

**Lower Colorado River – Phase 1, Texas
INTERIM FEASIBILITY REPORT AND
INTERGRATED ENVIRONMENTAL ASSESSMENT**

Appendix G

Section 2

Civil Design

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APPENDIX G CIVIL DESIGN SECTION

INTRODUCTION

PURPOSE OF STUDY

The study area is located north of the Colorado River and south of Baughman Slough in the City and County of Wharton, Texas, which is about 60 miles southwest of Houston (Sheet G301). The Colorado River originates in the panhandle of Texas, and has a contributing drainage area at Wharton of approximately 42,000 square miles. Baughman Slough is small drainage area that floods the northern side of Wharton, from localized storm events, as well as when the Colorado River overtops its bank upstream of Wharton. Levees, flood walls, channels, and sump areas are needed on both of these drainage systems to protect the City Wharton from future flooding. For the purpose of this appendix, the study area has been divided into the following reaches:

Table G-1 Reach Descriptions

REACH NAME	START LOCATION	END LOCATION	REACH DESCRIPTION
BS-1	0+00	19+80	Levee from abandoned RR embankment to Richmond St along Baughman Slough
BS-2	19+80	30+40	Levee from Richmond Street to Fulton Street
BS-3	30+50	34+30	Flood wall from Fulton Street to Past the home east of Fulton and south of Baughman Slough.
BS-4	34+30	70+00	Levee from flood wall to Junior College Blvd
BS-4A	49+50	70+00	75 foot bottom modified channel begins. Continuation of levee from Station 49+50
BS-5	1+20	27+80	75 foot modified channel from Junior College Blvd. to County Road 150
BS-6	27+80	49+00	75 foot modified channel from County Road 150 to end
CR-1	0+00	78+10	Levee from FM 102 to US Hwy 59 embankment along the Colorado River.
CR-2	0+00	42+50	Levee from US Hwy 59 embankment to Station 42+50
CR-2A	42+50	46+60	Floodwall from Station 42+50 to landfill berm
CR-3	0+00	14+60	Levee from landfill berm to abandoned RR embankment
CR-4	0+00	11+90	Levee from abandoned RR embankment to Richmond Street
CR-5	0+00	15+00	Floodwall from Richmond St to park area
CR-5A	15+00	71+00	Levee from park area to Alabama Street (end)

Construction limits for the National Economical Plan (NED) encompasses a levee and flood wall along the Colorado River from FM 102 downstream to Alabama Road. This project will also involve the building of levees and flood walls from the abandoned railroad embankment to Junior College Boulevard along Baughman Slough. An improved channel will be constructed just upstream of Junior College Boulevard to downstream of County Road 150 within Baughman Slough. The objective of the proposed NED design for the City of Wharton, from a Civil Engineering perspective, is to protect the town from a 100-year flood event within the proposed channel while minimizing the impacts to existing utility relocations and real estate acquisition. Implementation of the NED will reduce flood damages to public and private infrastructure and increase traffic during the flooding event.

EXISTING CONDITIONS

RIVERS AND SLOUGHS GEOMETRY

The Colorado River borders the City of Wharton on the south and Baughman Slough is on the northern side of town. Bank stabilization structures have been built along the Colorado River for erosion protection. Richmond Street, US 59, and the abandoned railroad are three bridges that cross the Colorado River within the project limit. On the other side of the river from the city is flat farmland. The existing river bottom width varies from 100 feet to 300 feet with the slopes reaching 1V:1H with some areas in 30 feet of vertical relief. The proposed levee for the Colorado River will be located on the left bank or as close as practical to the bank of the river while maintaining a sufficient buffer in case of future channel migration.

Baughman Slough is roughly 10-45 feet wide at the bottom with side slopes of 1V:2.5H to 1V:4H with the depth of the ditch being between 6' to 10'. The drainage openings just south of Baughman Slough in the abandoned railroad embankment and Junior College Boulevard will be plugged. The proposed levee will be located on the right bank and the proposed channel will widen and deepen the existing channel.

The following roadway crossings that occur along the proposed construction limits of Colorado River and Baughman Slough (based on 2' topography):

Table G-2 Colorado River and Baughman Slough Roadway Crossings

<i>Colorado River Road</i>	<i>Road Width (Ft)</i>	<i>Sidewalk Width (Ft)</i>	<i>Number Of Barrels</i>	<i>Existing Culvert Material</i>	<i>Culvert/ Bridge Span (Ft)</i>	<i>Culvert/ Bridge Height(Ft)</i>
Us 59 (Twin Bridges)	47	None	Clear Span	Concrete	600	45
Abandoned Rr Bridge	12	None	Clear Span	Steel	760	45
Richmond St (Twin Bridges)	22(W) 36(E)	8(E)	Clear Span	Steel	1150	50
Baughman Slough Roads						
Abandoned RR	12	None	Clear Span	Steel	50	11
Richmond St	52	None	4	Concrete	30	(Est.) 8'x10'
Fulton St	30	None	Clear Span	Wood	42	9
Junior College	30	None	Clear Span	Wood	70	12
Moers Lane	24	None	Clear Span	Wood	50	9

Colorado River Levee # 1 is located in an open field and runs from FM 102 to the roadway embankment for US 59. The proposed levee does cross a private road and the drainage ditch from Wal-Mart. A ramp over the levee will be needed for the private road and a drainage structure with gates will be needed at the Wal-Mart drainage ditch crossing. A sump area west of the drainage ditch will be needed for temporary storage while the Colorado River is in flood stage.



Figure 1-Colorado River Levee # 1-Open Pasture Land



Figure 2 - Wal-Mart Drainage Ditch.

Colorado River Levee # 2 goes from the US 59 embankments to the existing city landfill berm (The elevation of the proposed levee is lower than the top of berm for the landfill). This proposed levee is south of the existing plastic pipe company and will need two separate sump areas. Some houses/pre-manufactured homes/structures will be removed along Camellia Street for the proposed levee. In addition to drainage structures from the two sump areas, drainage pipes will be constructed along Hughes Street to the Colorado River for the purpose of draining Caney Creek. A flood wall will be needed just before the levee reaches the landfill because of terrain conditions.



Figure 3-Colorado River Levee # 2-Home along Camellia Street near the Levee Alignment

Colorado River Levee # 3 goes from the northeast berm of the landfill, crosses the road for the landfill (S. Shepherd Street), and crosses the end of S. Ford, and ties into the abandoned railroad embankment. A ramp over the levee will be provided for trucks to the landfill transfer station. Overhead power lines poles will affect the alignment of the levee. The proposed levee is relatively close to one house on South Ford Street.



Figure 3-Colorado River Levee # 3-Close to the End of South Ford Street

Colorado River Levee # 4 connects the abandoned Texas and New Orleans railroad embankment to the road embankment for Richmond Street. The levee passes close to Sunset Street. The street, one house, and one barn structure may need to be relocated or demolished. Also, one 12" sewer line and one 42" storm drain is located within the ROW of the proposed levee close to Richmond Street.



Figure 6-Colorado Levee # 4-Home along Sunset Street Close to Levee Alignment

Colorado River Levee # 5 starts at Richmond Street embankment and ends at the Alabama Road. The first part of levee that runs along Elm Street will be a flood wall because of space between the top of bank and the street. If the existing restaurant chooses to stay on the water side of the levee, it will be necessary to allow vehicular traffic and pedestrian over the flood wall. An existing storm drain line that crosses the levee alignment will need to have a flap gate installed. This flood wall/levee passes close to park area and the flood wall/levee will need to be compatible with recreational activities. The levee will pass near the storage sheds owned by the County. These facilities will need to be modified, relocated, or demolished. The levee will pass the existing waste treatment plant and require extension of relief wells. The purpose of the relief wells is for bank stabilization for the Colorado River. Two sump areas will be built in conjunction with this levee system with necessary gated drainage structures.



Figure 7-Colorado River Levee # 5-Park Area along Elm Street



Figure 8-Picnic Shelter Close to Levee # 5



Figure 9-Levee #5-Existing Waste Treatment Plant & Relief Wells

The Baughman Slough Levee, Flood Wall, and Channel Improvement will start at the abandoned Texas and New Orleans railroad embankment and extend to just downstream of Moers Lane. The existing channel is relatively small and the over banks are flat. The proposed levee and flood wall is located on the right bank of this drainage ditch and keeps the houses on the north side of Wharton from being flooded. A proposed flood wall is just downstream of Fulton Street where there is not enough room to place an earthen levee between the bank of the creek and the house. The improved channel for Baughman Sough starts upstream of Junior College Boulevard and extends downstream of Moers Lane. The bridges at Fulton Street, Junior College Boulevard, and Moers Lane will be demolished and replaced with bridges with larger hydraulic openings.



Figure 10-Baughman Slough-Fulton Bridge



Figure 11-Baughman Slough-Junior College Road Bridge



Figure 12-Baughman Slough-Downstream of Junior College Road Bridge

EXISTING UTILITIES

Water, sewer, and storm drain lines have been shown on plan sheets as given to our design team by the City of Wharton. No information has been received from the gas, electrical, and telecommunication companies. The existing sanitary sewer and water lines will be sleeved where the lines pass under the proposed levee and don't pose a potential hazard. The existing storm drain pipes will be fitted with a flap gates on the downstream end where the lines pass under the proposed levees (Table G-3).

Table G-3 Utility Crossings

Colorado River Levees	Utility	Size
# 1-STA 68+10	Wal-Mart Drainage Ditch	10'X10' Trapezoidal Channel
# 1-STA 76+10	Fiber Optic	Unknown
“ “	Sewer Line	24”
# 2-STA 45+00	Storm Drain-Landfill	42”
# 3-STA 0+65	Water Line	Unknown
# 3-STA 0+80	Sewer Line	Unknown
# 3-STA 3+00	Overhead Transmission Lines	Unknown
# 4-STA 12+00	Sewer Line	12”
#5-STA 12+10	Storm Drain Line	48”

The sanitary sewer lines need to be documented during the next stage of design. The existing sewer lines will be sleeved. It is anticipated that there may be some infiltration since the interceptor was constructed in 1969. It is also anticipated that some of the laterals may have to be replaced, but this cannot be confirmed until a field survey of the flowlines has been performed.

There are numerous existing storm drainage outfalls that discharge into Baughman Slough and the Colorado River within the project limits. The outfalls were located during two field visits and the topographic maps. It should be noted that the City of Wharton provided limited as-built information for the storm drainage infrastructure in the design area.

Table G-4 Existing Storm Drainage Outfall Structures

OUTFALL STRUCTURE	BAUGHMAN SLOUGH STATION	OFFSET DISTANCE (FEET)	OFFSET SIDE
2-1'x4' Box Culvert	19+40	10	LAND SIDE
1-2' Grass Lined Ditch	20+30	0	Thru Levee
2-4' Grass lined Ditches	30+00 & 30+60	Fulton St	Thru Levee
AHLDAG DITCH	64+00	0	Thru Levee
2-8' Grass Lined Ditches	68+60 & 69+00	Junior College Boulevard	Thru Levee
2-3' Grass Lined Ditches	27+50 & 27+80	Moers Road	Thru Levee
	COLORADO RIVER STATION		
1-1' Grass Lined Ditch	CR # 1(0+70)	FM 102	Thru Levee
1-10'X10' Grass Lined Ditch	CR # 1(68+10)	0	Thru Levee
1-2' Grass Lined Ditch	CR # 1(77+60)	US 59	Thru Levee
1-3' Grass Lined Ditch	CR # 2(0+30)	US 59	Thru Levee
1-20' Grass Lined Ditch	CR # 2(19+45)	0	Thru Levee
1-15' Grass Lined Ditch	CR # 2(30+10)	0	Thru Levee
1-48" RCP	CR # 2(45+10)	0	Water Side
2-2' Grass Lined Ditches	CR # 3 (0+25 & 0+45)	0	County Landfill Road
1-4' Grass Lined Ditch	CR # 3 (8+20)	0	Ford Street
1-5' Grass Lined Ditch	CR # 3 (14+10)	0	Abandoned RR
1-2' Grass Lined Ditch	CR # 4 (0+50)	0	Abandoned RR
1-42" Storm Drain	CR # 4 (11+60)	140'	Water Side
1-48" Storm Drain	CR # 5 (12+10)	100'	Water Side
1-25' Grass Lined Ditch	CR # 5 (48+80)	0	Thru Levee

The levees and flood walls will tie into existing roadway embankments. Within the right-of-ways for these, there will be ditches and various utilities to be modified. These embankments will need to be investigated to verify if the materials are compatible with the proposed levee.

Existing gas, electrical, and communication utilities cross throughout the design limits of Baughman Slough and Colorado River, and will have to field located (topographic survey) to ensure that potential conflicts with construction activities will be minimized or the utilities will have to be relocated.

EXISTING DATA

As-built for the existing sanitary sewer mains and storm drains were provided by the City of Wharton, Texas. During field visits, some of the above ground utilities and marked underground utility lines were identified. There was no as-built information provided for the existing sanitary sewer laterals that discharge into the sanitary sewer main. Storm drainage infrastructure was observed to be not functioning in some areas. All utilities will need to be field verified before beginning the next stage of design.

PROPOSED IMPROVEMENTS

LEVEES, FLOOD WALLS, AND CHANNELS

The proposed levees and flood walls along the Colorado River in addition to levees, flood walls, channel widening, and deepening of the Baughman Slough will contain majority of the floods for the City of Wharton as shown on Sheets C101 through C129. The average height of the earthen levees and flood walls will be 3-4 feet high. Occasionally, the levee height will reach over 20 feet high where it crosses a drainage ditch that flows into the Colorado River. The top width of earthen levees will be 12 feet with 1V:3.5H slopes on both sides. The flood walls as shown on the Sheets S201 through S203 will be used only where the earthen levee cannot be built to the full template because of terrain or real estate concerns. An improved channel will be constructed along Baughman Slough that is 75 feet wide with 1V:3.5H cut slopes on both sides.

Most the fill for the earthen levees will come from sump and channel excavations. Special imported fill will be needed around the structures. Excess excavation will be deposited in appropriate areas. Special erosion protection is necessary around the discharge and inlet structures for the sumps in this project because of water velocities. The earthen levees and channels will be turfed. Ponds will be designed within the sump areas for wildlife and livestock considerations.

Three 60" diameter pipes will be constructed along Hughes Street and empty out into the Hugh Street sump area. Two 60" diameter pipes will be built under Polk and discharged into the Colorado River. These storm drain pipes will help drain old Caney Creek watershed.

ROAD, BRIDGE, AND UTILITY RELOCATION

The bridge and roads at Fulton Street, Junior College Boulevard, and Moers Lane will be demolished and replaced along Baughman Slough. The elevation of Fulton Street will need to be raised to the top of levee in addition to relocating the bridge. Additional vehicular ramps over the levee will be needed for access to the landfill, obtaining access to the property blocked by the levee, etc.

Utilities along the proposed Baughman Slough channel improvement need to be relocated because the channel deepening and widening and relocation of the bridges. No impacts to the main sanitary sewer lines are anticipated. However, a topographic survey needs to be performed to locate all utilities. Main water lines that run under the proposed levees and flood walls will have to be sleeved. Storm drain lines, both proposed and existing will be sleeved and fitted with a flap gate on the downstream end. None the utility relocations will be placed through the levees (either over or under). See Table G-3 for location of known utility crossings.

SUPPLEMENTAL DATA REQUIRED FOR PED

Supplemental planimetric and topographic surveys are necessary for both the Baughman Slough and Colorado River levees and flood walls, and the sump areas to accurately locate all existing utilities and to establish both horizontal and vertical control. The accuracy of the topo shall be for 1' contours.

The local sponsor will need to supply areas for disposal of the excess excavation, staging areas for the contractor, and necessary land acquisition to construct this project.