APPENDIX A2

HYDRAULICS

GENERAL INFORMATION

Development of Model Data

The hydraulic model developed for the Central City study was based on the model developed in the Upper Trinity River Feasibility Study (UTRFS). The study limits of the UTRFS hydraulic modeling consisted of the following:

- Elm Fork: West Fork/Elm Fork confluence to Lewisville Dam (29.04 miles)
- West Fork: West Fork/Elm Fork confluence to Lake Worth Dam (58.08 miles)
- Clear Fork: West Fork/Clear Fork confluence to Benbrook Dam (12.43 miles)
- Trinity River main stem: West Fork/Elm Fork confluence to downstream of Dowdy-Ferry Road in southeast Dallas (23.25 miles).

The UTRFS hydraulic models were developed by extensive use of digitized 2-foot contour interval topography. The topographic data was developed from February/March 1991 aerial photography. The majority of the cross-section data was supplied by the surveying contractor and generated from the topographic data, with cross-sections locations developed by the U.S. Army Corps of Engineers. Additional cross-sections were developed in-house from the topographic files and included in the models as necessary. Other information used in the development of the models originated from bridge plans, bridge surveys, field reconnaissance, and levee surveys. Channel data originated from 1975 field surveys. Aerial photographs and field reconnaissance were used to determine roughness coefficients.

Calibration

The initial phase of the development of the UTRFS hydraulic models consisted of the development of calibration models for the Clear Fork, West Fork, Elm Fork, and main stem Trinity River. The models were developed using HEC-2 Water Surface Profiles program. High watermarks from the June 1989 flood and the May 1990 flood supplemented with USGS gaging station data were used in the model calibration process. Available high watermarks used in the UTRFS were located within the Dallas Floodway, the West Fork from Dallas to Arlington, and the Elm Fork from Dallas to Lewisville. The May 1990 high watermarks were tabulated and compared to the Upper Trinity River Reconnaissance Study profiles for flood event determination. Most of the high watermarks lied within the 25 year to 50-year flood event range. The UTRFS models were calibrated to compute generally the water surface profiles within the same range of flood events.

The completed calibration models served as the basis for the Upper Trinity River Flood Insurance models developed for FEMA. The FEMA models represented year 2000 hydrology and constructed development projects. The FEMA models also incorporated changes to the floodplain area (development projects, new bridges) constructed after the completion of the 1991 topography.

Storage models were developed for the computation of flood routing data for use in the hydrologic HEC-1 models. The storage models incorporated the conveyance models stage-discharge relationship at every cross-section. Ineffective flow areas and other non-conveying flow areas were included in the storage models to account for storage volume in these areas.

The computed flood routing data was used in the HEC-1 models to compute frequency flood event discharges.

Main Stem Trinity River Calibration Model

A major flood event occurring in May 1990 provided a reasonable basis for calibrating the HEC-2 backwater models because the flood was estimated to be the largest in magnitude since 1942 and high watermarks were established for the study reach following the flood. The 1991 topographic data represented hydraulic conditions at the time of the May 1990 flood sufficiently to be used without revision for the calibration.

Initial Manning's roughness coefficients were estimated by field surveys, aerial photographs, and using the “Guide for Selecting Manning’s Roughness Coefficients for Natural Channels and Flood Plains by Arcement and Schneider”. Calibration of the hydraulic model was accomplished by using the U.S.G.S. gage data at both the Below Dallas Gage and the Dallas Gage. The Dallas Gage is located 90 feet downstream of the Commerce Street Bridge and the Below Dallas Gage is located at the downstream side of the Loop 12 bridge. Calibration of the model by adjusting the Manning's roughness coefficients resulted in a reasonable reproduction of the May 1990 flood event. Measured peak discharges and corresponding gage readings published by the U.S.G.S. were used as reference points. High watermarks for the May 1990 flood established by the U.S. Army Corps of Engineers and Halff Associates, Inc., at various locations in the study area were also used in the calibration of the model. The measured peak discharges published by the U.S.G.S for the May 1990 flood were 82,300 cfs at the Below Dallas Gage and 87,000 cfs at the Dallas Gage. Manning's roughness coefficients used in the study for the channel vary from 0.035 to 0.063 and range from 0.084 for open grassy areas to 0.210 for densely wooded areas in the overbanks. The channel flow capacity is approximately 6000 cfs.

West Fork Trinity River Calibration Model

The Grand Prairie Gage is located upstream of Belt Line Road. Historically the gage has been difficult to calibrate hydrologically and hydraulically. The gage is located upstream of a bridge and downstream of a major tributary to the West Fork (Johnson Creek). Overland flows across Belt Line Road north of the West Fork occurred during the May 1990 flood. This flow was not considered in the gage readings. Additionally, overflow from Bear Creek into the area upstream of Belt Line Road also occurs.

The Beach Street Gage is located at the Beach Street bridge. During the May 1990 flood, overflow occurred over the Beach Street roadway north of the river channel. The model reasonably duplicated the gage rating curve. The model produced low elevations once flow was out of the river channel. Matching the higher gage rating curve would require unreasonable modification of the model.

The Fort Worth Gage is located at river station 2522+18 upstream of Nutt Dam. Because of the close proximity to the dam, the rating curve is generally independent of channel roughness.

The Manning coefficients of roughness (n values) used in the hydraulic models within the limits of the Fort Worth Floodway were the project design values of 0.035 for the channel, and 0.055 for the overbanks.

Clear Fork Trinity River Calibration Model

The Manning coefficients of roughness (n values) used in the hydraulic models within the limits of the Fort Worth Floodway, from SH183/Southwest Boulevard to the Clear Fork/West Fork confluence, were the project design values of 0.035 for the channel, and 0.060 for the overbanks.

Two separate hydraulic models were developed for the Clear Fork. The basis for the development of two models is the left overbank flooding pattern in the reach between Rosedale Street and Rogers Road. A low flow model was developed for the 1-year to 100-year flood events. A high flow model was developed for the 500-year and SPF events. The high flow model includes conveyance in the left overbank area from Rogers Road to Rosedale Street.

Figure B-1 indicates the stages of development of the Upper Trinity River hydraulic models.

Figure B-1
Development of Upper Trinity River Hydraulic Models

Calibration Model

- May 1990 flood high watermarks
- USGS gage data – May 1990 flood
- 1991 Upper Trinity River area topography
- Upper Trinity River Reconnaissance Model used to compare flood elevations/frequency

Upper Trinity River FEMA Model

- Calibration model as base
- Year 2000 hydrology
- Year 2000 floodplain conditions – changes in floodplain since development of 1991 topography
- Development of 100-year effective floodway

Upper Trinity River CDC Model

- FEMA model as base
- Year 2050 hydrology
- Permitted projects included in model

Central City Baseline Conditions Model

- CDC Model as base
- Incorporates recent physical changes to the river
- Revised 100-year and SPF discharges

CENTRAL CITY HYDRAULIC BACKWATER MODEL

Backwater Model Limits

Hydraulic limits of analysis within the Central City study area (hydrologic and hydraulic impacts for proposed alternatives will be evaluated upstream and downstream of these limits):

West Fork: Riverside Drive (cross-section 222947) to upstream of University Drive at Rockwood Park (cross-section 264804), total length 7.93 river miles

Clear Fork: Clear Fork/West Fork confluence (cross-section 0) to IH 30 (cross-section 12075), total length 2.29 river miles

West Fork Trinity River Model

The hydraulic model used in this study is based on the current Corridor Development Certificate (CDC) model for the West Fork Trinity River. The CDC Model was developed by using the Upper Trinity River FEMA Model as the base model, which was developed during the UTRFS. The Central City Model utilizes both Existing Conditions and Future Conditions flood discharges (see Appendix A - Hydrology). The CDC Model was originally developed using the backwater program HEC-2 Water Surface Profiles. The model was later converted to HEC-RAS – River Analysis System, using several versions.

The original CDC Model was modified as part of the development of the Central City backwater model for this study. The Central City Model includes features of the river that have been modified within the Fort Worth Floodway. Two channel dams recently constructed by the Tarrant Regional Water District (TRWD) has been incorporated into the model - the Beach Street Dam, located downstream of Beach Street and upstream of the West Fork/old West Fork confluence and the Fourth Street Dam, located downstream of Fourth Street. These two dams are both roller-compacted concrete dams similar in design. The Beach Street Dam crest elevation is 494.5, the Fourth Street Dam crest elevation is 500.5. The model includes modifications to the Fort Worth Floodway performed by the TRWD operations department from 1995 to 2000. These modifications included re-grading the channel slopes and dredging the river from the Beach Street Dam to the channel dam located adjacent to the TRWD offices. The TRWD developed a HEC-RAS model of the river that incorporated the changes completed. This model was extensively reviewed and an analysis performed to create a unified model for the river system. Notes of the analysis follow.

There are three HEC-RAS models that have been developed in recent years as part of various studies that incorporate the Fort Worth Floodway:

<u>CDC Model</u>: Developed by the USACE in the 1990s as part of the Upper Trinity River Feasibility Study and CDC process, the CDC Model is used in the CDC Process and is maintained by the USACE.

<u>TRWD Model</u>: Developed by the TRWD in the late 1990s to represent physical changes the TRWD made to within the Floodway – construction of the Beach Street Dam, construction of the Fourth Street Dam, and removal of silt and dredging operations.

<u>CDM Model</u>: Developed by CDM, Inc. as part of the Trinity River Channel Re-alignment Study. CDM incorporated the TRWD Model within the CDC Model and used this to establish Existing Conditions for the project.

A detailed comparative analysis was performed on the CDC Model and the TRWD Model. The goal was to develop a current model for use in this study. Notes on the procedure follow:

1. Compare TRWD Model with the current CDC Model. Compare these two models to identify the changes the TRWD incorporated in their model to represent the physical changes stated in the above paragraph. Develop a complete cross-section list of changes.

2. Update the CDC Model. Modify the CDC Model by incorporating data from the TRWD Model (where applicable).

- The CDM Model and TRWD Model were provided to the USACE by CDM on CD dated September 2002.

- The TRWD surveyed cross-sections in the locations based on the original USACE cross-section locations.

- The TRWD Model data was checked from West Fork cross-section 215762 – 251976. The data was scrutinized to at each cross-section and incorporated into the revised CDC Model where applicable.

- The TRWD did not physically modify the Clear Fork portion of the Floodway.

- Most of the TRWD data was incorporated into the Revised CDC Model. There were instances where some of the TRWD was not used or used in combination with the current CDC Model data. In these cases, the TRWD surveyed channel data was used with the current CDC Model data for the left overbank and right overbank.

- At several cross-sections (upstream of Riverside Drive to the CRIP Railroad in particular), the original digitized cross-section data developed by Greenhorne and O'Mara – the Upper Trinity River mapping contractor – was used. In this reach, it was used in the LOB for the portion of the cross-section north of the left bank levee. This data was used in combination with the TRWD surveyed data.

- The current CDC Model bridge data, which were all surveyed by the USACE in 1975, was used as originally modeled in the Revised CDC Model.

Clear Fork Trinity River Existing Conditions Model

The hydraulic model used in this study is the current Corridor Development Certificate (CDC) model for the West Fork Trinity River. The CDC Model was developed by using the Upper Trinity River FEMA Model as the base model, which was developed during the UTRFS. The Central City Model utilizes both Existing Conditions and Future Conditions flood discharges (see Appendix A - Hydrology). The CDC Model was originally developed using the backwater program HEC-2 Water Surface Profiles. The model was later converted to HEC-RAS – River Analysis System version 2.0, using several versions.

- The Central City Model incorporates the Pier 1 Headquarters project located on the right bank of the Clear Fork downstream of 7^{th} Street. The revised cross-sections include 3100, 3365, 3590, 3803, and 4057.

- The central City Model incorporates the Radio Shack Campus project located at the Tandy parking lot at the West Fork/Clear Fork confluence. The revised cross-sections include West Fork 254060 – 254346, Clear Fork 477 – 1324.

During the analysis, the CDC Model was reviewed. The model was revised at several locations during this refinement. The changes to the model were as follows:

- Reach from IH 30 to City Dam No.2. Checked the entire reach under all of the bridges at IH 30 because it is complicated due to the many bridges – revised both the CDC 100 and SPF geometries: changed cross-sections 12131, 12411, 12541, 12565 to better define the effective conveyance areas – some of the blocked conveyance areas were not represented in the SPF geometry – compared current CDC Model with the CDC Model including these changes – the SPF was lowered slightly (-0.22 feet or so) - did not change the CDC 1-500 year water surface elevations.

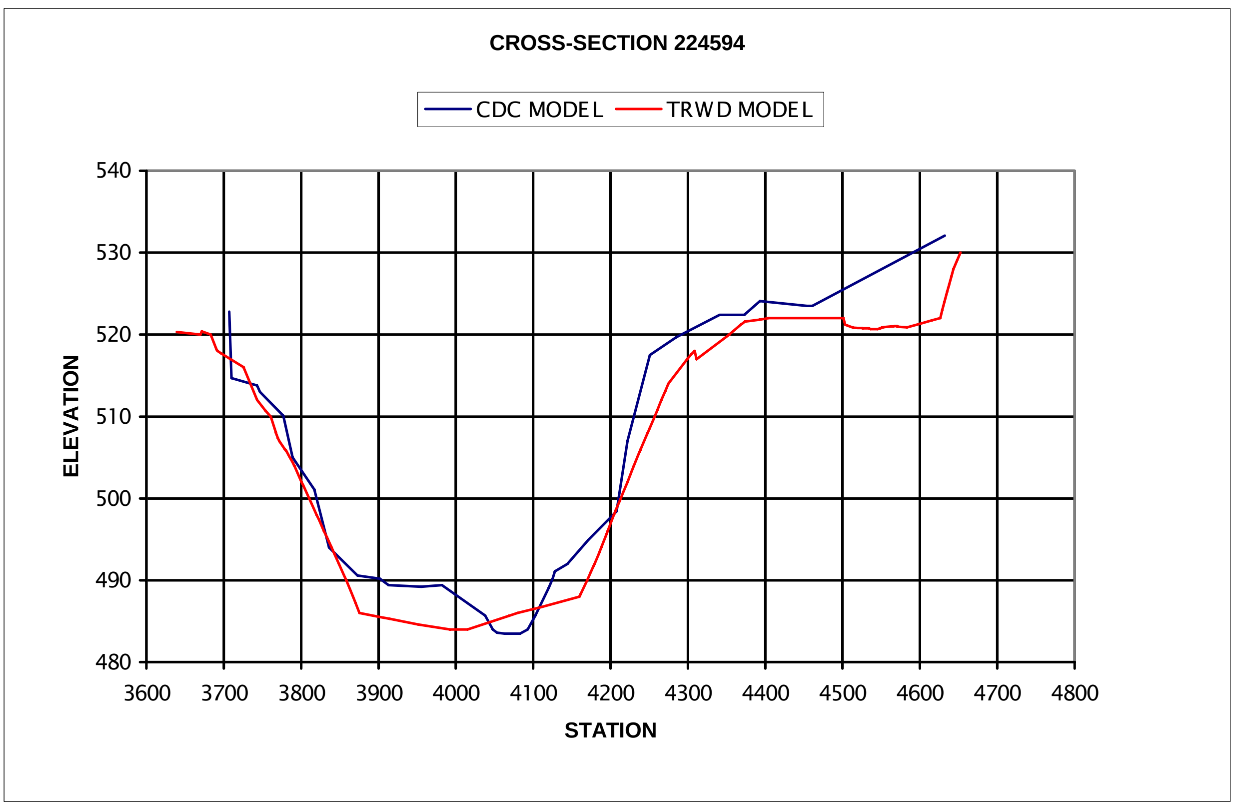
- Added ineffective flow in ROB due to right bank levee at cross-sections 29435, 29485, 29535, 29613, 29638, 29663 – for SPF geometry only.

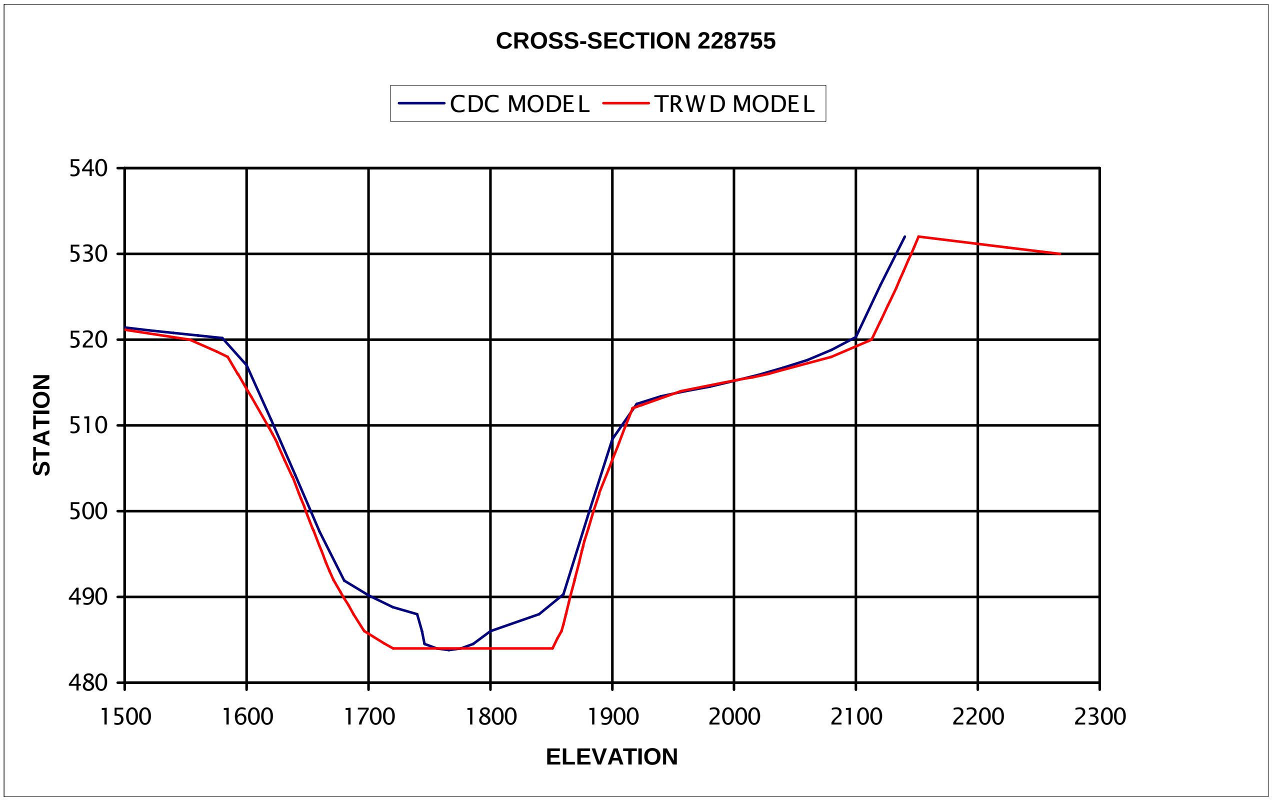
- Added ineffective flow in ROB at cross-section 40178 due to SH 183 bridge – for SPF geometry only.

- Changed blocked obstructions to ineffective flow at cross-sections 44342, 45015, 45544, 46175 - for SPF geometry only.

Figure B-2 show plots that indicate the comparison between the original West Fork backwater model and the TRWD surveyed data at two typical cross-sections.

Figure B-2
Cross-section Comparison of CDC Model and TRWD Data




CROSS-SECTION 228755
CDC MODEL
TRWD MODEL
540
530
520
510
500
490
480
STATION
1500
1600
1700
1800
1900
2000
2100
2200
2300
ELEVATION

The project baseline conditions HEC-RAS Model incorporates the physical changes and the refinement described in the above paragraphs, along with changes to the representation of ineffective/blocked flow to allow the model to compute both conveyance and storage. The model also incorporates the revised 100-year and SPF peak discharge specifically computed for this study.

Fort Worth Floodway

Shortly after the damaging flood of 1908, local interests organized the Fort Worth Improvement District of Tarrant County for the purpose of constructing local flood protection works for the city. As a result, the Fort Worth Floodway was constructed in 1910. The 1922 flood overtopped the levees and the levee height increased when repairs were made shortly thereafter. Further work on the levees was accomplished in 1936 with WPA funds, which consisted of minor re-alignment and re-grading of slopes. Failure of the levee system during the May 1949 flood confirmed the necessity for strengthening and extending the floodway. The USACE, with the TRWD as the local sponsor, began work on the channel modification and levee work in July 1950 and ended July 1958. The Fort Worth Floodway was later extended upstream on the West Fork and Clear Fork in separate extension phases.

“Authorization

The completed flood control project was authorized by Section 2 of Public Law No. 14, 79th Congress, 2nd Session approved March 2, 1945.

Location

The completed flood control work is located on the Clear Fork and West Fork of the Trinity River in Fort Worth, Tarrant County, Texas.

Description of Project

The completed project consists of channel improvements, construction and strengthening of levees, installation and modification of drainage structures, modification of highway and railroad bridges, road relocations, and sodding and seeding of embankment and channel slopes, on the West and Clear Forks of the Trinity River between river mile 551.45 and 570.40, and river mile 0.00 and 7.57 respectively.

Protection Provided

The project, in conjunction with Benbrook Reservoir, was designed and constructed to provide the leveed area of the city of Fort Worth a high degree of protection against possible future high water stages on the Clear Fork and the West fork of the Trinity River.

Dates of Construction

Work was initiated on the Fort Worth Floodway on 18 July 1950 and completed (except for turfing on the Clear Fork) on 15 July 1970.”[1]

Approximately 57,300 linear feet of levee strengthening and 49,700 linear feet of new levee construction were accomplished on the West Fork and Clear Fork. The freeboard on the

[1] Operation and Maintenance Manual, West Fork – Clear Fork, Trinity River at Fort Worth, Texas August 1970

levees was provided at four feet above the design water surface. The Fort Worth Floodway design discharges are 95,000 cfs on the West Fork downstream of the West Fork/Clear Fork confluence, 50,000 cfs on the West Fork upstream of the West Fork/clear Fork confluence, and 75,000 cfs on the Clear Fork. These discharges are equivalent to the Standard Project Flood.

The Fort Worth Floodway experienced record flows in May 1990. The Clear Fork peak discharge was 17,500 cfs and the West Fork peak discharge downstream of the West Fork/Clear Fork confluence was 36,000 cfs.

The project includes 30 sumps to accommodate interior drainage. Each sump contains a concrete structure with a gravity sluice, consisting of a flap gate(s) and manually operated gate(s).

Levees

There are five levee systems within the study area:

West Fork Levee Loop. Located on the right bank of the West Fork, total length approx. 4.09 miles

North Main Loop. Located on left bank of West Fork, total length 2.73 miles

Clear Fork Levee Loop. Located on right bank of West Fork and left bank of Clear Fork, total length 2.86 miles

Water Works Levee. Located on right bank of Clear Fork, total length approx. 0.94 miles

Riverside Levee. Located on left bank of West Fork, total length approx.

The original adopted design discharges of the Fort Worth Floodway are: 95000 cfs on the West Fork below the mouth of the Clear Fork, 50000 cfs on the West Fork above the mouth of the Clear Fork, 75000 cfs on the Clear Fork. These discharges are equivalent to the standard project flood.

A minimum levee freeboard of 4 feet was considered necessary in order to allow for possible deviation from the adopted design discharge as a result of the rapid rise in flood discharge for this type of watershed, as well as for allowing for wave action, outer bend ride-up, un-cleared vegetation, levee settlement, floating debris buildup, duration of high water against the levees, upper river improvements, and future urbanization.

Four feet of freeboard was established as an additional safety factor over the more traditional three feet because of the flashy nature of floods within the Fort Worth District boundaries. Time periods of 12 to 24 hours between heavy rainfall and peak rise in discharges are common so that local officials rarely would have an opportunity to provide emergency construction to prevent overtopping.

The TRWD performs routine maintenance operations on the Fort Worth Floodway. These operations include mowing of the levees and overbanks, removal of excessive vegetation along the channels slopes, maintaining the integrity of the levees, river channel slope protection, and cleaning and maintenance of the sump areas. Per the agreement between the TRWD and the USACE, annual and periodic (every five years) inspections are made to insure that the maintenance measures are being effectively carried out. In accordance with provisions of Title 33 Code of Federal Regulations, Section 208.10, no improvement shall be passed over, under or through the levees, improved channels, or floodways, nor any excavation or construction be permitted within the limits of the project right-of-way nor any change be made in any feature of the project with prior determination by the USACE that such improvement or alteration will not adversely effect the functioning of the protective facilities. The TRWD has an excellent record in maintaining the project to safely maintain the integrity of the project during passage of the design flood.

An economic reach listing (Table B-1) was developed to compile data for use in the economic analysis. The river was separated into distinct reaches and an index point was determined for each reach.

Table B-1

Reach	Description	Bank	River	Downstream	Upstream	Index Point
West Fork North - Riverside	Riverside Drive to TRE Railroad	LB	West Fork	222947	228095	226962
West Fork North - Middle	TRE Railroad to IH 35	LB	West Fork	228095.1	235534	232217
West Fork North - Upper	IH 35 to Samuels Avenue	LB	West Fork	235534.1	242340	239744
West Fork South	Riverside Drive to West Fork/Clear Fork confluence	RB	West Fork	222947	254500	225658
North Main - Marine Creek	Samuels Avenue to Marine Creek	LB	West Fork	242340.1	242500	242451
North Main	Marine Creek to upstream of Tarantula Railroad	LB	West Fork	242500.1	258300	253302
North Main - Jacksboro	Upstream of Tarantula Railroad to Rockwood Park	LB	West Fork	258300.1	265500	261002
Clear Fork East - Lower	West Fork/Clear Fork confluence to 10th Street	RB	Clear Fork	0	4600	2249
Clear Fork East - Water Works	10th Street to Tarantula Railroad	RB	Clear Fork	4600.1	8189	6258
Clear Fork East - Upper	Tarantula Railroad to IH 30	RB	Clear Fork	8189.1	12020	10906
Clear Fork West - Levee	West Fork/Clear Fork confluence to Rockwood Park	RB	West Fork	254500	265500	257654
Clear Fork West - Trinity Park	Clear Fork Levee Loop Levee to IH 30	LB	Clear Fork	8600	12020	10906

West Fork Levee Loop

- Located on right bank of West Fork
- Most of the levee has been raised by the TRWD
- Minimum level of protection: 2.8 feet freeboard at existing conditions SPF, 2.2 feet freeboard at future conditions SPF
- Most of levee has 4+ feet of freeboard

North Main Levee

- Located on left bank of West Fork
- Small portion of levee has been raised by TRWD
- Levee system critical point at concrete floodwall at TXU Plant: overtops wall 1.0 feet at existing conditions SPF, overtops wall 1.7 feet at future conditions SPF
- Most of levee has less than 4 feet of freeboard

Clear Fork Levee Loop

- Located on right bank of West Fork and left bank of Clear Fork
- Portion of levee from WF/CF confluence to Tarantula Railroad on West Fork has been raised by TRWD greater than SPF + 4 feet of freeboard
- Levee critical point occurs at one isolated point: SPF overtops levee 0.7 feet at future conditions SPF
- Most of levee has 1+ feet freeboard

Water Works Levee

- Located on right bank of Clear Fork
- Minimum level of protection: 2.1 feet freeboard at existing conditions SPF, 1.5 feet freeboard at future conditions SPF
- Most of levee has 3 + feet of freeboard

Riverside Levee

- Located on left bank of West Fork
- Non-Federal levee – the levee was constructed by the TRWD
- Level of protection is between a 25-year and 50-year flood event

Table B-2
Central City
Structures Within Study Area

All stations measured in feet
West Fork station 0 is at confluence of West Fork and Elm Fork
Clear Fork station 0 is at confluence of West Fork and Clear Fork

Bridges

West Fork (from downstream to upstream)	River Station
Riverside Drive	222947
Chicago, Rock Island, and Pacific Railroad	228095
East 4th Street	229495
S.H. 121	231025
U.S. 377/Belknap Street	231316
I.H. 35W	235355
Union Pacific Railroad	238401
Northside Drive	239230
Union Pacific Railroad	241825
Burlington Northern Railroad	241937
Sante Fe Railroad	242110
Samuels Avenue	242341
Northside Drive	244767
North Main Street	253241
Pedestrian Bridge	254118
Tarantula Railroad	257546
U.S. 199 Jacksboro Highway/Henderson Street	259501
University Drive	262548

Clear Fork (from downstream to upstream)

Pedestrian Bridge	483
U.S. 199 / Henderson Street	1463
7th Street	4402
Lancaster Avenue	6130
Tarantula Railroad	8189
I.H. 30	12075

Channel dams

West Fork (from downstream to upstream)

4th Street Dam	229428
TRWD Dam	247157
Nutt Dam	252041

Clear Fork (from downstream to upstream)

Dam upstream of Lancaster Avenue	6707
Dam near Trinity Park	8243
Dam near Trinity Park	9566
Dam near Trinity Park	10956

Table B-4
Sump Structures

Sump	Sluice Dimensions	Inlet Elev.	**Outlet Elev.**
14W	3 - 5' Diameter Sluices w/ Hand & Flap Gates	523.5	523.5
15W	1 - 3' Diameter Sluice w/ Hand & Flap Gate	523.7	522.8
16W	1 - 6' x 5' Sluice w/ Hand & Flap Gate	525.5	524.2
19C	1 - 3' x 3' Sluice w/ Hand & Flap Gate	538.15	538.0
20C	1 - 5' x 5' Sluice w/ Hand & Flap Gate	532.5	530.5
21C	1 - 5' x 5' Sluice w/ Hand & Flap Gate	533.0	531.1
22C	1 - 6' x 6' Sluice w/ Hand Gate	-	524.8
23C	1 - 6' x 7' Sluice w/ Hand & Flap Gate	524.2	523.2
24C	1 - 2' 3" x 4' 8" Drop Inlet to 60" Storm Sewer	525.5	524.2
25C	1 - 42" Storm Sewer (Valley View)	-	522.7
26	3 - 5' x 5' Sluices w/ 3' x 5' Hand Gate & 5' Diameter Flap Gate	517.2	516.6
27	1 - 6' x 5' Sluice w/ Hand Gate (2 - 4' x 4' Gates)	-	524.1
28	1 - 6' x 6' Sluice w/ Hand & Flap Gate	512.6	510.1
29	3 - 4' x 4' Sluices w/ Hand & Flap Gates	508.7	506.0
30	2 - 4' x 4' Sluices w/ Hand & Flap Gates	507.3	504.7
31	1 - 6' x 5' Sluice w/ Hand Gate	-	499.5

NED Plan

The NED Plan consists of raising portions of the North Main Levee and Clear Fork Levee Loop Levee to achieve a level of protection of SPF + 1 foot (using Future Conditions discharges). (Other plans of raising the Fort Worth Floodway levees to achieve SPF + 2 feet, SPF + 3 feet, and SPF + 4 feet were also analyzed).

Three reaches along the Clear Fork Levee Loop Levee were identified:

- Upstream of Henderson Street along the West Fork. Approximate length 1300 feet.
- Upstream of the Tarantula Railroad along the West Fork. Approximate length 1300 feet.
- Upstream of Henderson Street along the Clear Fork. Approximate length 1000 feet.

One reach along the Clear Fork Levee Loop Levee is identified:

- The floodwall at the TXU Plant along the West Fork. To minimize cost and provide an effective solution, this wall shall be removed and replaced with an earthen levee.

Hydraulic computations of the NED Plan resulted in no impact to the project design water surface profile. The fill placed on the levee to raise the reaches will be mitigated within the project reach. A site, located on the left bank of the West Fork approximately 1000 feet upstream of the Tarantula Railroad, was selected as a possible mitigation area.

NER Plan

The NER Plan included various environmental enhancements features within the study area. The features of the plan would minimally impact the hydraulics of the river system and would not impact the project design water surface profile.