REPORT ON

ALTERNATIVE DRAINAGE OUTLET TO THE MISSISSIPPI RIVER FOR THE HOEY'S BASIN JEFFERSON PARISH, LOUISIANA

FOR

JEFFERSON PARISH, LOUISIANA

JULY 9, 2007

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N-Y Project No. 07013

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ALTERNATIVE DRAINAGE OUTLET TO THE MISSISSIPPI RIVER FOR THE HOEY'S BASIN

I. INTRODUCTION

A. PURPOSE OF REPORT

N-Y Associates, Inc. (the Engineer) has been retained by Jefferson Parish to assist them in the planning, design and construction of an alternative drainage outlet to the Mississippi River for the Hoey's Basin. One of the tasks assigned to the Engineer was to review and assess the report prepared by DMJM Harris for this project. The report is designated as Project No. 16 Redirect Flow from Hoey's Basin to Mississippi River – Jefferson Parish. This report was part of an overall report entitled "Final Report of Alternatives Analysis of the Interim Drainage Maintenance Opportunities for Orleans East Bank Project, New Orleans District" published on August 18, 2006.

The purpose of this report is to present the Engineer's findings. It includes a critique of the overall design concept, the constructability of the project and the determination of the estimated total project cost.

When it became apparent that the total project cost would exceed that estimated in the DMJM Harris report, the Engineer made modifications

to the design concept in an effort to reduce the cost. Additionally, new design concepts were developed and investigated.

B. BASIN DESCRIPTION

The Hoey's Basin consists of 2,500 acres located in the southeastern area of the east bank of Jefferson Parish. The Basin is bounded to the east by the 17th Street Canal, to the west by the Severn Avenue-Shrewsbury Road area, to the north by Metairie Road, and to the south by the Mississippi River. Land use in the basin consists of a mix of industrial, commercial and residential development. See Drawing No. 1 for an aerial view of Hoey's basin.

C. HYDROLOGY

The Mississippi River Levee and Metairie Road are the highest points in the basin. The Airline-Metairie Country Club golf course area, Pelham Drive, Nassau Drive, and the south side of Northline Street are the lowest points in the basin.

The Hoey's Canal connects to the 17th Street Canal to help drain the areas of Jefferson Parish along the Mississippi River. Water from Hoey's Basin is collected by the Geisenheimer Canal and flows east to

the Hoey's Canal and eventually the 17th Street Canal. The 17th Street Canal drains substantial areas of uptown New Orleans, Metairie, and surrounding areas. Gates have been constructed at the end of the 17th Street Canal to protect the area from Lake Pontchartrain storm surge. Pumps have been installed to pump around the gates for use when the flood gates are closed.

D. SCHEDULE

Jefferson Parish selected the Engineer for the Hoey's Basin Pump to the River Project on June 6, 2007. The firm was verbally authorized to proceed on June 13, 2007.

The U.S. Army Corps of Engineers (U.S.A.C.E.) has been mandated by Congress under Section 4303 of H.R. 2206 to study and determine the best solution for pumping storm drainage to Lake Pontchartrain from the 17th St. Canal. It's study must consider (a) a new pump station at Lake Pontchartrain (b) the possible removal of existing Drainage Pump Station No. 6 (c) pumping storm drainage directly to the Mississippi River in Jefferson Parish in combination with pumping to Lake Pontchartrain and (c) required improvements to the floodwalls and levees along the 17th St. Canal.

This U.S.A.C.E. study is in progress. A partnering session is planned for July 17th, 2007, and a senior partnering session is planned for July 31st with the best technical solution report to Congress being made on August 25, 2007.

N-Y Associates, Inc. (the Engineer) has to complete their report on the Hoey's basin in order that it may be utilized by Jefferson Parish at the partnering session to be held on July 17th.

E. LEVEL OF EFFORT

Jefferson Parish instructed the Engineer to perform a "quick and dirty" review of the DMJM Harris report. All of the work performed by the Engineer was concept level work. However, an effort was made to ensure that this report was as technically accurate as possible. This was accomplished by numerous field reconnaissance visits, preparation of a force main profile, preparation of a pumping system curve, and preparation of detailed construction cost estimates. A more detailed design development report will have to be prepared prior to the preparation of preliminary and final construction plans and specifications.

II. OVERALL PLAN AND PROJECT DESCRIPTION

A. GENERAL

The DMJM Harris report proposed to divert 2400 cfs of storm water from Hoey's Canal to the Mississippi River through a pump station and force main. This proposed diversion will drain all 2500 acres of Hoey's Basin thereby eliminating for the most part the need to rely on Drainage Pump Station No. 6 which is owned by the Sewerage and Water Board of New Orleans.

This would be accomplished by the construction of a pump station with a capacity of 2400 cfs located approximately midway between Earhart Blvd. and Jefferson Highway. The 2400 cfs of storm drainage would be conveyed to the Mississippi River through three 10' diameter discharge pipes. (See Drawing No. 2, Location Layout prepared by DMJM Harris.)

An over-all layout of the plan proposed by the Engineer follows. Please refer to Drawing No. 3.

B. PROPOSED PUMP STATION

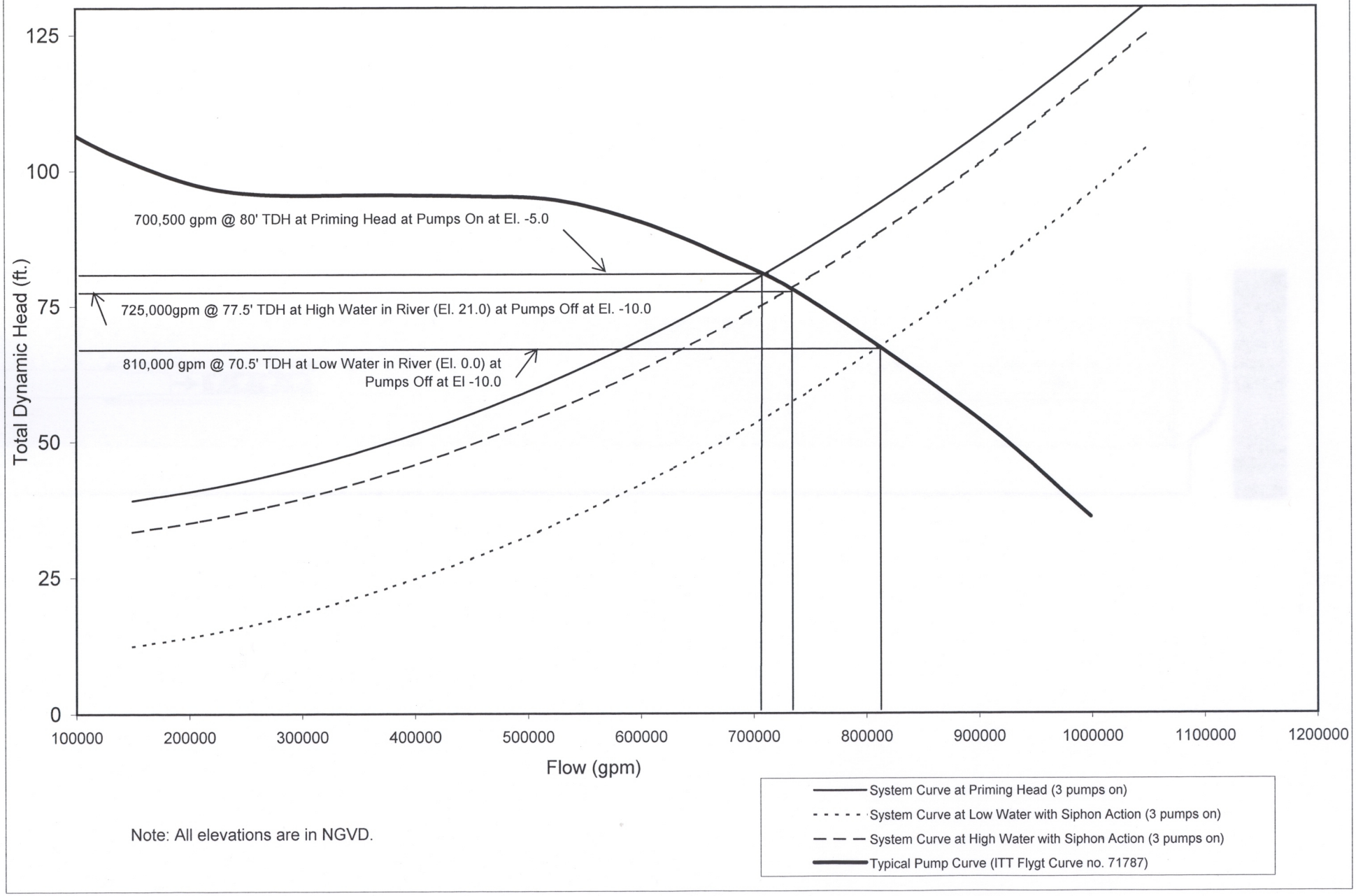
1. CAPACITY

The capacity of the pump station in the DMJM Harris report was 2400 cfs. In anticipation that the total project cost of $106,000,000 shown in the DMJM Harris report would be exceeded, the Engineer reduced the capacity of the pump station to 1600 cfs to be followed by a second phase of 800 cfs. This decision was corroborated by a report prepared by BCG entitled "Rationale for the Hoey's Basin Flood Control Plan for the 2006 Hurricane Season" which stated that "a minimum of 1600 cfs would have to be diverted to the Mississippi River in a Pump to the River Plan to meet the watershed needs that currently exist in the Hoey's Basin."

2. TYPE OF PUMPS

The Engineer prepared a profile showing the pump station, force mains and Mississippi River (Drawing No. 4) and a preliminary pumping system curve (Figure No. 1). The DMJM Harris report recommended the use of two 1000 cfs horizontal pumps and two smaller pumps with a total capacity of 2400 cfs. The DMJM Harris report indicated that a total system head of 32 feet would be required which could be achieved with horizontal pumps.

Figure No. 1
Preliminary System Curve for
Hoey's Canal Pump to the River



Note: All elevations are in NGVD.

However, the Engineer's calculations and data indicated that vertical pumps with a much higher system head will be required. For example, using ITT FLYGT vertical pumps at a capacity of approximately 533 cfs each, a Total Dynamic Head (TDH) of 80 feet will be required for priming with the required TDH fluctuating from 77.5 feet at high river to 70.5 feet at low river when operating as a siphon.

Three pumps will be installed initially to pump 1600 CFS, and two could be installed in the future for a total capacity of 2400 CFS.

3. DESCRIPTION AND LAYOUT OF PUMP STATION

See Drawing No. 5 for the proposed pump station site plan. The pump station is located just south of Hoey's Canal about midway between Earhart Blvd. and Jefferson Highway.

The new pump station will have climber screens on the suction side. It will be designed to accommodate two future pumps all of which will be driven by diesel engines. A stand-by generator will be provided for ancillary electrical power in the event of the loss of Entergy power. The pump station shall be flood-proof and

designed for a 150 MPH wind load. It is not anticipated that surge protection will be required.

C. FORCE MAINS

1. NUMBER OF PIPES

The DMJM Harris report proposed three 10’ diameter force mains for a total pumping capacity of 2400 cfs. In order to reduce the total project cost, the Engineer recommends one 13’ diameter force main to pump the present flow of 1600 cfs and a future 10’ diameter force main to pump an additional 800 cfs.

Although the construction of any force mains in the large diameters being contemplated will be difficult because of the congestion and topography along the alignment, the Engineer was not able to determine a route more suitable than the one shown in the DMJM Harris report. Again, refer to Drawing No. 3 for the proposed force main route, and Drawing No. 4 for a profile of the force mains.

The Engineer has proposed that the force main be installed above ground between the new drainage pump station and the KCS Railroad Crossing, and between the Jefferson Highway

Crossing and Dakin Street except for the underground crossing for the N.O.P.B. Railroad. If this can be accomplished, it will result in a significant reduction in construction cost.

2. HIGHWAY CROSSINGS

Preliminary discussions with the Louisiana Department of Transportation and Development (LADOTD) indicate that the highway crossings at Jefferson Highway and River Road can be constructed by open cut. This should be less expensive and more aesthetically pleasing than the elevated crossings proposed in the DMJM Harris report. The Jefferson Highway crossing will be one 13’ diameter pipe, and the River Road Highway crossing will be five 6’ diameter pipes because of the clearance restrictions at the levee crossing.

3. RAILROAD CROSSINGS

A railroad crossing is required at the KCS Railroad just north of Jefferson Highway and at the N.O.P.B. Railroad about two thirds of the way between Jefferson Highway and Dakin Street. These crossings will require three 10’ diameter casing pipes installed by the jack and bore method and three 8’ diameter force mains. DMJM Harris also used underground pipes at these locations.

4. MISSISSIPPI RIVER LEVEE CROSSING

The Mississippi River Levee Crossing consists of three components. The first component shall consist of a continuation of the five 6’ diameter pipes under River Road. These pipes will be installed on a concrete slope paving over the levee crown. The levee will have to be re-shaped to accommodate this work in accordance with U.S.A.C.E. standards with a roadway over the pipes at the relocated levee crown.

The second phase will consist of installing the five 6’ discharge pipes underground in the batture. The third phase will consist of installing five 6’ discharge pipes into the Mississippi River supported on pile bents.

A discharge box will be required at the end of the force mains together with protective dolphins or a circular steel sheet pile structure filled with sand. Rip-rap or revetment will also be required on the river bottom at the point of discharge.

5. LENGTH OF FORCE MAIN

The over-all length of the force main in the DMJM Harris report and as proposed by the Engineer is approximately 5600 linear feet.

D. GEISENHEIMER CANAL

The Geisenheimer Canal is generally a west-east primary collector canal which runs parallel to Airline Drive (US 61). The canal begins on the south side of Airline Drive and eventually crosses over to the north side where it intersects with the Hoey's Canal. The Geisenheimer Canal Begins as a 30-inch Reinforced Concrete Pipe (RCP) and gradually increases to an 8' x 15' Reinforced Concrete Box (RCB), prior to where it intersects with the Hoey's Canal. The combined system then continues northeast as an 11' x 23' RCB. There is an open transition with floodgates before it discharges into the 17th Street Canal as 2 – 8' x 9' and 1 – 9' x 12' RCBs.

Flow from the Geisenheimer Canal to the east will be intercepted with a new twin 8' x 8' box culvert approximately 600' long discharging across Airline Highway into Hoey's By-Pass Canal which is slope paved. This is similar to the DMJM Harris plan. See Drawings No. 3, Over-All Layout and No. 6, Proposed Geisenheimer Canal Box Culvert and Hoey's Canal Improvements.

E. HOEY'S CANAL

Hoey's Canal is generally a west-east secondary collector canal located south of Airline Drive (US 61) in the Hoey's Basin Drainage Area. It is approximately 1.85 miles long and begins near Causeway Blvd., south of the Earhart Expressway. It runs east to a point where it intersects with the L&A Ditch. It then runs northeast until it intersects with the Geisenheimer Canal, north of Airline Drive (US 61) at the Metairie Country Club. Hoey's Canal is both an earthen, slope paved and subsurface culverted canal at different locations.

Photographs of Hoey's Canal are shown on Photo Nos. 1 through 8.

Photo No. 1 - Two 8 x 8 RCB under L&A Road

Photo No. 2 - Hoey's Canal facing Southeast from L&A Road

Photo No. 3 - Hoey's Canal facing Northeast at Earhart Expressway

Photo No. 4 - Hoey's Canal facing Southwest at Earhart Expressway

Photo No. 5 - Hoey's Canal traveling under Cold Storage Road

Photo No. 6 - South side of RCB Under Cold Storage Road

Photo No. 7 - Hoey's Canal facing Northwest toward Airline Drive

Photo No. 8 - Hoey's By-Pass Canal Discharging into Hoey's Canal

Hoey's Canal will be improved by slope paving it between Airline Drive and the Earhart Expressway as shown on Drawing No. 3. This will provide a continuous slope paved section for Hoey's Canal between Airline Drive and the proposed pump station since Hoey's Canal is slope paved south of Earhart Expressway.

F. HOEY'S BY-PASS CANAL

Hoey's By-Pass Canal is a planned reroute of Hoey's Canal between Earhart Expressway and Airline Drive (US 61). The plan is to reroute water from the Hoey's Canal to the Monticello Canal before it crosses Airline Drive. This will help to alleviate the ponding of additional water in Hoey's Canal north of Airline Drive, which has the lowest elevation in the entire basin. However, only a portion of this canal consisting of a slope paved section has been constructed to date.

Photographs of Hoey's By-Pass Canal are shown on Photo Nos. 9 through 12.

Photo No. 9 - Hoey's By-Pass Canal at L&A Road Facing Southwest

Photo No. 10 - Hoey's By-Pass turning 90º towards Hoey's Canal

Photo No. 11 - Hoey's By-Pass entering 72" RCP under Cold Storage Rd.

Photo No. 12 - Beginning of unlined portion of Hoey's By-Pass Canal

Hoey's Canal will be improved by slope paving the canal between Airline Drive and the Earhart Expressway as shown on Drawing No. 3.

III. OTHER DESIGN CONSIDERATIONS

A. GEOTECHNICAL

There are no extraordinary geotechnical problems at this project site that are different from those typically encountered in other parts of Jefferson Parish. Design issues will include pile capacities, the effects of sand deposits on dewatering and pressure relief for excavations. Other geotechnical concerns are construction related damages to adjacent structures due to settlement and vibrations, and the stability of open channels.

B. ENVIRONMENTAL

The proposed project will require environmental clearance if federal funds are used to finance the project. The DMJM Harris report stated that this may be accomplished by an amendment to EA No. 433. This will have to be investigated further. A cursory review of the project indicates that it will not result in any adverse short term or long term impacts on the environment. In any event, funds for environmental services have been budgeted in the total project cost. Also time has

been allocated in the Design and Construction Schedule. (See Figure No. 2).

C. REQUIRED RIGHTS-OF-WAY

Rights-of-way acquisition may be significant. For purposes of this report, the Engineer made certain assumptions to determine if right-of-way acquisition would be required. The acreage of required rights-of-way was multiplied by estimated current property values to determine the total rights-of-way acquisition costs. These costs must be refined at a later date based upon title research and more refined estimates of property values. Special attention must be given to the homes that have been built in the batture of the Mississippi River where the force mains will be constructed since the ownership of this property is in question.

Right-of-Way acquisition will be required for the pump station and for the force main along the KCS and N.O.P.B. Railroads as well as parallel to the L&A Ditch.

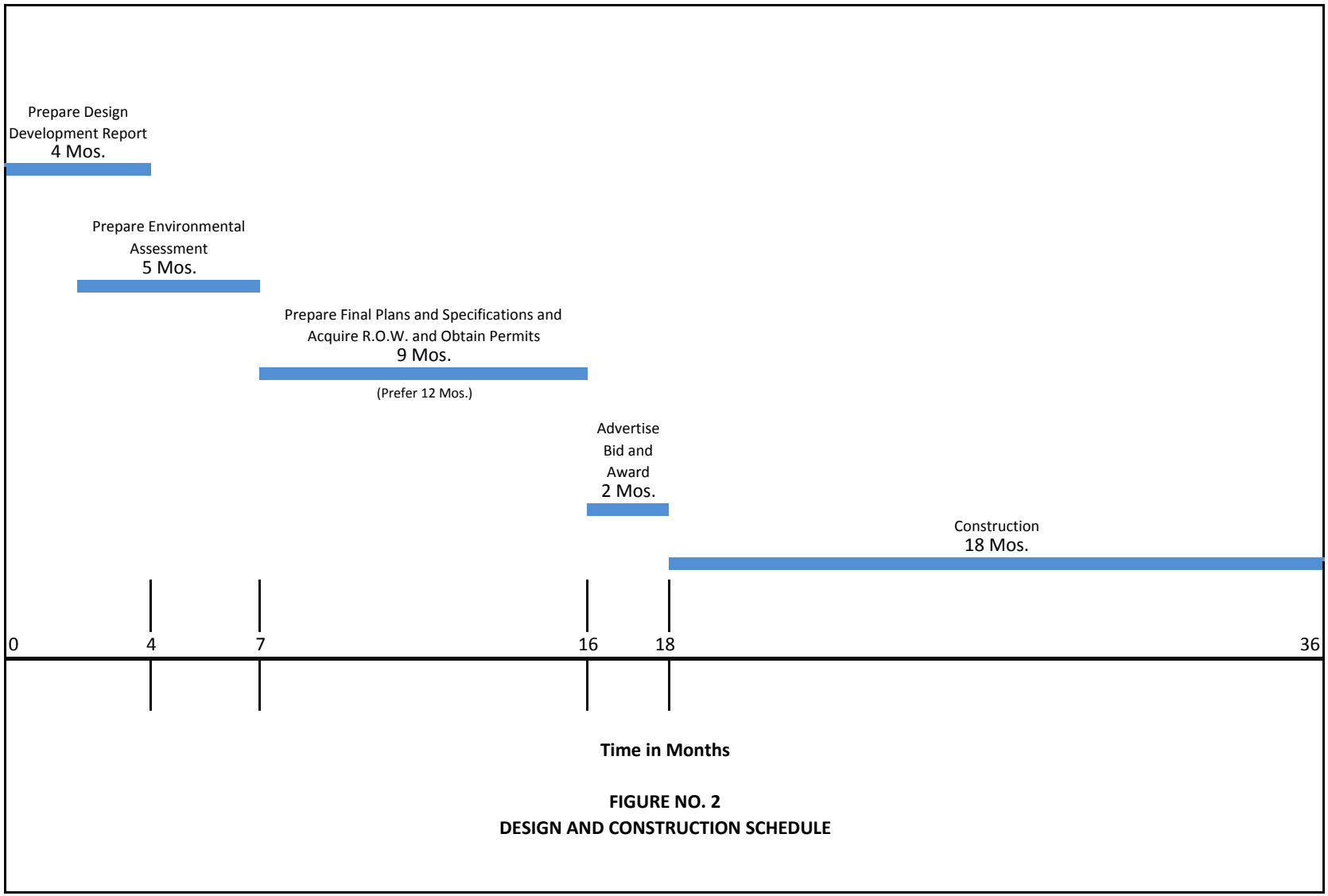


FIGURE NO. 2
DESIGN AND CONSTRUCTION SCHEDULE

D. DESIGN AND CONSTRUCTION SCHEDULE

Figure No. 2 is an approximate schedule for the design and construction of this project. It is an aggressive schedule which can be met only if everything falls into place without any unforeseen problems. If at all possible, this schedule should be extended by four to six months.

E. PERMITS

Permits will be required from the Louisiana Department of Transportation and Development (LADOTD) for crossing Airline Drive, Jefferson Highway and River Road. Permits will also be required when crossing the two railroads at three locations. The force mains crossing the levee into the batture to the discharge structure will require permits from the U.S.A.C.E., the East Jefferson Levee District, Louisiana Department of Natural Resources and the Louisiana Department of Environmental Quality. The force main discharge structure and the associated protective dolphins will require permits from the United States Coast Guard.

F. UTILITY RELOCATIONS AND REPAIRS

It is anticipated that several utilities, both public and private, will require relocation and/or repairs for the installation of the force main and the drainage modifications. A walk through the project site identified several private utilities such as telecommunication lines and gas lines that will require relocation. A study of the Parish GIS maps indicates that Parish-owned utilities such as water and sewer lines will require relocation.

IV. OPINION OF PROBABLE CONSTRUCTION COST

Figure No. 3 is a concept level Opinion of Probable Construction Cost. All major construction items have been listed separately and in some detail to allow a reader to better evaluate how the total project cost was determined. All costs reflect estimated post-Katrina escalated prices and are in year 2007 dollars.

The cost of the pump station was determined on the basis of $17,500 per cfs after carefully evaluating the cost per cfs of recently constructed drainage pump stations in Jefferson Parish, and then comparing these stations with the one contemplated in this report. A normal escalation factor and an escalation factor due to Hurricane Katrina was included.

The unit costs for the force mains and related railroad and highway crossings were based on brief discussions with contractors, past construction projects and other contemplated similar projects again taking into account post-Katrina price escalation.

A 20% construction contingency, which is the minimum customarily used on concept level reports of this type, has been added to the total project cost.

Because of the time constraints associated with the preparation of this report, coupled with the unusually large diameter force mains proposed to be installed in a congested area, it is recommended that some additional time be spent refining the total estimated project cost.

V. COST REDUCTION ALTERNATIVE FOR CONSIDERATION

In order to attempt to reduce the construction cost, it was determined that a reduction in force main length and size should be considered. This was accomplished by moving the proposed pump station closer to the Mississippi River. The size of the force main could be reduced if the pump station capacity were reduced. In order to accomplish the reduction in pump station capacity, the use of a detention pond was investigated.

This alternative consists of a 300’ x 750’ detention pond with an effective depth of sixteen feet which will have a capacity of 2,641,140 cubic feet and a new drainage pump station with a capacity of 1000 cfs located north of the N.O.P.B. Railroad between Jefferson Highway and River Road. It will discharge into the Mississippi River through a single 10’ diameter Underground Force Main Along Industrial Avenue, all as shown on Drawing No. 7. A new canal would have to be constructed to connect Hoey’s Canal to the detention pond.

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This plan will result in approximately 2” or less of standing water on the majority of streets in the Hoey’s basin for a 10 year rainfall event.

The estimated Opinion of Probable Construction Cost for this alternative is approximately $96,881,808 million dollars as shown on Figure No. 4.

This illustrates the approximate relative level of flood protection that can be accomplished with approximately $97,000,000 million dollars.

FIGURE NO. 3
OPINION OF PROBABLE CONSTRUCTION COSTS
ALTERNATE DRAINAGE OUTLET TO THE MISSISSIPPI RIVER
FOR THE HOEY'S BASIN (1,600 c.f.s. Pump Station)

ITEM	QTY.	UNIT	UNIT PRICE	EXTENSION
1,600 CFS Pumping Station	1,600	CFS	$ 17,500	$ 28,000,000
13' Diameter Force Main: Below Ground	1,000	LF	$ 11,250	$ 11,250,000
13' Diameter Force Main: Above Ground	3,600	LF	$ 6,500	$ 23,400,000
13' Diameter Force Main Under Jefferson Highway: Open Cut	150	LF	$ 13,027	$ 1,954,050
Crossing at KCS Railroad (Jack and Bore three 10' casing pipes, and install three 8' Force Main)	120	LF	$ 16,900	$ 2,028,000
Crossing at New Orleans Public Belt Railroad (Jack and Bore three 10' casing pipes, and install three 8' Force Main)	120	LF	$ 16,900	$ 2,028,000
River Road Crossing: Open Cut (Five 6' Force Mains)	50	LF	$ 12,000	$ 600,000
Pipeline Transition Structures: Single Pipe to Multiple Pipes and back	5	EA	$ 500,000	$ 2,500,000
Mississippi River Levee Pipeline Crossing: Install on Concrete Slope Paving (Five 6' Force Mains)	250	LF	$ 16,000	$ 4,000,000
Mississippi River Bature Crossing (Five 6' Underground Force Mains)	150	LF	$ 6,000	$ 900,000
Force Main Discharge into Mississippi River (Five 6' Force Mains Supported on Pile Bents)	100	LF	$ 20,000	$ 2,000,000
Force Main Diffuser Box and Protective Dolphins or Cells	1	LS	$ 2,000,000	$ 2,000,000
Hoey's Canal Improvement: Concrete Flume with Slope Paving	1,000	LF	$ 6,000	$ 6,000,000
Geisenheimer Canal Relocation: Twin 8'x8' Box Culvert	600	LF	$ 11,500	$ 6,900,000
Creosote Ditch Relocation	180	LF	$ 1,000	$ 180,000
Utility Relocations and Repairs (Public and Private)	1	LS	$ 1,000,000	$ 1,000,000
Street Pavement and Driveway Repairs	1	LS	$ 1,000,000	$ 1,000,000
SUB-TOTAL CONSTRUCTION COST				**$ 95,740,050**
CONTINGENCY @ 20%				**$ 19,148,010**
TOTAL CONSTRUCTION COST				**$ 114,888,060**
ENVIRONMENTAL				**$ 500,000**
RIGHT-OF-WAY ACQUISITION				**$ 2,000,000**
DESIGN				**$ 11,488,806**
GRAND TOTAL PROJECT COST				**$ 128,876,866**

FIGURE NO. 4
OPINION OF PROBABLE CONSTRUCTION COSTS FOR ALTERNATE OPTION
ALTERNATE DRAINAGE OUTLET TO THE MISSISSIPPI RIVER
FOR THE HOEY'S BASIN (Alternate with 1,000 c.f.s. Pump Station and Detention Pond)

ITEM	QTY.	UNIT	UNIT PRICE	EXTENSION
Pumping Station	1,000	CFS	$ 17,500	$ 17,500,000
10' Diameter Force Main: Below Ground	1,900	LF	$ 6,500	$ 12,350,000
Crossing at New Orleans Public Belt Railroad (Jack and Bore three 7' casing pipes, and install three 6' Force Main)	120	LF	$ 9,000	$ 1,080,000
Pipeline Transition Structures: Single Pipe to Multiple Pipes and back	3	EA	$ 500,000	$ 1,500,000
River Road Crossing: Open Cut (Three 6' Force Mains)	50	LF	$ 7,200	$ 360,000
Mississippi River Levee Pipeline Crossing: Install on Concrete Slope Paving (Three 6' Force Mains)	250	LF	$ 10,000	$ 2,500,000
Mississippi River Bature Crossing (Three 6' Underground Force Mains)	150	LF	$ 3,600	$ 540,000
Force Main Discharge into Mississippi River (Three 6' Force Mains Supported on Pile Bents)	100	LF	$ 12,000	$ 1,200,000
Force Main Diffuser Box and Protective Dolphins or Cells	1	LS	$ 1,750,000	$ 1,750,000
Hoey's Canal Improvement: Concrete Flume with Slope Paving	1,000	LF	$ 6,000	$ 6,000,000
Geisenheimer Canal Relocation: 2-8'x8' Box Culvert	600	LF	$ 11,500	$ 6,900,000
Excavation for Detention Pond	106,200	CY	$ 12	$ 1,274,400
Tie-in Detention Pond to Hoey's Canal using Subsurface Drainage	1,500	LF	$ 10,000	$ 15,000,000
Utility Relocations and Repairs (Public and Private)	1	LS	$ 1,300,000	$ 1,300,000
Street Pavement and Driveway Repairs	1	LS	$ 1,300,000	$ 1,300,000
SUB-TOTAL CONSTRUCTION COST				**$ 70,554,400**
CONTINGENCY @ 20%				**$ 14,110,880**
TOTAL CONSTRUCTION COST				**$ 84,665,280**
ENVIRONMENTAL				**$ 500,000**
RIGHT-OF-WAY ACQUISITION				**$ 3,250,000**
DESIGN				**$ 8,466,528**
GRAND TOTAL PROJECT COST				**$ 96,881,808**

APPENDIX ‘A’

The Hydraulic Model

Objective: The objective of this project is to reduce pumping needs at the 17th Street Canal by redirecting rainwater in the Hoey's Basin into the Mississippi River by way of new pump station and additional culverts.

Model Overview: The system model was developed using the USEPA Stormwater Management Model (SWMM) version 5. SWMM simulates both the hydrologic (rainfall-runoff) and hydraulic processes. In order to better understand the system and determine the appropriate system improvements, it was necessary to model both the existing and proposed conditions.

Schematics of the existing and proposed conditions systems as developed in SWMM5 are shown in **Figures A-1 and A-2**. The main components of the system include:

- Geisenheimer Canal
- Hoey's Canal

There are several versions of the proposed conditions model. Each version include the existing model components, in addition to the new pump station and associated pipes, which are designed to handle 1600 cfs, but will ultimately handle 2400 cfs. The proposed conditions models include one or more alternatives to fix overflow problems associated with reversing the system.

Information gathered based on available figures and data includes:

- Subbasin area
- % impervious
- Invert of Hoey's Channel near Earhart Expressway

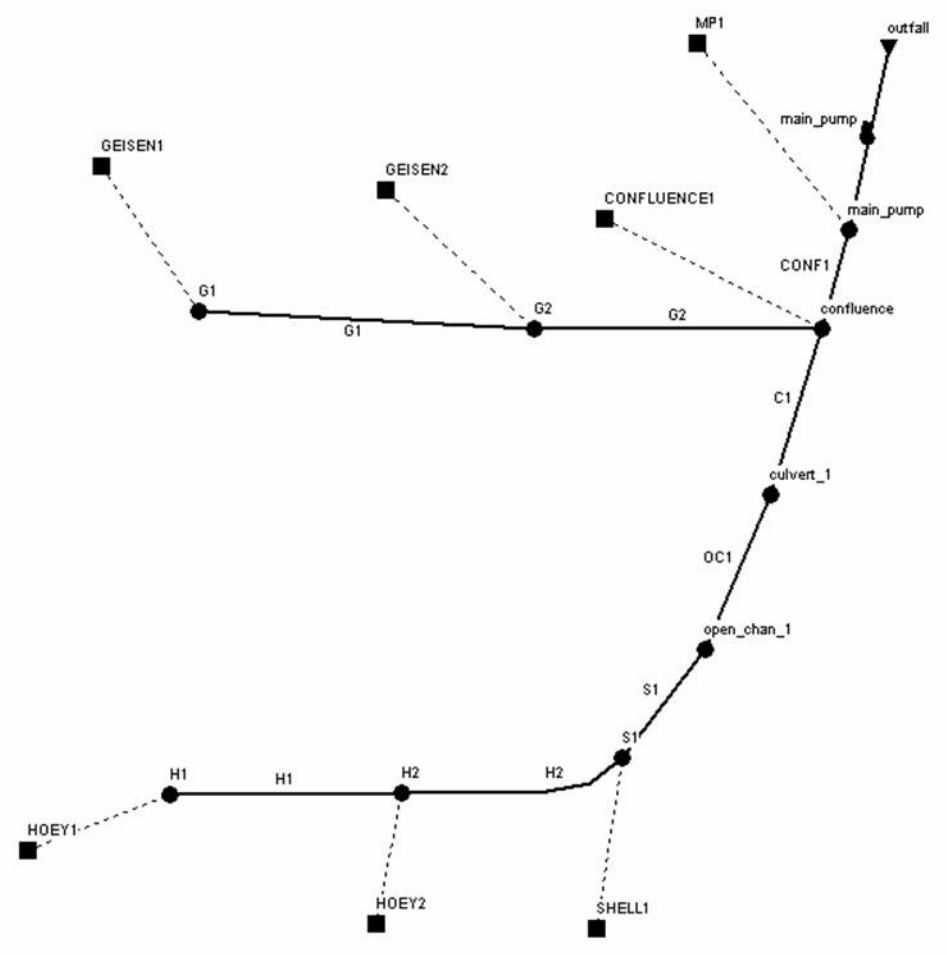

Figure A-1: Existing conditions Hoey's Canal SWMM5 model schematic.

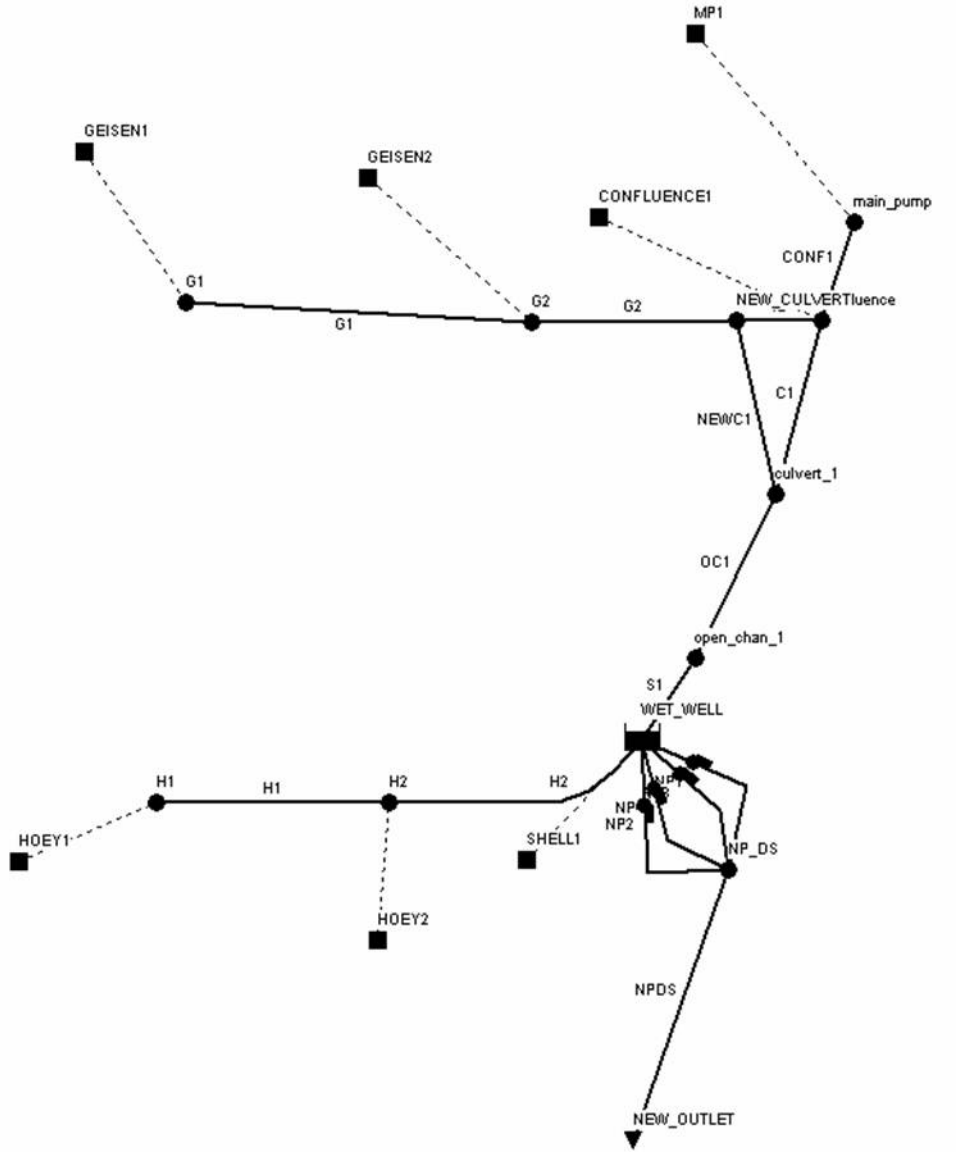

Figure A-2: Proposed conditions Hoey's Canal SWMM5 model schematic.

Storm Development: There was no design storm specified for modeling the Hoey's Canal system. Therefore the design storms were dictated based on the capacity of the new pump station. The 10-yr 24-hr event with the nested 10-yr 6-hr event and the 25-yr 24-hr event with nested 25-yr 6-hr were used to provide 1600 cfs and 2400 cfs, respectively, to the new pump station. These storm events, as well as their distribution in the model are shown in **Tables A-1 and A-2**.

Table A-11: Modeled storm events for Hoey's Canal Improvement.

Event	Depth (in)
10-yr 6-hr	6.2
25-yr 6-hr	7.3
10-yr 24-hr	9.2
25-yr 24-hr	10.5

Table A-2: Storm event distribution for Hoey's Canal Improvement SWMM5 model.

	Intensity (in/hr)	
Time (hrs)	10-yr 24-hr	25-yr 24-hr
0	0.164	0.18
6	0.164	0.18
12	1.04	1.22
18	0.164	0.18
24	0.00	0.00
30	0.00	0.00
36	0.00	0.00

Model Development: Sub-basin Delineation and Hydrologic Information

Very few drawings and information were available for this system. Many assumptions were made and in many cases best engineering judgment was used. An overview of the entire system was used to delineate subbasins and determine where model junctions were placed based on points of interest and visible divisions within the system.

Subbasin areas were estimated based on a percentage of the entire 2500 acre watershed. The percent impervious was estimated as the percentage of each subbasin that was either residential or commercial. Subbasin information is summarized in **Table A-3**.

Table A-3. Subbasin SWMM5 model input.

Subbasin	Area (ac)	% Residential/Commercial	% Open Space	% Impervious
H1	425	90	10	90
H2	425	90	10	90
S1	600	80	20	80
G1	300	80	20	80
G2	250	70	30	70
CONF1	200	0	100	0
MP1	250	60	40	60

Existing and Proposed Conditions Hydraulic Information: The existing conditions model drains both the entire Hoey's and Geisenheimer Canal watersheds into the 17th Street Canal . The Geisenheimer Canal in the modeled part of the system is pipe, while the Hoey's Canal in this area includes a combination of lined and unlined open channel, pipe and culverts.

The base proposed conditions model contains most of the same components as the existing conditions model, but no longer uses the 17th Street Canal pump station. Instead, part of the flow in Hoey's Canal is reversed, so that both the Geisenheimer and Hoey's Canal watersheds drain into the Mississippi River via a new pump station and additional piping.

Only one invert was known in the system which is at the downstream end of the culverts near Shell, junction **S1** (see **Figure A-2**). Pipe lengths were scaled using the overview drawing. Inverts for all other junctions were determined using these pipe lengths and an assumed slope of 0.05%. The assumption was also made that the entire system slopes toward the 17th Street Canal.

Alternative Proposed Conditions: The alternative proposed conditions models contains the same basic components as the base proposed conditions model, but include slight variations that account for overflow that occurs due to the reversed flow along Hoey's Canal. There are three alternatives. These include:

1. Sloping the Hoey's Canal segment from junction **NEW_CANAL** to **S1** down towards the Mississippi River.
2. Increasing the capacity of the open channel along Hoey's Canal from junction **culvert_1** to **open_chann_1**.
3. A combination of alternatives 1 and 2.

Results: The SWMM5 model was run for existing and proposed conditions, as well as proposed conditions including alternatives for alleviating overflow problems. Model results indicate that the overflow occurs in the proposed conditions model at the junction **NEW_CULVERT**. This is a low point in the system. Flows and depths at selected locations are shown in **Tables A-4 and A-5**.

Table A-4. SWMM5 model results - peak flow in conduits at selected locations.

	Peak flows (cfs)				
Conduit ID	**Existing**	**Proposed**	**Proposed alternative 1**	**Proposed alternative 2**	**Proposed alternative 3**
G1	500	500	600	600	590
NEWC1	--	280	450	460	390
C1	1230	310	460	470	400
OC1	1230	590	950	930	930
H2	860	850	960	1080	960

Table A-5. SWMM5 model results - depth in nodes at selected locations.

	Depth (ft)				
Node ID	**Existing**	**Proposed**	**Proposed alternative 1**	**Proposed alternative 2**	**Proposed alternative 3**
G2	10.1	10.7	9.2	10.9	9.2
NEW_CULVERT	--	10.7	9.7	10.7	9.8
Confluence	10.9	10.8	9.8	10.8	9.9
culvert 1	11.6	10.5	9.7	10.5	9.8
H2	9.8	8.1	6.6	8.2	6.5