br>1,995.25<br>31,663.37 | 162,554.99<br>13,881.57<br>176,436.55 | 156,437.84<br>10,524.58<br>166,962.43 | 77,909.21<br>6,521.25<br>84,430.46 |
| 1b LESS MARINE CK.                      | 127,641.01                            | 22,398.77                          | 141,765.31                            | 62,907.18                          | 25,374.44                          | 161,547.41                            | 152,964.37                            | 70,894.32                          | 26,176.86                          | 171,139.55                            | 164,163.43                            | 78,881.46                          |
| 1c LESS INTEL                           | 127,641.01                            | 22,398.77                          | 141,765.31                            | 62,907.18                          | 25,374.44                          | 161,547.41                            | 152,964.37                            | 70,894.32                          | 26,176.86                          | 171,139.55                            | 164,163.43                            | 78,881.46                          |
| 1d LESS LITTLE FOS.                     | 117,565.01                            | 24,059.11                          | 133,482.03                            | 61,558.90                          | 28,408.97                          | 152,589.98                            | 144,959.93                            | 69,734.05                          | 29,668.12                          | 162,554.99                            | 156,437.84                            | 77,909.21                          |
| 2a LESS R. HILLS                        | 122,457.64                            | 24,800.00                          | 135,443.50                            | 61,943.82                          | 29,149.86                          | 155,278.73                            | 146,077.90                            | 69,980.21                          | 30,409.01                          | 165,147.38                            | 156,712.29                            | 78,016.61                          |
| 2b TCWSC (RH)                           | 9,374.37                              | 1,254.35                           | 9,136.81                              | 5,374.35                           | 1,254.35                           | 11,289.18                             | 9,693.47                              | 5,894.11                           | 1,254.35                           | 11,289.18                             | 10,250.13                             | 6,413.86                           |
| 3a F.W. - H.C. ONLY                     | 103,503.65                            | 22,554.73                          | 115,531.25                            | 54,482.92                          | 26,855.15                          | 134,020.05                            | 124,955.67                            | 61,813.45                          | 28,114.30                          | 143,888.70                            | 134,380.09                            | 69,143.99                          |
| 3b TCWSC (NRH,RH)                       | 28,328.36                             | 3,499.63                           | 29,049.06                             | 12,835.26                          | 3,549.06                           | 32,547.85                             | 30,815.69                             | 14,060.87                          | 3,549.06                           | 32,547.85                             | 32,582.33                             | 15,286.48                          |

NOTE: Options Which Ir

| SUBAREA               | 2020 Equiv Pop | 2020 Sewer Acres | POP_2050 | EMP_2050 | 2050 Sewer Acres | 2050 Equiv Pop | POP_2060 | EMP_2060 | 2060 Sewer Acres | 2060 Equiv Pop | POP_2070 | EMP_2070 |
|-----------------------|----------------|------------------|----------|----------|------------------|----------------|----------|----------|------------------|----------------|----------|----------|
| (1) Haslet            | 607            | 407              | 952      | 363      | 407              | 1,134          | 1,100    | 419      | 407              | 1,309          | 1,247    | 475      |
| (2) Hallom City       | 17,752         | 1,900            | 17,858   | 10,855   | 2,470            | 22,928         | 18,893   | 12,475   | 2,656            | 24,653         | 19,927   | 14,095   |
| (3) Wauauga           | 24,269         | 2,327            | 28,205   | 3,139    | 2,483            | 24,269         | 29,914   | 3,393    | 2,483            | 24,269         | 31,622   | 3,647    |
| (4) N. Richland Hills | 18,954         | 2,245            | 19,912   | 7,461    | 2,295            | 21,259         | 21,122   | 8,167    | 2,295            | 21,259         | 22,332   | 8,873    |
| (5) Richland Hills    | 9,374          | 1,254            | 9,137    | 5,374    | 1,254            | 11,289         | 9,693    | 5,894    | 1,254            | 11,289         | 10,250   | 6,414    |
| (6) Saginaw           | 1,596          | 764              | 2,761    | 679      | 764              | 3,101          | 3,215    | 773      | 764              | 3,602          | 3,670    | 868      |
| (7) Fort Worth        | 45,013         | 15,161           | 54,657   | 33,687   | 18,735           | 68,611         | 61,023   | 38,613   | 19,808           | 76,174         | 67,389   | 43,538   |

TOTALS BY CITY

Notes:

SUBAREA POPULATI... ROJECTIONS - PART 2

BIG FO. SEWER STUDY

| SUBAREA            | 2070 Sewer Acres | 2070 Equip Pop    | Dry GWI     | 2 Year GWI       | 5 Year GWI       | 10 Year GWI      | Matrix ID        | Area        | Index Number    | Wastewater Index | Rainfall Index | Runoff Index    | Zero Index  |
|--------------------|------------------|-------------------|-------------|------------------|------------------|------------------|------------------|-------------|-----------------|------------------|----------------|-----------------|-------------|
| BF002030           | 10.35            | 405.83            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 SF-1B     | Small       | 24.00           | 35.00            | 7.00           | 60.00           | 0.00        |
| BF002860           | 58.54            | 246.00            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 SF-1B     | Large       | 7.00            | 35.00            | 7.00           | 1.00            | 0.00        |
| BF002990           | 99.90            | 418.33            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 SF-1B     | Large       | 7.00            | 35.00            | 7.00           | 1.00            | 0.00        |
| BF003060           | 70.07            | 344.00            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 SF-1B     | Large       | 7.00            | 35.00            | 7.00           | 1.00            | 0.00        |
| BF003170           | 162.25           | 1,333.52          | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 SF-1B     | Small       | 24.00           | 35.00            | 7.00           | 1.00            | 0.00        |
| BF004590           | 151.52           | 1,311.50          | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 SF-1B     | Large       | 7.00            | 35.00            | 7.00           | 75.00           | 0.00        |
| BF004720           | 76.32            | 649.50            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 SF-1B     | Large       | 7.00            | 35.00            | 7.00           | 75.00           | 0.00        |
| BF004800           | 45.55            | 420.00            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 SF-1B     | Small       | 24.00           | 35.00            | 7.00           | 75.00           | 0.00        |
| <b>SUB-TOTAL 1</b> | <b>18,627.03</b> | <b>143,175.93</b> | <b>0.00</b> | <b>10,739.07</b> | <b>16,368.28</b> | <b>18,859.46</b> | <b>0.00</b>      | <b>0.00</b> | <b>1,070.40</b> | <b>1,699.79</b>  | <b>662.08</b>  | <b>3,418.72</b> | <b>0.00</b> |
| BFX10-01           | 375.34           | 1,457.33          | 0.00        | 140.00           | 220.00           | 220.00           | 270.00 OR-1      | Large       | 3.00            | 3.00             | 3.00           | 50.00           | 0.00        |
| BFX10-02           | 722.57           | 2,031.50          | 0.00        | 140.00           | 220.00           | 220.00           | 270.00 OR-1      | Large       | 3.00            | 3.00             | 3.00           | 50.00           | 0.00        |
| BFX10-05           | 697.81           | 3,007.00          | 0.00        | 140.00           | 220.00           | 220.00           | 270.00 OR-1      | Large       | 3.00            | 3.00             | 3.00           | 50.00           | 0.00        |
| BFX10-06           | 413.89           | 2,001.00          | 0.00        | 140.00           | 220.00           | 220.00           | 270.00 OR-1      | Large       | 3.00            | 3.00             | 3.00           | 50.00           | 0.00        |
| BFX10-07           | 407.44           | 1,484.83          | 0.00        | 140.00           | 220.00           | 220.00           | 270.00 OR-1      | Large       | 3.00            | 3.00             | 3.00           | 50.00           | 0.00        |
| BFX10-03           | 110.96           | 4,898.83          | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| BFX10-04           | 327.42           | 3,962.17          | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| BFX10-15           | 709.10           | 1,137.00          | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| BFX10-16           | 25.78            | 219.17            | 0.00        | 180.00           | 280.00           | 280.00           | 260.00 IN-1      | Large       | 1.00            | 1.00             | 1.00           | 50.00           | 0.00        |
| BFX10-10           | 105.55           | 265.17            | 0.00        | 150.00           | 220.00           | 220.00           | 260.00 IN-1      | Large       | 1.00            | 1.00             | 1.00           | 50.00           | 0.00        |
| BFX10-11           | 1,561.02         | 1,914.50          | 0.00        | 150.00           | 220.00           | 220.00           | 260.00 IN-1      | Large       | 1.00            | 1.00             | 1.00           | 50.00           | 0.00        |
| BFX10-12           | 523.82           | 322.33            | 0.00        | 150.00           | 220.00           | 220.00           | 260.00 IN-1      | Large       | 1.00            | 1.00             | 1.00           | 50.00           | 0.00        |
| BFX10-13           | 140.14           | 171.33            | 0.00        | 150.00           | 220.00           | 220.00           | 260.00 IN-1      | Large       | 1.00            | 1.00             | 1.00           | 50.00           | 0.00        |
| BFX10-17           | 227.91           | 183.00            | 0.00        | 150.00           | 220.00           | 220.00           | 260.00 IN-1      | Large       | 1.00            | 1.00             | 1.00           | 50.00           | 0.00        |
| <b>SUB-TOTAL 2</b> | <b>6,348.75</b>  | <b>23,055.17</b>  | <b>0.00</b> | <b>2,170.00</b>  | <b>3,320.00</b>  | <b>3,930.00</b>  | <b>0.00</b>      | <b>0.00</b> | <b>68.00</b>    | <b>48.00</b>     | <b>68.00</b>   | <b>700.00</b>   | <b>0.00</b> |
| <b>TOTAL B.F.</b>  | <b>24,975.78</b> | <b>166,231.10</b> | <b>0.00</b> | <b>12,909.07</b> | <b>19,688.28</b> | <b>22,789.46</b> | <b>0.00</b>      | <b>0.00</b> | <b>1,138.40</b> | <b>1,747.79</b>  | <b>730.08</b>  | <b>4,118.72</b> | <b>0.00</b> |
| MCX20-01           | 72.56            | 184.83            | 0.00        | 160.00           | 230.00           | 230.00           | 270.00 IN-2      | Large       | 8.00            | 7.00             | 8.00           | 50.00           | 0.00        |
| MCX20-03           | 24.38            | 104.00            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX20-04           | 361.38           | 93.00             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX20-05           | 510.37           | 252.00            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX20-06           | 193.96           | 275.67            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX20-07           | 95.88            | 103.33            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX20-08           | 39.50            | 69.33             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX20-09           | 11.21            | 89.67             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-10           | 17.20            | 144.17            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-11           | 203.32           | 90.33             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-12           | 156.63           | 88.50             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-13           | 337.37           | 171.83            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-16           | 4.88             | 39.00             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-17           | 9.92             | 79.33             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-19           | 13.33            | 56.50             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-20           | 61.68            | 55.83             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-21           | 6.99             | 47.67             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-22           | 24.33            | 194.67            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-23           | 8.53             | 81.50             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-24           | 442.84           | 249.33            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |
| MCX10-02           | 29.62            | 875.67            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD | Large       | 12.00           | 7.00             | 12.00          | 50.00           | 0.00        |

SUBAREA POPULATI ROJECTIONS - PART 2

BIG FO. SEWER STUDY

| SUBAREA               | 2070 Sewer Acres | 2070 Equip Pop    | Dry GWI     | 2 Year GWI       | 5 Year GWI       | 10 Year GWI      | Matrix ID          | Area          | Index Number    | Wastewater Index | Rainfall Index  | Runoff Index    | Zero Index  |
|-----------------------|------------------|-------------------|-------------|------------------|------------------|------------------|--------------------|---------------|-----------------|------------------|-----------------|-----------------|-------------|
| MCX10-03              | 19.58            | 53.17             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD   | Large         | 12.00           | 7.00             | 12.00           | 50.00           | 0.00        |
| MCX10-04              | 55.27            | 160.83            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD   | Large         | 12.00           | 7.00             | 12.00           | 50.00           | 0.00        |
| MCX10-05              | 10.65            | 85.17             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD   | Large         | 12.00           | 7.00             | 12.00           | 50.00           | 0.00        |
| MCX10-06              | 117.57           | 400.33            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD   | Large         | 12.00           | 7.00             | 12.00           | 50.00           | 0.00        |
| MCX10-07              | 270.23           | 596.83            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD   | Large         | 12.00           | 7.00             | 12.00           | 50.00           | 0.00        |
| MCX10-08              | 251.89           | 485.33            | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD   | Large         | 12.00           | 7.00             | 12.00           | 50.00           | 0.00        |
| MCX10-09              | 1,007.71         | 1,110.33          | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD   | Large         | 12.00           | 7.00             | 12.00           | 50.00           | 0.00        |
| MCX10-10              | 676.73           | 98.67             | 0.00        | 150.00           | 220.00           | 220.00           | 260.00 IN-1        | Large         | 1.00            | 1.00             | 1.00            | 50.00           | 0.00        |
| MCX10-11              | 848.62           | 93.50             | 0.00        | 150.00           | 220.00           | 220.00           | 260.00 IN-1        | Large         | 1.00            | 1.00             | 1.00            | 50.00           | 0.00        |
| MCX10-12              | 5.65             | 77.33             | 0.00        | 160.00           | 230.00           | 230.00           | 270.00 IN-2        | Large         | 8.00            | 7.00             | 8.00            | 50.00           | 0.00        |
| MCX10-13              | 8.23             | 65.83             | 0.00        | 180.00           | 280.00           | 280.00           | 320.00 High GPCD   | Large         | 12.00           | 7.00             | 12.00           | 50.00           | 0.00        |
| <b>SUB-TOTALS</b>     | <b>5,898.00</b>  | <b>5,573.50</b>   | <b>0.00</b> | <b>5,660.00</b>  | <b>8,740.00</b>  | <b>10,020.00</b> | <b>0.00</b>        | <b>0.00</b>   | <b>354.00</b>   | <b>212.00</b>    | <b>354.00</b>   | <b>1,600.00</b> | <b>0.00</b> |
| <b>B.F. CUR. + MC</b> | <b>24,525.02</b> | <b>148,749.43</b> | <b>0.00</b> | <b>16,399.07</b> | <b>25,108.28</b> | <b>28,879.46</b> | <b>0.00</b>        | <b>0.00</b>   | <b>1,424.40</b> | <b>1,911.79</b>  | <b>1,016.08</b> | <b>5,018.72</b> | <b>0.00</b> |
| <b>B.F. TOT + MC</b>  | <b>30,873.77</b> | <b>171,804.60</b> | <b>0.00</b> | <b>18,569.07</b> | <b>28,428.28</b> | <b>32,809.46</b> | <b>0.00</b>        | <b>0.00</b>   | <b>1,492.40</b> | <b>1,959.79</b>  | <b>1,084.08</b> | <b>5,718.72</b> | <b>0.00</b> |
| BF000350-S            | 1,254.35         | 11,289.18         | 0.00        | 200.00           | 280.00           | 280.00           | 320.00 MX-3        | Large         | 17.00           | 7.00             | 17.00           | 1.00            | 0.00        |
| BF000350-N            | 1,509.76         | 13,587.81         | 0.00        | 200.00           | 280.00           | 280.00           | 320.00 MX-3        | Large         | 17.00           | 7.00             | 17.00           | 1.00            | 0.00        |
| <b>TCWSC LINE</b>     | <b>2,764.11</b>  | <b>24,876.99</b>  | <b>0.00</b> | <b>400.00</b>    | <b>560.00</b>    | <b>560.00</b>    | <b>640.00 MX-3</b> | <b>Large</b>  | <b>20.19</b>    | <b>8.31</b>      | <b>20.19</b>    | <b>1.19</b>     | <b>0.00</b> |
| BF - TCWSC            | 28,109.66        | 146,927.61        | 0.00        | 18,169.07        | 27,868.28        | 32,169.46        |                    |               |                 |                  |                 |                 |             |
| BF - M.C.             | 22,211.67        | 141,354.11        | 0.00        | 12,509.07        | 19,128.28        | 22,149.46        |                    |               |                 |                  |                 |                 |             |
| BF - MC - BFX         | 15,862.92        | 118,298.94        | 0.00        | 10,339.07        | 15,808.28        | 18,219.46        |                    |               |                 |                  |                 |                 |             |
| BF000350-S            | 1,254.35         | 11,289.18         | 0.00        | 200.00           | 280.00           | 280.00           | 320.00 MX-3        | Large         | 17.00           | 7.00             | 17.00           | 1.00            | 0.00        |
| BF000350-N            | 1,509.76         | 13,587.81         | 0.00        | 200.00           | 280.00           | 280.00           | 320.00 MX-3        | Large         | 17.00           | 7.00             | 17.00           | 1.00            | 0.00        |
| BF000890-S            | 784.95           | 7,670.86          | 0.00        | 200.00           | 280.00           | 280.00           | 320.00 MX-3        | Large         | 17.00           | 7.00             | 17.00           | 1.00            | 0.00        |
| <b>TCWSC (REV.)</b>   | <b>3,549.06</b>  | <b>32,547.85</b>  | <b>0.00</b> | <b>600.00</b>    | <b>840.00</b>    | <b>960.00</b>    | <b>960.00</b>      | <b>960.00</b> | <b>17.00</b>    | <b>7.00</b>      | <b>17.00</b>    | <b>1.00</b>     | <b>0.00</b> |
| BF000350-N            | 1,509.76         | 13,587.81         | 0.00        | 200.00           | 280.00           | 280.00           | 320.00 MX-3        | Large         | 17.00           | 7.00             | 17.00           | 1.00            | 0.00        |
| BF000890-S            | 784.95           | 7,670.86          | 0.00        | 200.00           | 280.00           | 280.00           | 320.00 MX-3        | Large         | 17.00           | 7.00             | 17.00           | 1.00            | 0.00        |
| <b>NRH (BF)</b>       | <b>2,294.71</b>  | <b>21,258.67</b>  | <b>0.00</b> | <b>400.00</b>    | <b>560.00</b>    | <b>640.00</b>    | <b>640.00</b>      | <b>640.00</b> | <b>17.00</b>    | <b>7.00</b>      | <b>17.00</b>    | <b>1.00</b>     | <b>0.00</b> |
| BF000380              | 2,675.48         | 24,802.17         | 0.00        | 160.00           | 220.00           | 220.00           | 260.00 HD-2        | Large         | 11.00           | 7.00             | 11.00           | 1.00            | 0.00        |
| BF000890-W            | 161.30           | 1,576.33          | 0.00        | 200.00           | 280.00           | 280.00           | 320.00 MX-3        | Large         | 17.00           | 7.00             | 17.00           | 1.00            | 0.00        |
| <b>HALTOM (BF)</b>    | <b>2,836.78</b>  | <b>26,378.49</b>  | <b>0.00</b> | <b>360.00</b>    | <b>480.00</b>    | <b>540.00</b>    | <b>600.00</b>      | <b>600.00</b> | <b>11.00</b>    | <b>7.00</b>      | <b>11.00</b>    | <b>1.00</b>     | <b>0.00</b> |
| LF000410              | 1,794.56         | 12,398.67         | 0.00        | 170.00           | 240.00           | 240.00           | 290.00 IN-3        | Large         | 13.00           | 7.00             | 13.00           | 1.00            | 0.00        |
| EXTRA LF AREA         | 1,995.25         | 13,765.21         | 0.00        | 170.00           | 240.00           | 240.00           | 290.00 IN-3        | Large         | 13.00           | 7.00             | 13.00           | 1.00            | 0.00        |
| <b>HALTOM (BF+LF)</b> | <b>4,832.03</b>  | <b>40,163.70</b>  | <b>0.00</b> | <b>340.00</b>    | <b>480.00</b>    | <b>540.00</b>    | <b>600.00</b>      | <b>600.00</b> | <b>13.00</b>    | <b>7.00</b>      | <b>13.00</b>    | <b>1.00</b>     | <b>0.00</b> |

| SUBAREA               | 2070 Sewer Acres | 2070 Equiv Pop | Dry GWI | 2 Year GWI | 5 Year GWI | 10 Year GWI | Matrix ID | Area    | Index Number | Wastewater Index | Rainfall Index | Runoff Index | Zero Index |
|-----------------------|------------------|----------------|---------|------------|------------|-------------|-----------|---------|--------------|------------------|----------------|--------------|------------|
| 1a TOTAL BIG FOSSIL   | 30,873.77        | 171,804.60     | 0.00    | 18,569.07  | 28,428.28  | 32,809.46   | 0.00      | 0.00    | 1,492.40     | 1,959.79         | 1,084.08       | 5,718.72     | 0.00       |
| LITTLE FOSSIL         | 1,995.25         | 13,785.21      | 0.00    | 170.00     | 240.00     | 290.00      | IN-3      | Large   | 13.00        | 7.00             | 13.00          | 1.00         | 0.00       |
| TOTAL                 | 32,869.02        | 185,589.81     | 0.00    | 18,739.07  | 28,668.28  | 33,099.46   | #VALUE!   | #VALUE! | 1,505.40     | 1,966.79         | 1,097.08       | 5,719.72     | 0.00       |
| 1b LESS MARINE CK.    | 26,971.02        | 180,016.31     | 0.00    | 13,079.07  | 19,928.28  | 23,079.46   | #VALUE!   | #VALUE! | 1,151.40     | 1,754.79         | 743.08         | 4,119.72     | 0.00       |
| 1c LESS INTEL         | 26,971.02        | 180,016.31     | 0.00    | 13,079.07  | 19,928.28  | 23,079.46   | #VALUE!   | #VALUE! | 1,151.40     | 1,754.79         | 743.08         | 4,119.72     | 0.00       |
| 1d LESS LITTLE FOS.   | 30,873.77        | 171,804.60     | 0.00    | 18,569.07  | 28,428.28  | 32,809.46   | 0.00      | 0.00    | 1,492.40     | 1,959.79         | 1,084.08       | 5,718.72     | 0.00       |
| 2a LESS R. HILLS      | 31,614.67        | 174,300.63     | 0.00    | 18,539.07  | 28,388.28  | 32,779.46   | #VALUE!   | #VALUE! | 1,488.40     | 1,959.79         | 1,080.08       | 5,718.72     | 0.00       |
| 2b TCWSC (RH)         | 1,254.35         | 11,289.18      | 0.00    | 200.00     | 280.00     | 320.00      | MX-3      | Large   | 17.00        | 7.00             | 17.00          | 1.00         | 0.00       |
| 3a F. W. _ H. C. ONLY | 29,319.96        | 153,041.96     | 0.00    | 18,139.07  | 27,828.28  | 32,139.46   | #VALUE!   | #VALUE! | 1,505.40     | 1,966.79         | 1,097.08       | 5,719.72     | 0.00       |
| 3b TCWSC (NRH,RH)     | 3,549.06         | 32,547.85      | 0.00    | 600.00     | 840.00     | 960.00      | 0.00      | 0.00    | 0.00         | 0.00             | 0.00           | 0.00         | 0.00       |

DESIGN OPTIONS:

- 1a TOTAL BIG FOSSIL
- LITTLE FOSSIL
- TOTAL
- 1b LESS MARINE CK.
- 1c LESS INTEL
- 1d LESS LITTLE FOS.
- 2a LESS R. HILLS
- 2b TCWSC (RH)
- 3a F. W. \_ H. C. ONLY
- 3b TCWSC (NRH,RH)

NOTE: Options Which Ir

| SUBAREA              | 2070 Sewer Acres | 2070 Equiv Pop | Dry GWI | 2 Year GWI | 5 Year GWI | 10 Year GWI | Matrix ID | Area  | Index Number | Wastewater Index | Rainfall Index | Runoff Index | Zero Index |
|----------------------|------------------|----------------|---------|------------|------------|-------------|-----------|-------|--------------|------------------|----------------|--------------|------------|
| TOTALS BY CITY       |                  |                |         |            |            |             |           |       |              |                  |                |              |            |
| (1) Haslet           | 407              | 1,485          | 0       | 140        | 220        | 270 OR-1    | Large     | 3     | 3            | 3                | 3              | 50           | 0          |
| (2) Haltom City      | 2,837            | 26,378         | 0       | 360        | 500        | 580         | Large     | 28    | 14           | 28               | 28             | 2            | 0          |
| (3) Watauga          | 2,483            | 24,269         | 0       | 237        | 332        | 380 MX-3    | Large     | 20    | 8            | 20               | 20             | 1            | 0          |
| (4) N. Richard Hills | 2,295            | 21,259         | 0       | 400        | 560        | 640         | Large     | 34    | 14           | 34               | 34             | 2            | 0          |
| (5) Richard Hills    | 1,254            | 11,289         | 0       | 200        | 280        | 320 MX-3    | Large     | 17    | 7            | 17               | 17             | 1            | 0          |
| (6) Seginaw          | 764              | 4,104          | 0       | 180        | 280        | 320 MX-1    | Large     | 5     | 35           | 7                | 7              | 80           | 0          |
| (7) Fort Worth       | 20,833           | 83,021         | 0       | 17,052     | 26,256     | 30,299      | 0         | 1,385 | 1,878        | 975              | 975            | 5,583        | 0          |

Notes:

| SUBAREA    | One Index | POP_1997  | EMP_1997 | 97 Equiv Pop. | 1997 Sewer Acres |
|------------|-----------|-----------|----------|---------------|------------------|
| BF003960   | 1.00      | 29.05     | 113.70   | 85.90         | 15.46            |
| BF000380   | 1.00      | 11,104.55 | 2,048.80 | 12,128.95     | 1,311.38         |
| BF001150   | 1.00      | 30.05     | 122.80   | 91.45         | 6.72             |
| BF001440   | 1.00      | 641.20    | 22.90    | 652.65        | 13.05            |
| BF001970   | 1.00      | 358.45    | 6.10     | 361.50        | 7.33             |
| BF002170   | 1.00      | 1,072.25  | 1,168.85 | 1,656.68      | 251.17           |
| BF003310   | 1.00      | 29.05     | 119.75   | 88.93         | 1.78             |
| BF003600   | 1.00      | 47.40     | 153.50   | 124.15        | 294.98           |
| BF003640   | 1.00      | 20.90     | 72.85    | 57.33         | 12.96            |
| BF003660   | 1.00      | 77.05     | 118.45   | 136.28        | 48.20            |
| BF003760   | 1.00      | 22.60     | 20.65    | 32.93         | 162.76           |
| BF003820   | 1.00      | 0.00      | 10.40    | 5.20          | 21.09            |
| BF004330   | 1.00      | 108.75    | 52.45    | 134.98        | 121.48           |
| BF004380   | 1.00      | 2.75      | 4.20     | 4.85          | 1.89             |
| BF005130   | 1.00      | 263.00    | 217.50   | 371.75        | 56.14            |
| BF004500   | 1.00      | 283.40    | 143.05   | 354.93        | 1,008.75         |
| BF003000   | 1.00      | 181.80    | 1.70     | 182.65        | 3.72             |
| BF003530   | 1.00      | 269.75    | 217.25   | 378.38        | 26.64            |
| BF001520   | 1.00      | 627.10    | 6.80     | 630.50        | 88.79            |
| BF005040   | 1.00      | 998.90    | 13.30    | 1,005.55      | 32.93            |
| BF001750   | 1.00      | 371.20    | 16.35    | 379.38        | 20.44            |
| BF002770   | 1.00      | 477.05    | 8.70     | 481.40        | 59.94            |
| BF004760   | 1.00      | 455.00    | 4.75     | 457.38        | 54.24            |
| BF001420   | 1.00      | 138.30    | 2.35     | 139.48        | 15.24            |
| BF001650   | 1.00      | 348.35    | 4.80     | 350.75        | 7.02             |
| BF002000   | 1.00      | 243.45    | 4.75     | 245.83        | 17.32            |
| BF002110   | 1.00      | 548.40    | 29.75    | 561.28        | 57.67            |
| BF002260   | 1.00      | 116.10    | 36.65    | 134.43        | 203.85           |
| BF002560   | 0.84      | 314.51    | 19.45    | 324.24        | 118.49           |
| BF002630   | 1.00      | 21.25     | 1.40     | 21.95         | 2.20             |
| BF002650   | 1.00      | 46.70     | 2.80     | 48.10         | 1.71             |
| BF002690   | 1.00      | 30.05     | 1.75     | 30.93         | 3.09             |
| BF003500   | 1.00      | 3.50      | 7.00     | 7.00          | 0.88             |
| BF003740   | 1.00      | 15.00     | 41.00    | 35.50         | 12.24            |
| BF003860   | 1.00      | 30.05     | 122.45   | 91.28         | 12.17            |
| BF004230   | 1.00      | 14.65     | 51.95    | 40.63         | 13.87            |
| BF004350   | 1.00      | 25.45     | 89.05    | 69.98         | 27.00            |
| BF004370   | 1.00      | 343.00    | 151.85   | 418.93        | 608.01           |
| BF004420   | 1.00      | 2.75      | 4.55     | 5.03          | 0.50             |
| BF005080   | 1.00      | 351.15    | 6.35     | 354.33        | 52.80            |
| BF002270   | 1.00      | 101.40    | 15.40    | 109.10        | 124.50           |
| BF004860   | 1.00      | 1,149.90  | 12.90    | 1,156.35      | 150.74           |
| BF000350-S | 1.00      | 6,310.18  | 2,608.44 | 7,614.40      | 1,114.31         |
| BF000350-N | 1.00      | 7,595.02  | 3,139.56 | 9,164.80      | 1,341.20         |
| BF000890-N | 1.19      | 19,185.10 | 1,775.38 | 20,072.79     | 1,924.67         |
| BF000890-S | 1.00      | 6,063.95  | 561.15   | 6,344.53      | 608.34           |
| BF000890-W | 1.00      | 1,246.11  | 115.31   | 1,303.77      | 125.01           |
| BF003280   | 1.00      | 465.00    | 4.75     | 467.38        | 70.07            |
| BF002750   | 1.00      | 6.75      | 21.00    | 17.25         | 28.84            |
| BF002840   | 1.00      | 299.95    | 3.70     | 301.80        | 6.04             |
| BF003410   | 1.00      | 62.85     | 213.60   | 169.65        | 3.39             |
| BF001230   | 1.00      | 33.55     | 119.95   | 93.53         | 6.07             |
| BF001330   | 1.00      | 491.15    | 9.05     | 495.68        | 71.90            |
| BF001380   | 1.00      | 231.30    | 4.35     | 233.48        | 31.20            |



| SUBAREA  | One Index | POP_1997 | EMP_1997 | 97 Equiv Pop | 1997 Sewer Acres |
|----------|-----------|----------|----------|--------------|------------------|
| BF002030 | 1.00      | 448.85   | 7.80     | 452.75       | 10.35            |
| BF002860 | 1.00      | 374.95   | 3.75     | 376.83       | 58.54            |
| BF002990 | 1.00      | 670.05   | 6.80     | 673.45       | 99.90            |
| BF003060 | 1.00      | 552.05   | 6.10     | 555.10       | 70.07            |
| BF003170 | 1.00      | 396.25   | 8.65     | 400.58       | 47.52            |
| BF004590 | 1.00      | 965.55   | 10.20    | 970.65       | 142.34           |
| BF004720 | 1.00      | 483.65   | 5.10     | 486.20       | 58.45            |
| BF004800 | 1.00      | 310.55   | 3.40     | 312.25       | 45.55            |

SUB-TOTAL 1 62.03 67,506.03 13,899.05 74,455.55 10,914.87

|          |      |        |        |        |        |
|----------|------|--------|--------|--------|--------|
| BFX10-01 | 1.00 | 75.80  | 68.45  | 110.03 | 131.48 |
| BFX10-02 | 1.00 | 96.05  | 105.85 | 148.98 | 192.27 |
| BFX10-05 | 1.00 | 166.90 | 198.70 | 266.25 | 132.60 |
| BFX10-06 | 1.00 | 135.10 | 97.05  | 183.63 | 200.73 |
| BFX10-07 | 1.00 | 155.60 | 55.35  | 183.28 | 407.44 |
| BFX10-03 | 1.00 | 551.80 | 71.70  | 587.65 | 13.31  |
| BFX10-04 | 1.00 | 380.45 | 106.95 | 433.93 | 35.86  |
| BFX10-15 | 1.00 | 23.95  | 37.25  | 42.58  | 58.10  |
| BFX10-16 | 1.00 | 5.35   | 8.05   | 9.38   | 1.10   |
| BFX10-10 | 1.00 | 26.45  | 50.95  | 51.93  | 20.67  |
| BFX10-11 | 1.00 | 102.30 | 45.55  | 125.08 | 388.56 |
| BFX10-12 | 1.00 | 20.45  | 85.70  | 63.30  | 102.87 |
| BFX10-13 | 1.00 | 12.35  | 95.50  | 60.10  | 49.16  |
| BFX10-17 | 1.00 | 15.70  | 49.40  | 40.40  | 50.31  |

SUB-TOTAL 2 14.00 1,768.25 1,076.45 2,306.48 1,784.46

TOTAL B.F. 76.03 69,274.28 14,975.50 76,762.03 12,699.33

|          |      |        |        |        |        |
|----------|------|--------|--------|--------|--------|
| MCX20-01 | 1.00 | 94.60  | 24.75  | 106.98 | 42.20  |
| MCX20-03 | 1.00 | 23.40  | 69.40  | 58.10  | 13.62  |
| MCX20-04 | 1.00 | 32.70  | 27.05  | 46.23  | 179.62 |
| MCX20-05 | 1.00 | 73.15  | 87.50  | 116.90 | 236.75 |
| MCX20-06 | 1.00 | 263.75 | 17.05  | 272.28 | 193.96 |
| MCX20-07 | 1.00 | 92.60  | 16.70  | 100.95 | 94.64  |
| MCX20-08 | 1.00 | 22.05  | 22.70  | 33.40  | 19.03  |
| MCX20-09 | 1.00 | 19.05  | 11.40  | 24.75  | 3.09   |
| MCX10-10 | 1.00 | 94.65  | 14.40  | 101.85 | 12.15  |
| MCX10-11 | 1.00 | 26.05  | 1.05   | 26.58  | 59.82  |
| MCX10-12 | 1.00 | 23.70  | 35.70  | 41.55  | 73.54  |
| MCX10-13 | 1.00 | 30.30  | 176.05 | 118.33 | 232.66 |
| MCX10-16 | 1.00 | 4.05   | 0.35   | 4.23   | 0.53   |
| MCX10-17 | 1.00 | 8.10   | 1.05   | 8.63   | 1.08   |
| MCX10-19 | 1.00 | 13.70  | 39.70  | 33.55  | 7.92   |
| MCX10-20 | 1.00 | 7.05   | 9.70   | 11.90  | 13.15  |
| MCX10-21 | 1.00 | 7.05   | 6.35   | 10.23  | 1.50   |
| MCX10-22 | 1.00 | 126.60 | 0.70   | 126.95 | 15.91  |
| MCX10-23 | 1.00 | 19.05  | 56.05  | 47.08  | 4.92   |
| MCX10-24 | 1.00 | 195.85 | 27.40  | 209.55 | 376.53 |
| MCX10-02 | 1.00 | 731.35 | 125.60 | 794.15 | 27.23  |

| SUBAREA               | One Index     | POP_1997         | EMP_1997         | 97 Equiv Pop     | 1997 Sewer Acres |
|-----------------------|---------------|------------------|------------------|------------------|------------------|
| MCX10-03              | 1.00          | 33.30            | 1.35             | 33.98            | 16.50            |
| MCX10-04              | 1.00          | 100.60           | 4.75             | 102.98           | 45.66            |
| MCX10-05              | 1.00          | 53.30            | 2.05             | 54.33            | 6.80             |
| MCX10-06              | 1.00          | 247.50           | 12.55            | 253.78           | 74.89            |
| MCX10-07              | 1.00          | 280.85           | 47.05            | 304.38           | 147.53           |
| MCX10-08              | 1.00          | 171.25           | 140.30           | 241.40           | 125.29           |
| MCX10-09              | 1.00          | 11.80            | 1.75             | 12.68            | 115.77           |
| MCX10-14              | 1.00          | 9.10             | 3.05             | 10.63            | 72.87            |
| MCX10-15              | 1.00          | 10.75            | 10.40            | 15.95            | 149.67           |
| MCX10-18              | 1.00          | 17.05            | 49.05            | 41.58            | 3.03             |
| MCX2D-02              | 1.00          | 5.40             | 10.05            | 10.43            | 1.30             |
| <b>SUB-TOTALS</b>     | <b>32.00</b>  | <b>2,849.70</b>  | <b>1,053.00</b>  | <b>3,376.20</b>  | <b>2,369.16</b>  |
| <b>B.F. CUR. + MC</b> | <b>94.03</b>  | <b>70,355.73</b> | <b>14,952.05</b> | <b>77,831.75</b> | <b>13,284.02</b> |
| <b>B.F. TOT + MC</b>  | <b>108.03</b> | <b>72,123.98</b> | <b>16,028.50</b> | <b>80,138.23</b> | <b>15,068.49</b> |
| BF000350-S            | 1.00          | 6,310.18         | 2,608.44         | 7,614.40         | 1,114.31         |
| BF000350-N            | 1.00          | 7,595.02         | 3,139.56         | 9,164.80         | 1,341.20         |
| TCWSC LINE            | 1.19          | 13,905.20        | 5,748.00         | 16,779.20        | 2,455.51         |
| BF - TCWSC            |               | 58,218.78        | 10,280.50        | 63,359.03        | 12,612.98        |
| BF - M.C.             |               | 55,369.08        | 9,227.50         | 59,982.83        | 10,243.82        |
| BF - MC - BFX         |               | 53,600.83        | 8,151.05         | 57,676.35        | 8,459.36         |
| BF000350-S            | 1.00          | 6,310.18         | 2,608.44         | 7,614.40         | 1,114.31         |
| BF000350-N            | 1.00          | 7,595.02         | 3,139.56         | 9,164.80         | 1,341.20         |
| BF000890-S            | 1.00          | 6,063.95         | 561.15           | 6,344.53         | 608.34           |
| TCWSC (REV.)          |               | 19,969.15        | 6,309.15         | 23,123.73        | 3,063.85         |
| BF000350-N            | 1.00          | 7,595.02         | 3,139.56         | 9,164.80         | 1,341.20         |
| BF000890-S            | 1.00          | 6,063.95         | 561.15           | 6,344.53         | 608.34           |
| NRH (BF)              |               | 13,658.97        | 3,700.71         | 15,509.33        | 1,949.54         |
| BF000380              | 1.00          | 11,104.55        | 2,048.80         | 12,128.95        | 1,311.38         |
| BF000890-W            | 1.00          | 1,246.11         | 115.31           | 1,303.77         | 125.01           |
| HALTOM (BF)           |               | 12,350.66        | 2,164.11         | 13,432.72        | 1,436.39         |
| LF000410              | 1.00          | 11,337.50        | 3,337.50         | 13,006.25        | 1,794.56         |
| EXTRA LF AREA         | 1.00          | 12,605.37        | 3,710.73         | 14,460.74        | 1,995.25         |
| HALTOM (BF+LF)        |               | 24,956.04        | 5,874.85         | 27,893.46        | 3,431.63         |

| SUBAREA | One Index | POP_1997 | EMP_1997 | 97 Equiv Pop | 1997 Sewer Acres |
|---------|-----------|----------|----------|--------------|------------------|
|---------|-----------|----------|----------|--------------|------------------|

NOTES:

Refer to Drain. Area Map titled "Lower Big Fossil Watershed" included in TAB 1 of the report.

DESIGN OPTIONS:

|                     |        |           |           |           |           |
|---------------------|--------|-----------|-----------|-----------|-----------|
| 1a TOTAL BIG FOSSIL | 108.03 | 72,123.98 | 16,028.50 | 80,138.23 | 15,068.49 |
| LITTLE FOSSIL       | 1.00   | 12,605.37 | 3,710.73  | 14,460.74 | 1,995.25  |
| TOTAL               | 109.03 | 84,729.35 | 19,739.23 | 94,598.97 | 17,063.73 |
| 1b LESS MARINE CK.  | 77.03  | 81,879.65 | 18,686.23 | 91,222.77 | 14,694.57 |
| 1c LESS INTEL       | 77.03  | 81,879.65 | 18,686.23 | 91,222.77 | 14,694.57 |
| 1d LESS LITTLE FOS. | 108.03 | 72,123.98 | 16,028.50 | 80,138.23 | 15,068.49 |
| 2a LESS R. HILLS    | 108.03 | 78,419.17 | 17,130.79 | 86,984.57 | 15,949.42 |
| 2b TCWSC (RH)       | 1.00   | 6,310.18  | 2,608.44  | 7,614.40  | 1,114.31  |
| 3a F.W. _ H.C. ONLY | 109.03 | 64,760.20 | 13,430.08 | 71,475.24 | 13,999.89 |
| 3b TCWSC (NRH,RH)   | 0.00   | 19,969.15 | 6,309.15  | 23,123.73 | 3,063.85  |

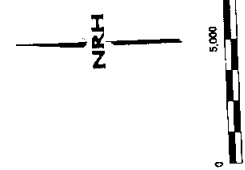
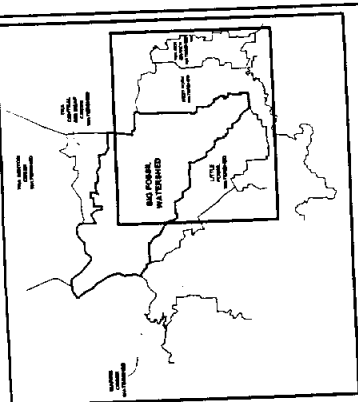
NOTE: Options Which Ir

| SUBAREA               | One Index | POP_1997 | EMP_1997 | 97 Equiv Pop | 1997 Sewer Acres |
|-----------------------|-----------|----------|----------|--------------|------------------|
| TOTALS BY CITY        |           |          |          |              |                  |
| (1) Haslet            | 1         | 156      | 55       | 183          | 407              |
| (2) Haltom City       | 2         | 12,351   | 2,164    | 13,433       | 1,436            |
| (3) Watauga           | 1         | 19,185   | 1,775    | 20,073       | 1,925            |
| (4) N. Richland Hills | 2         | 13,659   | 3,701    | 15,509       | 1,950            |
| (5) Richland Hills    | 1         | 6,310    | 2,608    | 7,614        | 1,114            |
| (6) Saginaw           | 1         | 343      | 152      | 419          | 608              |
| (7) Fort Worth        | 100       | 20,120   | 5,573    | 22,907       | 7,628            |

Notes:

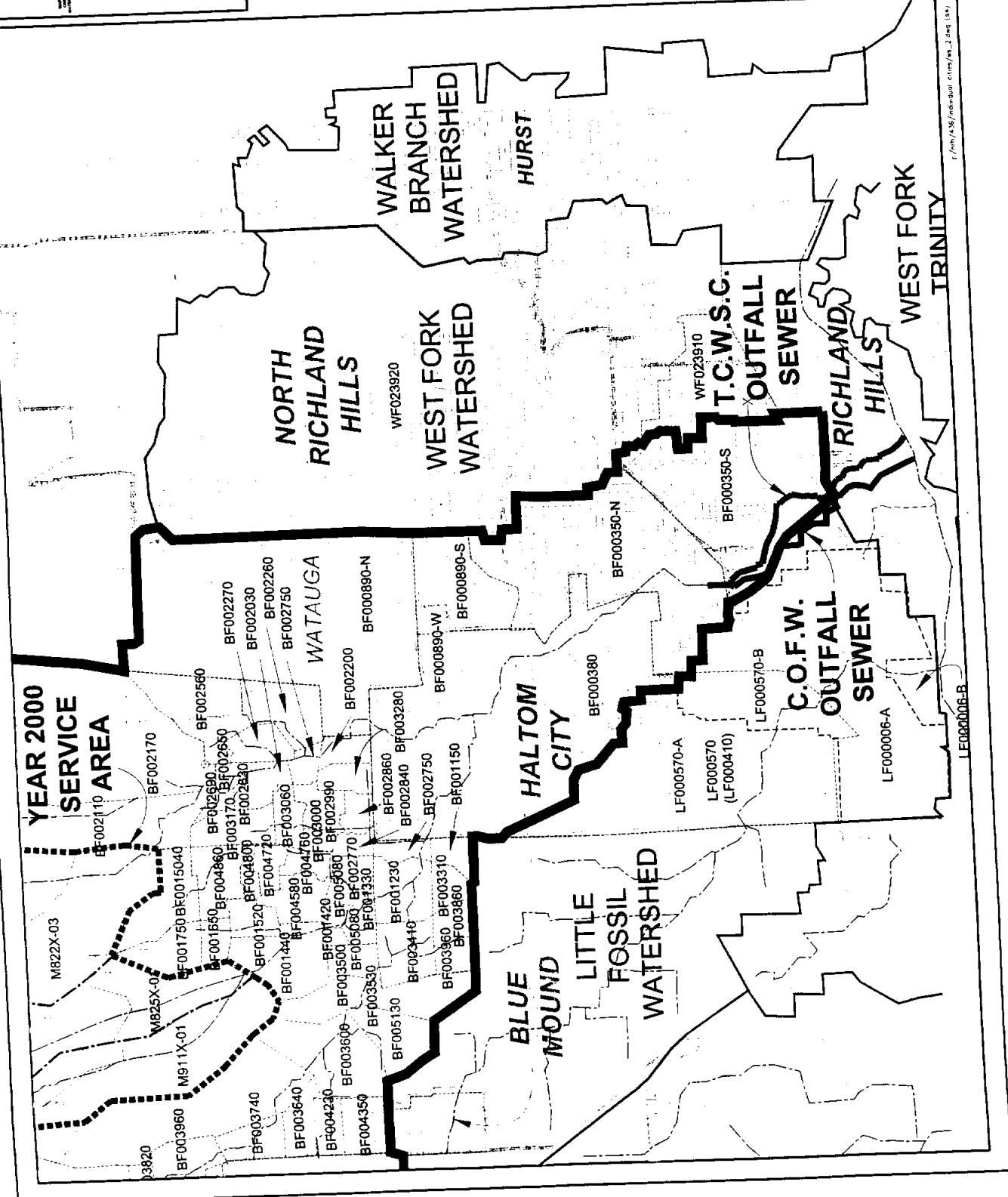
***EXHIBIT "I"***

***WATERSHED SUB-AREA MAPS***

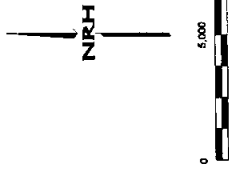
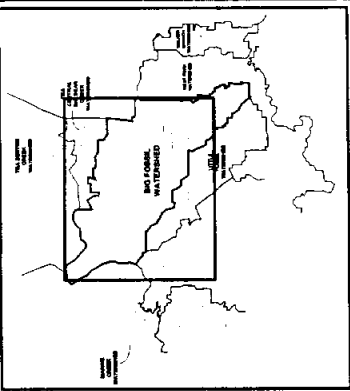


Notes:  
 1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.  
 2. Watershed areas shown are based on watershed and drainage area maps included in the City of Fort Worth Sanitary Sewer Masterplan dated September, 1998, prepared by Friesse and Nichols, Inc., Montgomery Watson, and Brown & Root, Inc. Data furnished to KEF for this study by the City of Fort Worth Water Dept.

|  |                      |
|--|----------------------|
| <b>BIG FOSSIL SEWER STUDY</b>  |                      |
| <b>LOWER BIG FOSSIL WATERSHED</b>  |                      |
| <b>CITY OF NORTH RICHLAND HILLS</b>  |                      |
| <b>KNOWLTON-ENGLISH-FLOWERS, INC.</b><br><small>CONSULTING ENGINEERS / Fort Worth, Texas</small> |                      |
| DESIGNED BY: KEF   | CHECKED BY: J. A. G. |
| DRAWN BY: J. A. G.   | DATE: 10/15/99       |
| PROJECT NO.: 99-483-308  | SHEET NO.: 1 OF 4    |

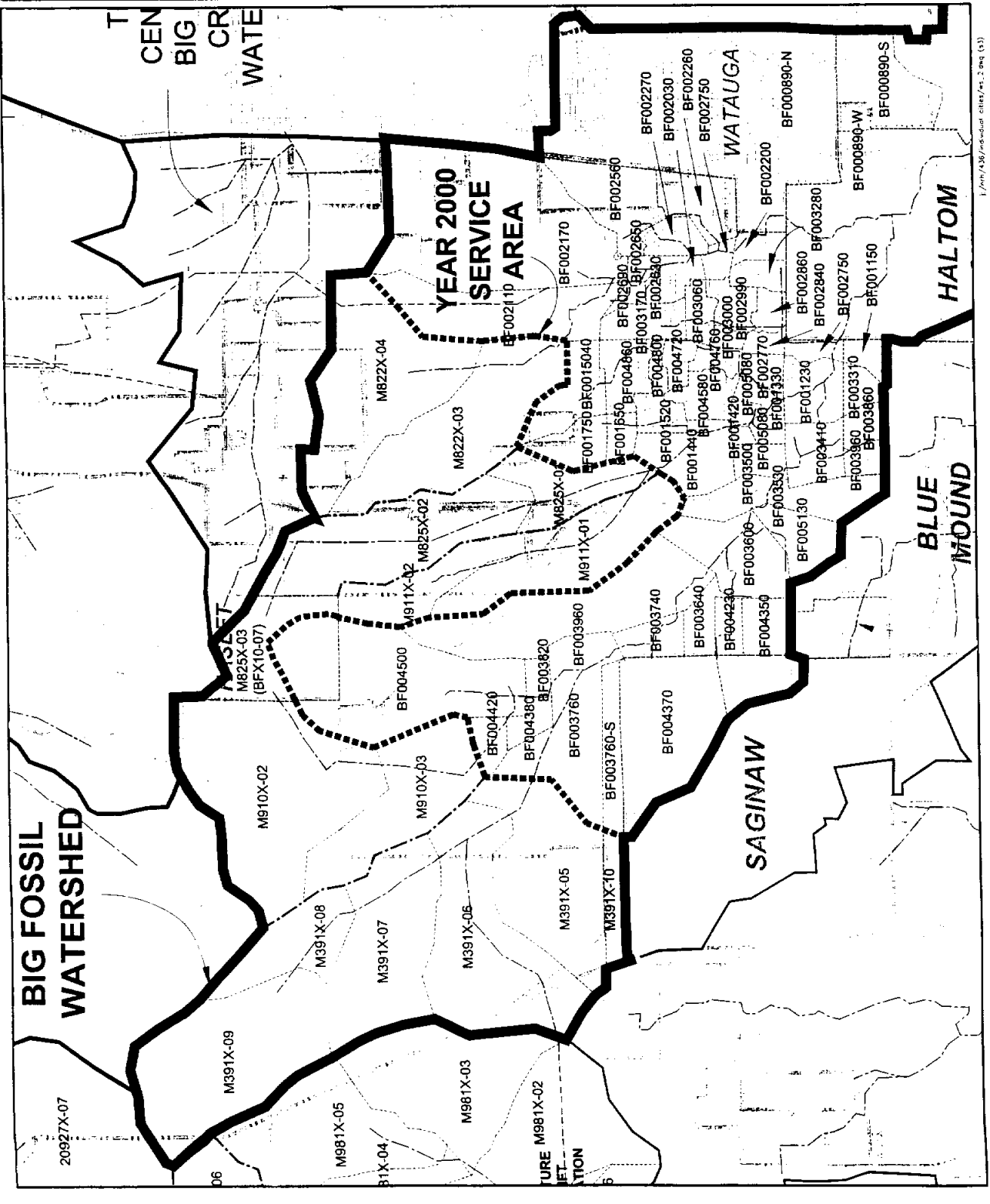


1/10/99/436/individual/ctm/fig\_2.dwg (15x)



Notes:  
 1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDA, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.  
 2. Watershed areas shown are based on watershed and drainage area maps included in the City of Fort Worth Sanitary Sewer Masterplan dated September, 1988, prepared by Friesse and Nichols, Inc., Montgomery KEF Watson, and Brown & Root, Inc. Data furnished to KEF for this study by the City of Fort Worth Water Dept.

|   |                  |
|---|------------------|
| <b>BIG FOSSIL SEWER STUDY</b>   |                  |
| <b>UPPER BIG FOSSIL WATERSHED</b>   |                  |
| <b>CITY OF NORTH RICHLAND HILLS</b>   |                  |
| <br>KNOWLTON-ENGLISH-FLOWERS, INC.<br><small>CONSULTING ENGINEERS / Fort Worth, Texas</small> |                  |
| DESIGNED BY: <b>ENR</b>   | DATE: 03/23/00   |
| DRAWN BY: <b>ENR</b>  | JOB NO: 3-128    |
| CHECKED BY: <b>NEC</b>  | SHEET NO: 2 OF 4 |



1/00/436/individual cities/ps.2 enq (3)

**EXHIBIT "J"**

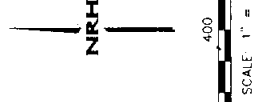
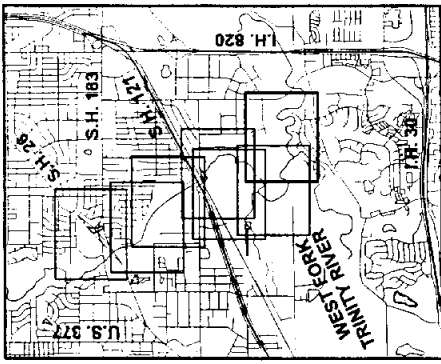
**REVISED R.O.W. PLAN MAPS**

**SHOWING PROPOSED RELIEF SEWER**

**ALIGNMENT ALTERNATES**

**1, 2 AND 3**



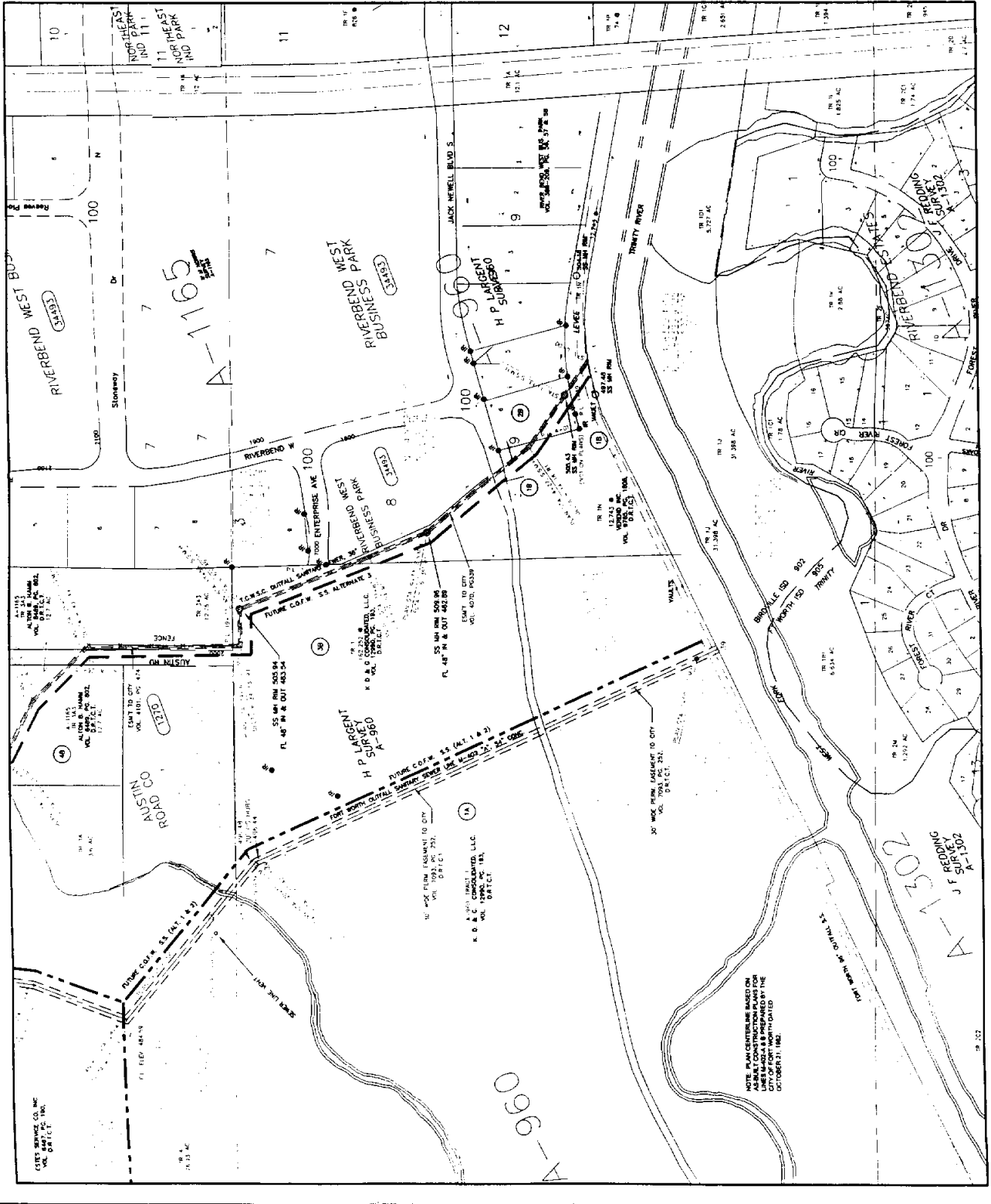


**Notes:**

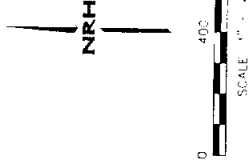
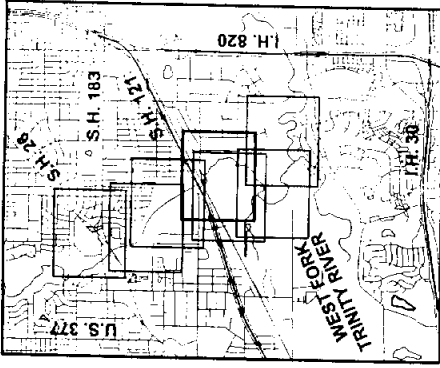
1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors, (817-282-6981), dated 1/17/1999, with R.O.W. document research by Universal Field Services, Inc. (918-494-7600), and KEF, Inc. (817-293-0211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

**BIG FOSSIL SEWER STUDY**  
**R.O.W. STRIP MAP**  
 CITY OF NORTH RICHLAND HILLS

DESIGNED BY: PWA  
 DRAWN BY: PWA  
 CHECKED BY: KEC  
 DATE: 02/28/2000  
 JOB NO: 1-1-00  
 SHEET NO: 1-1-3



NOTE: ALL CONSTRUCTION BASED ON AS-BUILT CONSTRUCTION PLANS FOR LINES SHOWN & PREPARED BY THE CITY OF NORTH RICHLAND HILLS ON OCTOBER 21, 1999.



**Notes:**

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 98-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors, (817-282-8981), dated 11/1/99, with R.O.W. document research by Universal Field Services, Inc. (918-434-7600), and KEF, Inc., (817-283-6211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

**BIG FOSSIL SEWER STUDY**

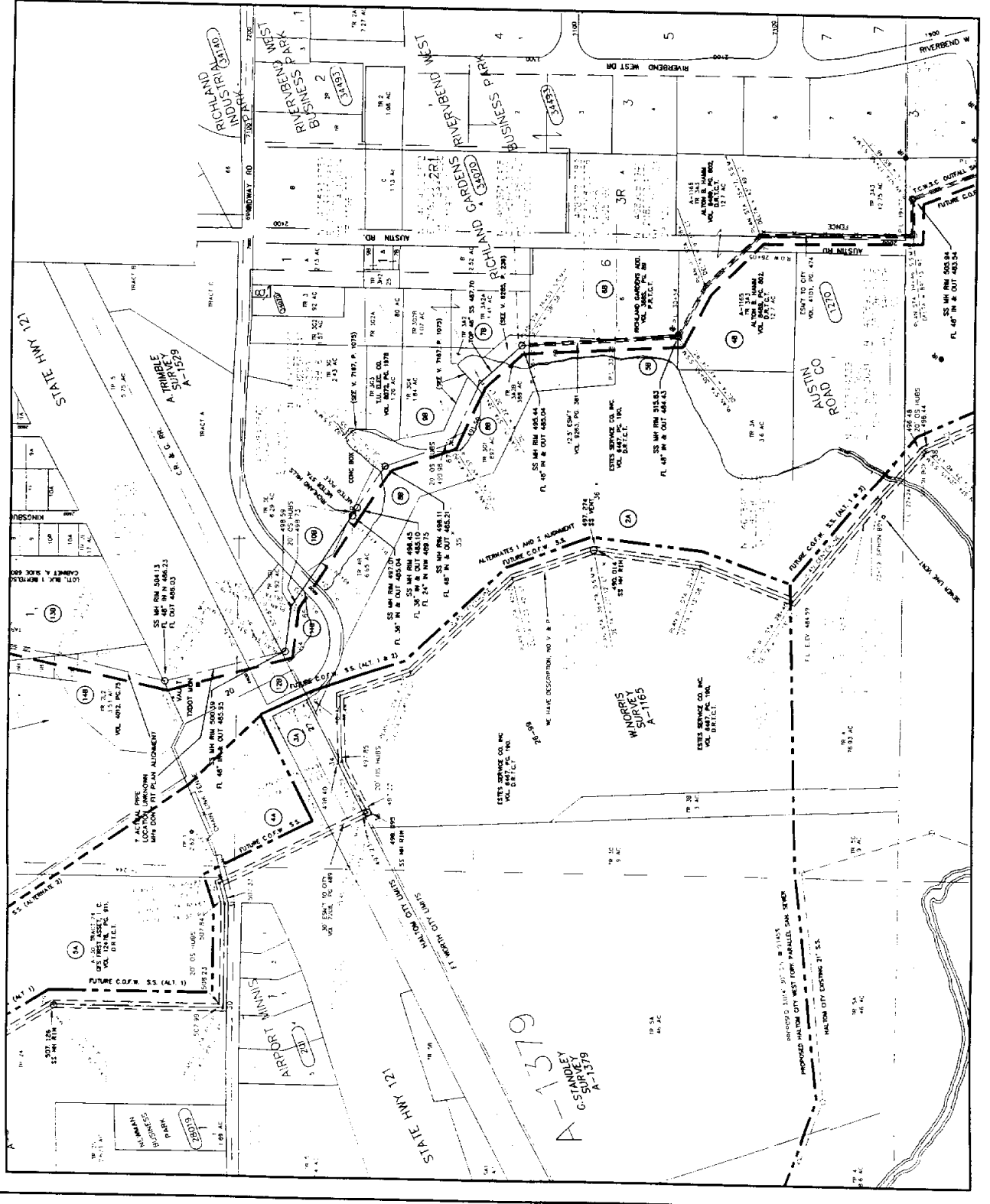
**R.O.W. STRIP MAP**

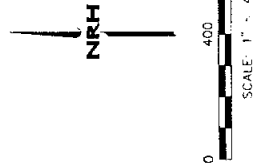
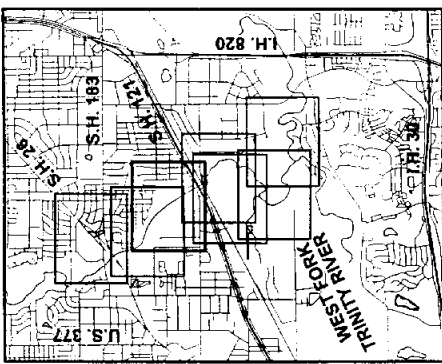
**CITY OF NORTH RICHLAND HILLS**



**KNOWLTON-ENGLISH-FLOWERS, INC.**  
CONSULTING ENGINEER / PLAN REVIEWER

|                  |                  |                  |                 |
|------------------|------------------|------------------|-----------------|
| DESIGNED BY: RWA | SCALE: 1" = 400' | DATE: 02/11/2003 | APP. NO. 3-1-98 |
| DRAWN BY: RWA    |                  |                  |                 |
| CHECKED BY: REC  |                  |                  |                 |





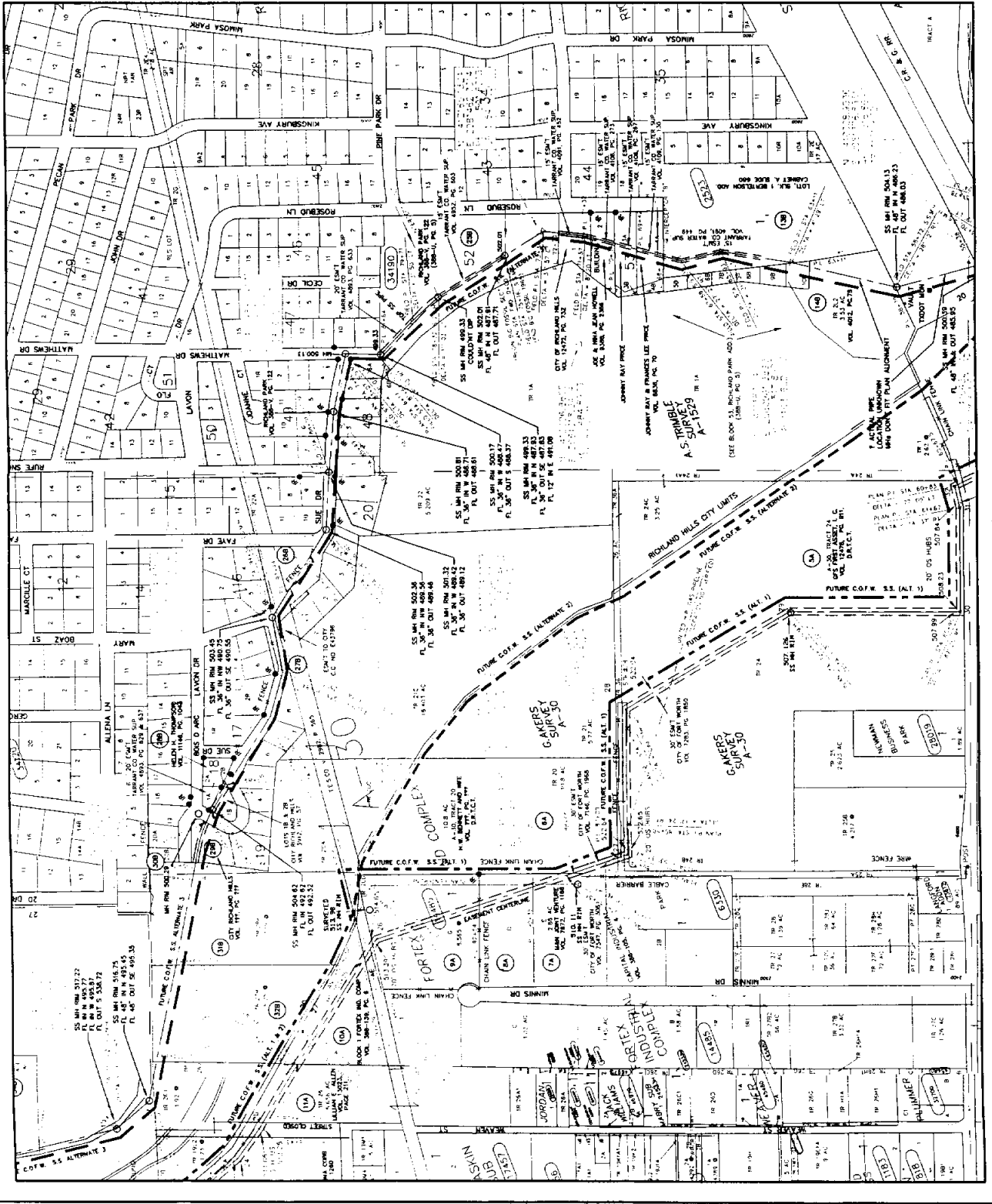
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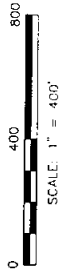
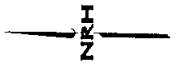
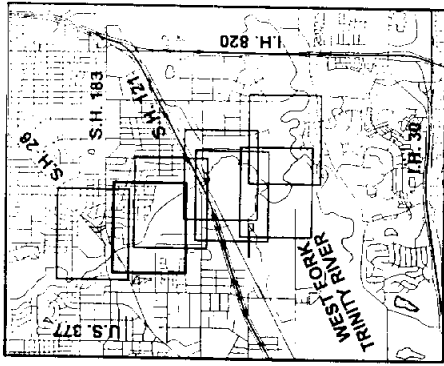
1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/18/99, between the City of North Richland Hills and the TWDB, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
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**BIG FOSSIL SEWER STUDY**  
**R.O.W. STRIP MAP**  
 CITY OF NORTH RICHLAND HILLS

**KNOWLTON-ENGLISH-FLOWERS, INC.**  
 CONSULTING ENGINEERS / P.A.C. 1987-1998

DESIGNED BY: RWA  
 DATE: OCTOBER 1999  
 DRAWN BY: RWA  
 JOB NO.: 3-1-08  
 SHEET NO.: 3 OF 3





**Notes:**

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/19/89, between the City of North Richland Hills and the TWD/S, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors, (817-282-8981), dated 11/17/89, with R.O.W. document research by Universal Field Services, Inc. (918-494-7600), and KEF, Inc. (817-283-6211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

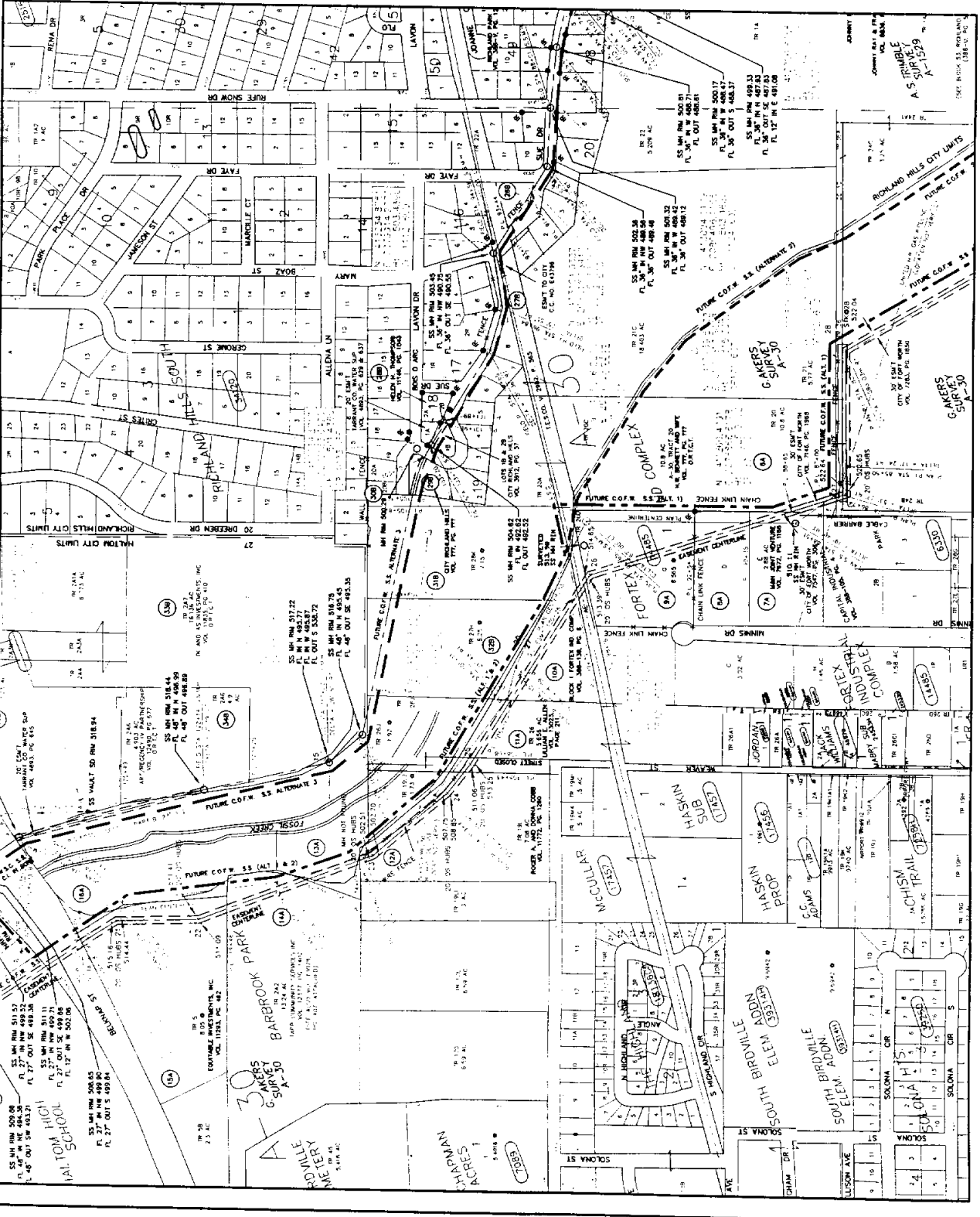
**BIG FOSSIL SEWER STUDY**  
**R.O.W. STRIP MAP**

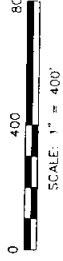
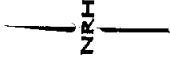
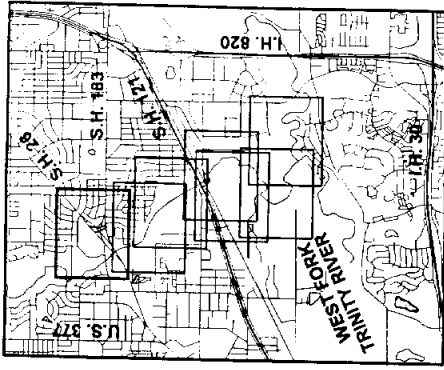
CITY OF NORTH RICHLAND HILLS



**KNOWLTON-ENGLISH-FLOWERS, INC.**  
 CONSULTING ENGINEERS / LAND SURVEYORS

|                 |               |
|-----------------|---------------|
| PROJECT NO. 444 | DATE 12/15/89 |
| SCALE 1" = 400' | DATE 12/15/89 |
| DRAWN BY RHA    | DATE 12/15/89 |
| CHECKED BY RHA  | DATE 12/15/89 |



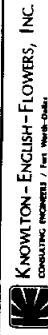


**Notes:**

1. This document is prepared in accordance with the provisions of Regional Facility Planning Contract No. 99-483-308, dated 5/1/89, between the City of North Richland Hills and the TYPDS, with funding participation by the City of Fort Worth, Haltom City and Richland Hills.
2. This drawing is based on a field survey prepared by Spooner & Associates, Inc., Land Surveyors, (817-282-8981), dated 11/1/99, with R.O.W. document research by Universal Field Services, Inc. (818-494-7600), and KEF, Inc., (817-283-6211), with data plotted on property maps furnished by the Tarrant County Appraisal District.

**BIG FOSSIL SEWER STUDY**  
**R.O.W. STRIP MAP**

CITY OF NORTH RICHLAND HILLS



**KNOWLTON-ENGLISH-FLOWERS, INC.**  
CONSULTING ENGINEERS / FERT. WORK-OVER

DESIGNED BY: **KEF** DATE: **DECEMBER 1999**  
DRAWN BY: **KEF** APPR. NO: **3-1-1-1-1**  
CHECKED BY: **KEF** SHEET NO: **5 OF 5**

