Mid-Barataria Sediment Diversion (BA-153) Independent Technical Design Review

REVIEW OF 30% ENGINEERING DESIGN ALTERNATIVE REPORTS, PLANS AND SPECIFICATIONS

FINAL DRAFT
APPENDICIES

JANUARY9, 2015

FOR

THE COASTAL PROTECTION AND RESTORATION AUTHORITY OF LOUISIANA

CONFIDENTIAL

Plan Design Enable

JANUARY 9, 2015
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)

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CONFIDENTIAL

ATKINS Ben C. Gerwick, Inc. COWI

JANUARY 9, 2015
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NOTICES

This document and its contents have been prepared and are intended solely for information and use by the Coastal Protection and Resource Agency of the State of Louisiana in relation to the review of documents describing the work associated with the 30% Basis of Design provided to this team.

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DOCUMENT HISTORY

VERSION	PREPARED BY	DATE	REVIEWED BY	DATE	COMMENTS
INTERIM DRAFT	WKJ ATKINS	AUG 17, 2014	DL, DB GERWICK	AUG 18,2014	FOR RELEASE
INTERIM DRAFT		AUG 27, 2014			MINOR CORRECTIONS
FINAL DRAFT INITIATED APPENDIX C	DB GERWICK	SEPT 12 2014	WKJ ATKINS	SEPT 12 2014	MINOR COMMENTS FROM CPRA INCORPORATED
INCLUDED EXEC SUMMARY, MODELING, RECOMMENDATIONS,	WKJ ATKINS	SEPT 18, 2014			FOR FINAL REVIEW BY CPRA, NOT TO BE RELEASED WITHOUT AUTHORIZATION
FINAL DRAFT	WKJ-ATKINS	JAN 9, 2015	LL ATKINS	JAN 2, 2015	INCLUDES FINAL COMMENTS CPRA

List of Appendices

Appendix A

Appendix A

HDR 30% submittal
Review Criteria

				General Comment
4.3			**Review 30% modeling deliverables**	
	4.3.A.1		Structure modeling tasks	no structural models provided in submittal
	4.3.A.2		Flow -3D modeling	yes
	4.3.A.3		DEFLT-3D modeling	yes, TWIG submittal
	4.3.A.4		River stability assessment	None
	4.3.A.5		FEMA Floodplain analysis	Some information in Base Design Report
	4.3.A.6		Scour elevation at diversion Structure	Base Design Report 5.2.9
	4.3.B.1		Alternatives Evaluation	yes
	4.3.B.2		Outfall Channel HEC-RAS modeling	yes
	4.3.B.3		Scour and erosion Protection	Base design report 5.2.9
	4.3.C.1		Alternatives Evaluation	yes
	4.3.C.2		DEFLT-3D modeling	yes, TWIG submittal
4.4			**Review 30% Geotechnical deliverables**	
	4.4.A.1		dewatering impacts	Geotechnical report
	4.4.A.2		Structure Foundation Types	slope stability, settlement, wall pressure, structural recommendations in appendicies
	4.4.A.3		Dewatering Feasibility and Constraints	
4.5			**Review the 30% Civil Engineering deliverable**	
	4.5.A.1		Constructability review memo	Generally discussed in reports
	4.5.A.2	30%	Basis of Design Report	Base Design Report Chap 7
	4.5.A.3	30%	Specifications	draft outline
	4.5.A.4	30%	Plans will include but are not limited to:	Volume 1
	4.5.A.4.1		Title Sheet	yes
	4.5.A.4.2		Conveyance Channel Transitions & Typical sections	yes
	4.5.A.4.3		Guide Levee and Wall Typical Sections	yes
	4.5.A.4.4		Plan and Profile of channel bottom centerline	yes
	4.5.A.4.5		Cross Section and Plan View of Pipeline location	not found
	4.5.A.4.6		Profile of Maximum water surface elevation	in report (draft)
	4.5.A.4.7		MR&T levee tie-in plan and section view	in plan
	4.5.A.4.8		Back Levee (Non Federal Levee) tie-in plan and section view	in plan
	4.5.A.4.9		Drainage area map	yes
	4.5.A.4.10		Back structure design and layout	yes
4.6			**Review the 30% Diversion Structure Design deliverable**	
	4.6.A.1		Constructability review memo	Generally discussed in reports
	4.6.A.2	30%	Basis of Design Report	Base Design report Chap 9, additional information in Channel lining report
	4.6.A.3	30%	Specifications	draft outline
	4.6.A.4	30%	Plans. 30% Plans will include, but are not be limited to:	Volume 1, Volume 2
	4.6.A.4.1		Concrete approach walls on the river (upstream) side of the structure.	yes
	4.6.A.4.2		A pile supported concrete control structure	yes
	4.6.A.4.3		Multiple independently controlled diversion gates within bays of the control structure	yes
	4.6.A.4.4		Bulkheads for dewatering either the upstream or downstream sides of the gates and control bays	yes
	4.6.A.4.5		Independently operable mechanical hoists	limited information available
	4.6.A.4.6		Mechanical and electrical controls for the gate hoists	limited information available
	4.6.A.4.7		Emergency back-up power for gate controls	no
	4.6.A.4.8		Controls consistent with the ability to operate the facility remotely in the future	schematics
	4.6.A.4.9		Downstream training walls to transition from the control structure to the trapezoidal channel.	yes
4.7			**Review the 30% Pump Station Design deliverable**	
	4.7.A.1		Constructability review memo	not discussed
	4.7.A.2	30%	Basis of Design Report	base design memo, used a similar pumpstation as the basis
	4.7.A.3	30%	Plans, Specification, and tech memos. 30% Plans, specs, and memos, will include, but are not be limited to:	included Volume 3, draft specification outline
	4.7.A.3.1		Interior drainage computations for pump sizing	yes
	4.7.A.3.2		Pump station design restraints (type, size, and location)	yes
	4.7.A.3.3		Discharge configuration and locations.	yes
	4.7.A.3.4		Hydraulic, process, mechanical, electrical, and controls calculations to support preliminary design of a pump station	yes
	4.7.A.3.5		Pile supported foundation of the pump station	no calculations
	4.7.A.3.6		Independently controlled pumps, pump type, and performance selection	limited information
	4.7.A.3.7		Electrical power systems	schematics
	4.7.A.3.8		Evaluation of back-up power systems	have not found yet

HDR 30% submittal
Review Criteria

			General Comment
4.7.A.3.9		Bulkheads for dewatering the upstream or downstream sides of the pump station, intakes, and discharge bays.	general information
4.7.A.3.10		Mechanical Systems	limited information available
4.7.A.3.11		as hoists etc.	limited information available
4.7.A.3.12		Building/enclosure structure design	shown on diversion plans, no detail
4.7.A.3.13		Controls consistent with the ability to operate the facility remotely	schematics
4.7.A.3.14		Designs necessary to bring local power to the project	no
4.7.A.3.15		Area lighting, receptacles, and pneumatic systems (if needed)	limited information
4.7.A.3.16		Telephone and data communication systems	no
4.7.A.3.17		Architectural enclosures for electrical equipment, back-up power and maintenance equipment storage.	shown on diversion plans, no detail
4.8		**Review the 30% Back Structure deliverable**	
4.8.A.1		Constructability review memo	no design, general information, not in scope
4.8.A.2	30%	Basis of Design Report	none
4.8.A.3	30%	Specifications	draft specifications outline
4.8.A.4	30%	Plans	limited information in Volume 1 civil
4.9		**Review the 30% Road and Bridge Design**	
A)		The 30% Road and Bridge Design will consist of design and modification to the existing LA 23 and design of the North Side and South Side Haul Road. Review the following deliverables associated with the 30% Diversion Stucture Deliverable:	Access Rd. in Appendix
4.9.A.1		Constructability review memo	
4.9.A.2	30%	Basis of Design Report	Base Design Report Chap 10, Foundation report for bridges
4.9.A.3	30%	Specifications and Plans. 30% Plans, specification, and memos will include, but are not be limited to:	Volume 4, draft specification outline
4.9.A.3.1		Control monument and Loop Information to LADOTD	none
4.9.A.3.2		Roadway Bridge Typical Sections	yes
4.9.A.3.3		Schematic Roll plot with plans, profiles, and aerials	yes
4.9.A.3.4		Design Exceptions and/or waiver requests	not found yet
4.9.A.3.5		Traffic Control Plans	yes
4.9.A.3.6		Draft report for the Bridge type Study	foundation only, bridge looks to be a standard AASHTO design
4.9.A.3.7		Utility inventory/conflict list with adjustment date/effect of construction.	not found yet
4.10		**Review the 30% Rail Design deliverable**	
4.10.A.1	30%	Constructability review memo	Generally discussed in reports
4.10.A.2	30%	Basis of Design Report	Base design report chap 11
4.10.A.3	30%	Plans, specifications, and technical memos. These documents will include, but are not be limited to:	Volume 5 Rail design, draft specification outline
4.10.A.3.1		Schematic of the railroad track relocation schematic including Bridge Typical Sections	yes
4.10.A.3.2		Draft report for the Bridge Type Study	chap 11 base design report
4.10.A.3.3		Draft Preferred Alignment Report including design criteria	none
4.10.A.3.4		Draft Report for the Bridge Foundation Study	bridge fourndation report in Road and bridg design
4.11		**Review the 30 % Engineers Construction Cost Estimate**	
A)		Review the Engineers 30% Construction Cost Estimate and provide comments and recommendations for the Civil Design, Diversion Structure Design, Pump Station Design, Back Structure Design, Road and Bridge Design, and Rail Design.	Chap 15 Base Design Report, Conceptual estimates, significant number of lump sum items make it tough to isolate specific issues in the cost estimates
4.39		**Value Engineering**	NEW TASK
A)		Value Engineering Report and Appendicies	yes, Multiple alternatives provided

Mid-Barataria Sediment Diversion

Comparison of Value Engineering Alternates

	Base Design	VE Alt. 1, Ver. 2	VE Alt. 2, Ver. 2	VE Alt. 4, Ver. 2	VE Alt. 5, Ver. 2
	3 Channel Inlet 3 Gate Structure Transition Struc. 300' Channel Bot. 7 Gate Back Struc.	Open Channel Inlet 3 Gate Structure No Transition Struc. 300' Channel Bot. 7 Gate Back Struc.	Open Channel Inlet 2 Gate Structure No Transition Struc. 200' Channel Bot. 5 Gate Back Struc.	3 Tunnel Inlet 3 VL Gate Structure 3 Box Outlet 100' Channel Bot. 3 Gate Back Struc. No RR Bridge	3 Tunnel Inlet 3 VL Gate Structure 3 Bay Tunnel Outlet 100' Channel Bot. 3 VL Gate Back Struc. No RR Reloc. No Roadway Reloc. No Pump Station

Description	Base Design	VE Alt. 1, Ver. 2	VE Alt. 2, Ver. 2	VE Alt. 4, Ver. 2	VE Alt. 5, Ver. 2
1.0 GENERAL CIVIL					
Clear & Grub	$2,000,000	$2,000,000	$1,875,000	$1,750,000	$1,350,000
Contractor Haul Road	$2,149,500	$2,149,500	$2,149,500	$2,149,500	$1,480,000
Contractor Laydown	$500,000	$500,000	$500,000	$500,000	$500,000
Permanent Utility	$1,474,000	$1,474,000	$1,474,000	$1,474,000	$1,131,000
Site Work	$10,340,000	$10,340,000	$10,340,000	$10,340,000	$7,730,000
Earthwork (Includes canal excavation)	$79,730,000	$72,026,000	$64,595,600	$57,859,000	$33,520,000
Structural / Geotech Services	$19,934,332	$12,021,611	$12,021,611	$12,021,611	$11,298,806
Revetment	$48,658,500	$24,513,500	$24,513,500	$24,513,500	$12,256,750
Other Site Work	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$5,150,000
Utility Relocation	$6,000,000	$6,000,000	$6,000,000	$6,000,000	$1,000,000
TOTAL GENERAL CIVIL	**$180,786,332**	**$141,024,611**	**$133,469,211**	**$126,607,611**	**$75,416,556**
2.0 CONTROL STRUCTURE					
2.1 APPROACH CHANNEL / REVETMENT (Flowing into control structure)					
Revetment / Cofferdam at River	$76,498,790	$59,212,771	$59,212,771	$34,313,359	$34,313,359
Concrete Channel (In-The-Dry)	$58,000,210				
Concrete Channel (In-The-Wet)		$26,193,960	$18,422,560		
Immersed Tunnels (Precast) (In-The-Wet)				$44,881,645	$65,446,645
TOTAL APPROACH CHANNEL / REVETMENT	**$134,499,000**	**$85,406,731**	**$77,635,331**	**$79,195,004**	**$99,760,004**
2.2 CONTROL STRUCTURE	**3 Gate**	**3 Gate**	**2 Gate**	**3 Gate**	**3 Gate**
Transition	$34,146,996	$30,885,190	$30,551,935	$17,234,328	$17,234,328
Structure	$39,549,531	$39,549,531	$27,569,008	$27,346,911	$27,346,911
Gates (Swing)	$10,132,471	$10,132,471	$6,778,314		
Gates (Vertical Lift)				$14,702,012	$14,702,012
Miscellaneous Metals	$2,779,600	$2,779,600	$1,858,067	$2,680,600	$2,680,600
Stoplogs & Crane	$4,341,312	$4,341,312	$3,294,208	$3,163,320	$3,163,320
TOTAL CONTROL STRUCTURE	**$90,949,910**	**$87,688,104**	**$70,051,532**	**$65,127,171**	**$65,127,171**
2.6 TOTAL DIVERSION STRUCTURE MECH. & ELEC.	**$426,600**	**$426,600**	**$426,600**	**$426,600**	**$426,600**
2.7 OUTLET CHANNEL (Flowing out of control structure)					
Outlet Channel (In-The-Dry)	$7,051,782	$7,051,782	$5,348,745		
Outlet Box (In-The-Dry)				$77,520,428	
Outlet Tunnel (Bored)					$196,931,850
TOTAL OUTLET	**$7,051,782**	**$7,051,782**	**$5,348,745**	**$77,520,428**	**$196,931,850**
2.8 TRANSITION STRUCTURE (Transitions from outlet channel into canal)					
Transition Walls	$23,598,570	$0	$0	$0	$0
Concrete Structure	$13,534,673	$0	$0	$0	$0
TOTAL TRANSITION	**$37,133,243**	**$0**	**$0**	**$0**	**$0**
TOTAL CONTROL STRUCTURE	**$270,060,535**	**$180,573,217**	**$153,462,208**	**$222,269,203**	**$362,245,625**
2.9 BACK STRUCTURE	**7 Gate**	**7 Gate**	**5 Gate**	**3 Gate**	**3 Gate**
Transition Walls	$85,385,792	$43,582,483	$43,582,483	$43,582,483	$16,792,614
Concrete Structure (Gates)	$79,341,609	$79,341,609	$53,657,316	$37,203,505	$65,127,172
Gerwick Estimate					
TOTAL BACK STRUCTURE	**$164,727,401**	**$122,924,092**	**$97,239,799**	**$80,785,988**	**$81,919,786**
2.10 TOTAL BACK STRUCTURE MECH. & ELEC.	**$426,600**	**$426,600**	**$426,600**	**$426,600**	**$426,600**
TOTAL BACK STRUCTURE	**$165,154,001**	**$123,350,692**	**$97,666,399**	**$81,212,588**	**$82,346,386**
3.1 PUMP STATION					
Structure	$10,780,000	$10,780,000	$10,780,000	$10,780,000	$0
Mechanical	$730,000	$730,000	$730,000	$730,000	$0
Pumps / Engines	$9,900,000	$9,900,000	$9,900,000	$9,900,000	$0
Equipment / Electrical	$6,290,000	$6,290,000	$6,290,000	$6,290,000	$0
Inverted Siphon					
TOTAL PUMP STATION	**$27,700,000**	**$27,700,000**	**$27,700,000**	**$27,700,000**	**$0**
4.1 ROADWORK					
Clearing / Earthwork	$652,051	$652,051	$652,051	$652,051	$0
Pavement	$2,227,956	$2,227,956	$2,227,956	$2,227,956	$0
Bridge	$21,842,557	$21,842,557	$20,222,557	$18,602,557	$0
Pavement Markings / Grassing	$30,539	$30,539	$30,539	$30,539	$0
TOTAL ROADWORK	**$24,753,103**	**$24,753,103**	**$23,133,103**	**$21,513,103**	**$0**
5.0 RAILROAD					
5.1 TRACKWORK & GRADING					
Clearing	$656,010	$656,010	$656,010	$656,010	$0
Trackwork	$2,149,802	$2,149,802	$2,149,802	$2,149,802	$0
TOTAL TRACKWORK & GRADING	**$2,805,812**	**$2,805,812**	**$2,805,812**	**$2,805,812**	**$0**
5.3 RAILROAD BRIDGE					
Substructure	$12,704,918	$12,704,918	$12,241,793	$0	$0
Superstructure	$29,967,000	$29,967,000	$27,667,000	$0	$0
TOTAL RAILROAD BRIDGE	**$42,671,918**	**$42,671,918**	**$39,908,793**	**$0**	**$0**
TOTAL RAILROAD	**$45,477,730**	**$45,477,730**	**$42,714,605**	**$2,805,812**	**$0**
6.1 GENERAL CONDITIONS					
MISC. INSURANCE (HURRICANE & BUILDER'S RISK)	**$7,139,317**	$5,428,794	$4,781,455	$4,821,083	$5,200,086
MOBILIZATION / DEMOBILIZATION	**$21,417,951**	$16,286,381	$14,344,366	$14,463,250	$15,600,257
PAYMENT & PERFORMANCE BONDS	**$7,139,317**	$5,428,794	$4,781,455	$4,821,083	$5,200,086
TOTAL GENERAL CONDITIONS	**$35,696,585**	**$27,143,969**	**$23,907,276**	**$24,105,416**	**$26,000,429**
PROJECT TOTAL	**$749,628,286**	**$570,023,322**	**$502,052,802**	**$506,213,733**	**$546,008,996**

High (125%)	**$937,035,358**	**$712,529,153**	**$627,566,003**	**$632,767,166**	**$682,511,245**
Low (85%)	**$637,184,043**	**$484,519,824**	**$426,744,882**	**$430,281,673**	**$464,107,647**
Soft Costs:					
Total Engineering & Design	$41,229,556	$31,351,283	$27,612,904	$27,841,755	$30,030,495
NEPA & 3rd Party Contractor	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000
Corp of Engineering 214 Agreement	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000
Land Acquisition Subtotal	$12,000,000	$12,000,000	$12,000,000	$12,000,000	$12,000,000
Unforseen Incidents and Conditions	$187,407,071.50	$142,505,830.50	$125,513,200.50	$126,553,433.25	$136,502,249.00
Construction Management	$37,481,414.30	$28,501,166.10	$25,102,640.10	$25,310,686.65	$27,300,449.80
CPRA QA	$14,992,565.72	$11,400,466.44	$10,041,056.04	$10,124,274.66	$10,920,179.92
Grand Total (Project Total + Soft Costs)	**$1,054,238,893**	**$807,282,068**	**$713,822,603**	**$719,543,883**	**$774,262,370**
SAVINGS	**$0**	**$246,956,826**	**$340,416,291**	**$334,695,010**	**$279,976,524**
Soft Costs High	**$366,869,949.91**	**$285,913,012.39**	**$255,275,300.50**	**$257,150,840.15**	**$275,088,554.95**
Soft Costs Low	**$328,536,862.90**	**$255,751,951.24**	**$228,206,898.01**	**$229,893,115.30**	**$246,020,145.63**

Mid-Barataria Sediment Diversion

Comparison of Value Engineering Alternates

Description	Alternate A Gerwick Proposed Alternate Aug 14 2014 to VE Alt 1, Ver 2.	Alernate B Gerwick Proposed Alternate Aug 14 2014 to VE Alt 2, Ver 2.
1.0 GENERAL CIVIL		
Clear & Grub	$2,000,000	$1,875,000
Contractor Haul Road	$2,149,500	$2,149,500
Contractor Laydown	$500,000	$500,000
Permanent Utility	$1,474,000	$1,474,000
Site Work	$10,340,000	$10,340,000
Earthwork (Includes canal excavation)	$72,026,000	$64,595,600
Structural / Geotech Services	$12,021,611	$12,021,611
Revetment	$24,513,500	$24,513,500
Other Site Work	$10,000,000	$10,000,000
Utility Relocation	$6,000,000	$6,000,000
TOTAL GENERAL CIVIL	**$141,024,611**	**$133,469,211**
2.0 CONTROL STRUCTURE		
2.1 APPROACH CHANNEL / REVETMENT (Flowing into control structure)		
Revetment / Cofferdam at River		
Concrete Channel (In-The-Dry)		
Concrete Channel (In-The-Wet)		
Immersed Tunnels (Precast) (In-The-Wet)		
TOTAL APPROACH CHANNEL / REVETMENT	**$ 75,367,870.53**	**$60,294,296**
2.2 CONTROL STRUCTURE		
Transition		
Structure	$45,510,202	$36,408,162
Gates (Swing)	$10,132,471	$6,778,314
Gates (Vertical Lift)		
Miscellaneous Metals	$2,779,600	$1,858,067
Stoplogs & Crane	$4,341,312	$3,294,208
TOTAL CONTROL STRUCTURE	**$62,763,585**	**$48,338,751**
2.6 TOTAL DIVERSION STRUCTURE MECH. & ELEC.	**$426,600**	
2.7 OUTLET CHANNEL (Flowing out of control structure)		
Outlet Channel (In-The-Dry)	$7,051,782	$5,348,745
Outlet Box (In-The-Dry)		
Outlet Tunnel (Bored)		
TOTAL OUTLET	**$7,051,782**	**$5,348,745**
2.8 TRANSITION STRUCTURE (Transitions from outlet channel into canal)		
Transition Walls		
Concrete Structure		
TOTAL TRANSITION		
TOTAL CONTROL STRUCTURE	**$145,609,838**	**$113,981,792**
2.9 BACK STRUCTURE		
Transition Walls	$15,719,112	$15,719,112
Concrete Structure (Gates)	$1,194,734	$1,194,734
Gerwick Estimate	$40,410,930	$32,328,744
TOTAL BACK STRUCTURE	**$57,324,776**	**$49,242,590**
2.10 TOTAL BACK STRUCTURE MECH. & ELEC.	**$426,600**	**$426,600**
TOTAL BACK STRUCTURE	**$57,751,376**	**$49,669,190**
3.1 PUMP STATION		
Structure		
Mechanical		
Pumps / Engines		
Equipment / Electrical		
Inverted Siphon	$13,669,527	$13,669,527
TOTAL PUMP STATION	**$13,669,527**	**$13,669,527**
4.1 ROADWORK		
Clearing / Earthwork	$652,051	$652,051
Pavement	$2,227,956	$2,227,956
Bridge	$17,842,557	$16,222,557
Pavement Markings / Grassing	$30,539	$30,539
TOTAL ROADWORK	**$20,753,103**	**$19,133,103**
5.0 RAILROAD		
5.1 TRACKWORK & GRADING		
Clearing	$656,010	$656,010
Trackwork	$2,149,802	$2,149,802
TOTAL TRACKWORK & GRADING	**$2,805,812**	**$2,805,812**
5.3 RAILROAD BRIDGE		
Substructure		
Superstructure	$715,000	$715,000
TOTAL RAILROAD BRIDGE		
TOTAL RAILROAD	**$3,520,812**	**$3,520,812**
6.1 GENERAL CONDITIONS		
MISC. INSURANCE (HURRICANE & BUILDER'S RISK)	$5,428,794	$4,781,455
MOBILIZATION / DEMOBILIZATION	$16,286,381	$14,344,366
PAYMENT & PERFORMANCE BONDS	$5,428,794	$4,781,455
TOTAL GENERAL CONDITIONS	**$27,143,969**	**$23,907,276**
PROJECT TOTAL	**$409,473,236**	**$357,350,912**
High (125%)	**$511,841,545**	**$446,688,639**
Low (85%)	**$348,052,251**	**$303,748,275**
Soft Costs:		
Total Engineering & Design	$24,568,394	$21,441,055
NEPA & 3rd Party Contractor	$10,000,000	$10,000,000
Corp of Engineering 214 Agreement	$1,500,000	$1,500,000
Land Acquisition Subtotal	$12,000,000	$12,000,000
Unforeseen Incidents and Conditions	$102,368,309.04	$89,337,727.88
Construction Management	$20,473,661.81	$17,867,545.58
CPRA QA	$8,189,464.72	$7,147,018.23
Grand Total (Project Total + Soft Costs)	**$588,573,066**	**$516,644,258**
SAVINGS	$465,665,827	$537,594,635
Soft Costs High	**$215,899,532.31**	**$192,105,691.11**
Soft Costs Low	**$192,838,763.44**	**$171,442,549.18**

Appendix C

Appendix C – Additional Possible Alternate Concepts

Alternate A – “In the Wet” Concrete Immersed

Alternative C – “In the Wet“ Open topped approach and immerse tube at -60-ft

List of Figures

Appendix C – Additional Possible Alternate Concepts

Note that both Alternate A, and Alternate C, are laid-out to accommodate 75,000 cfs; however, lower flow rates (such as the 50,000 cfs Alternate B) can readily be configured by deleting cross-sectional flow and/or box culvert channels. Alternately, greater flow rates could be accommodated by providing more cross-sectional flow area and/or adding more box culvert channels, either in the initial construction and/or in future expansions.

Alternate A – "In the Wet" Concrete Immersed tube at -45-ft

As indicated in Figure C.1 Alternative A proposes to use offsite prefabrication and "in-the-wet" construction methodology to build the Mississippi River Approach Channel, tainter gate Control Structure, and Control Structure outlet. This figure indicates that first the set-back levee would be built, and a wall of sheet piles would be installed around the perimeter of a glory hole to be dredged when the MR&T levee is breeched. Concurrently, a retaining wall system would be installed "in-the-wet" on either side of the Approach Channel using plumb and battered piles driven through the revetment as indicated in Figure C.2 (note that this figure shows a stay-in-place precast concrete jacket that would serve as a template for installing the batter piles, with the plumb and batter pile structurally connected with a tremie concrete capbeam).

These two battered pile side retaining walls would use closure piles installed with jet-grouting to stop sand leakage in the point bar material when the soil between the two retaining walls are dredged. Then scour stone would be installed in the dredged approach channel prior to the MR&T levee being breeched to allow floating equipment to move into the glory hole and install the large diameter CIDH foundations using an oscillator similar to that shown in Figure C.3. After the in-the-wet foundation installation, concrete paving blocks would be installed in-the-wet for the outlet channel of the Control Structure as shown in Figure C.1.

Concurrently, while these operations are ongoing a concrete float-in shell for the Control Structure and a concrete immersed tube Approach Channel segment (floated-in with steel end bulkheads) would be built offsite (say on grounded barges) and floated respectively into place. Once the MR&T levee is breached the structures are floated through the retained dredged approach channel. The top of the immersed tube segment is proposed to have two floodwalls that would be tied into both the new heavy sheet pile wall (parallel to the MR&T levee) and to the crest of the restored MR&T levee. Then piles would be driven in the Mississippi River approach channel to support lift-in precast concrete intermediate wall panels (with flat jacks to control vertical elevation), and precast concrete side panels (attached to the batter pile retaining walls), and paving blocks installed, as shown in Figure C.4.

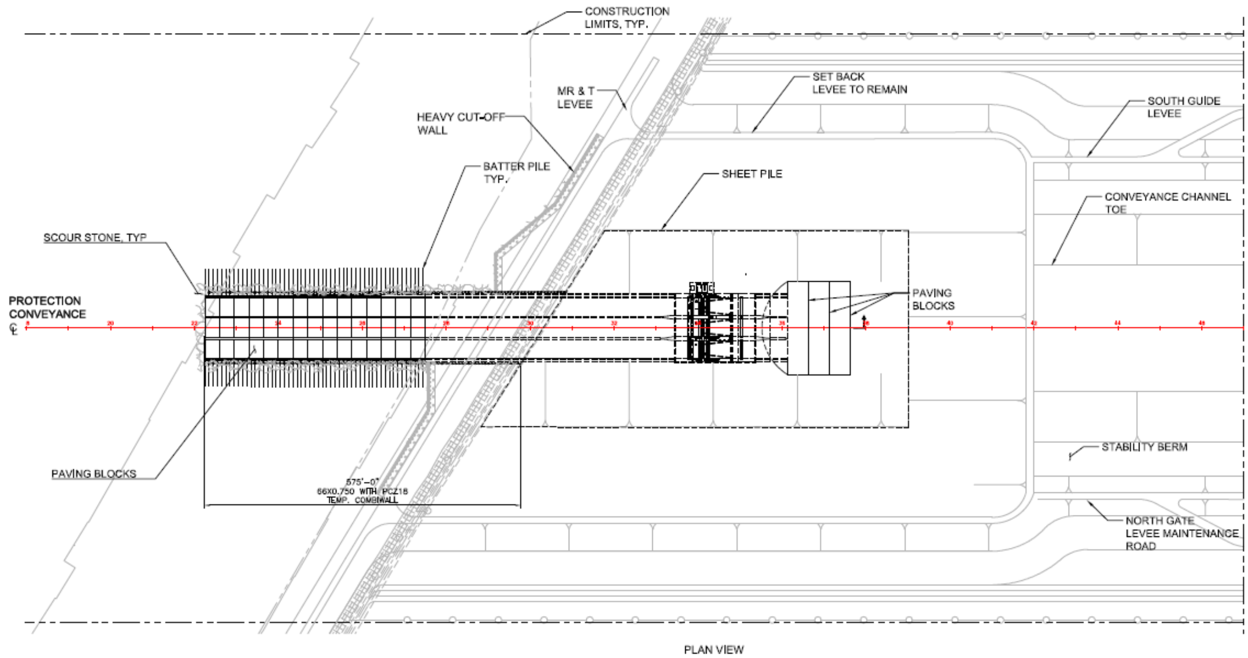

Figure C.1 Alt. A – Construction Stage Plan View of the Inlet/Approach Channel, Control Structure & Transition to the Conveyance Channel, Showing the Sheet Pile Limits of the Glory Hole

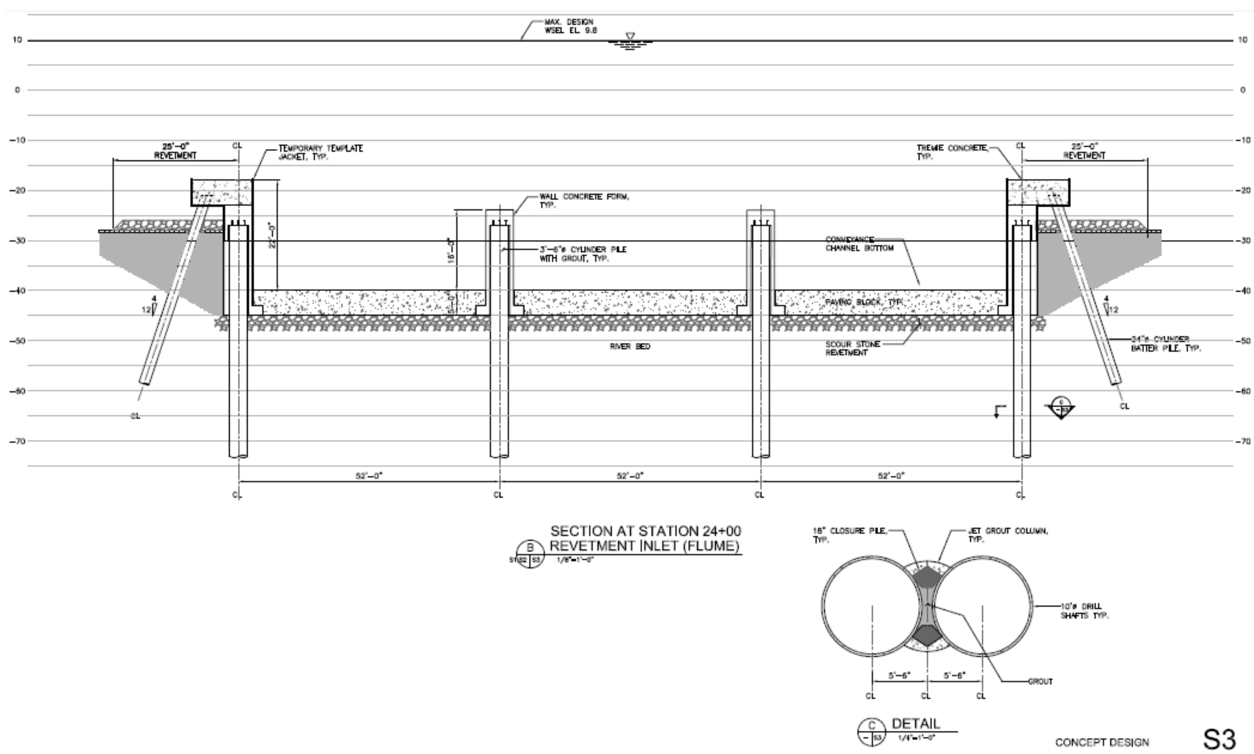

Figure C.2 Alt. A - End View of the Inlet/Approach Channel

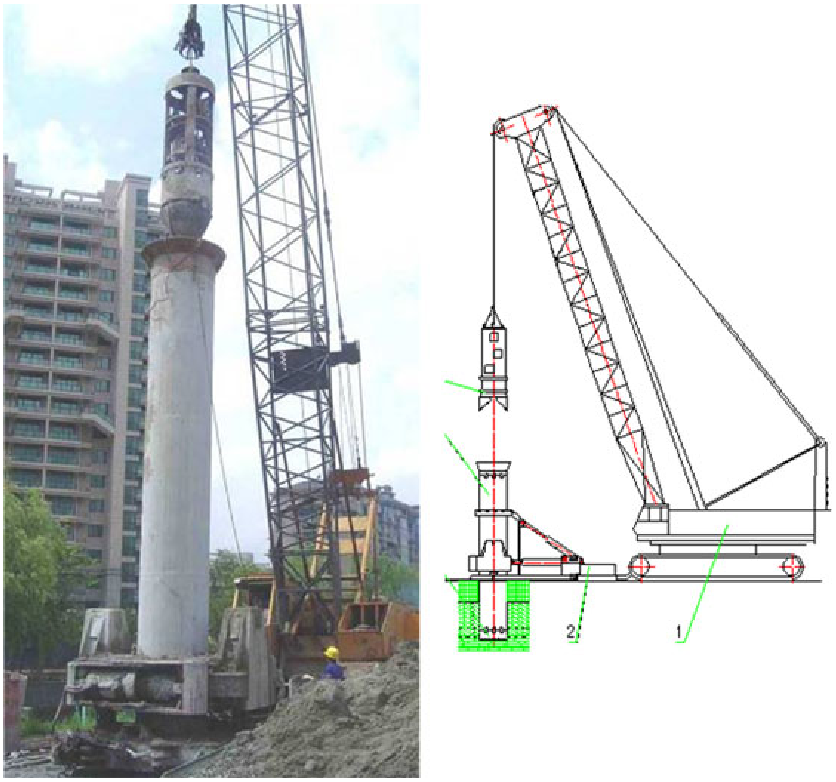

Figure C.3 Alt. A – Representative Large Diameter Casing Installation Using an Oscillator, Similar to That Proposed for the CIDH Construction.

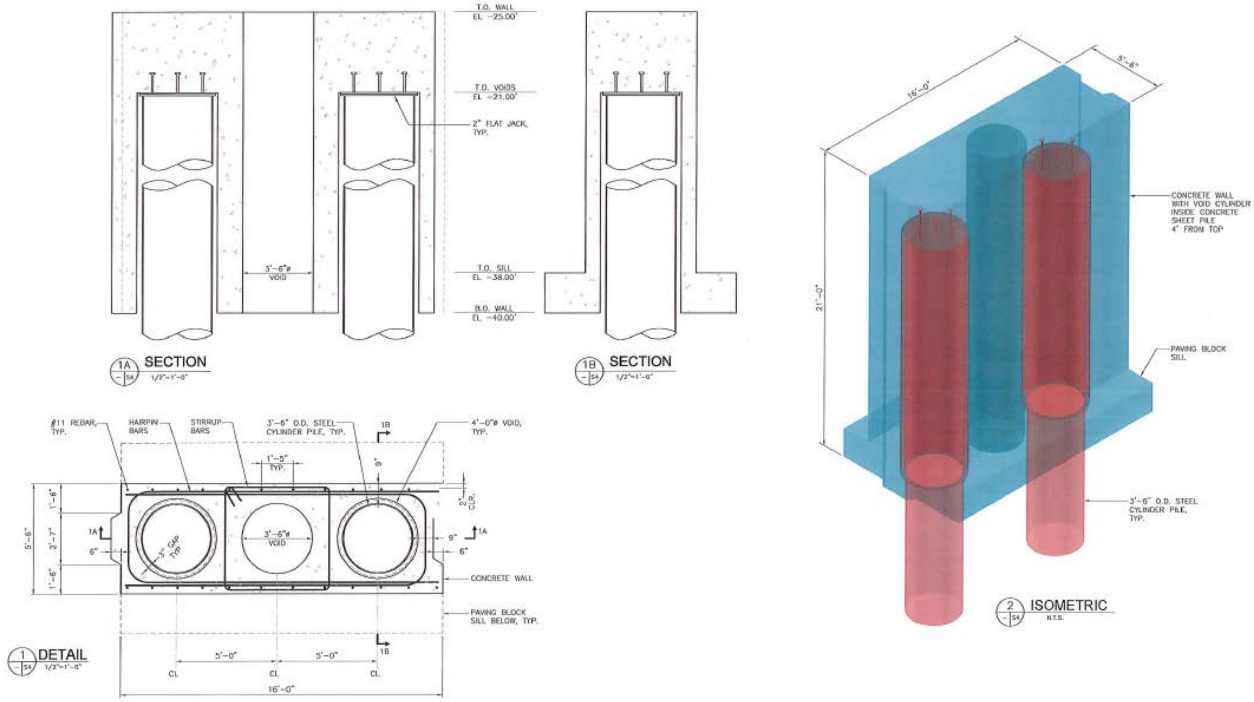

Figure C.4 Alt. A - Detail of the Inlet/Approach Channel Intermediate Wall Design for In-TheWet Construction

After the integrity of the MR&T levee is restored, the transition levees from the outlet of the Control Structure and the Conveyance Levees would be built (in-the-dry), and then the set-back levee (behind the restored MR&T levee) would be breeched to allow the railroad to be installed (on fill) so that it can pass over the top of the immersed tube segment as indicated in Figure C.5 (Plan View) and C.6 (Profile View).

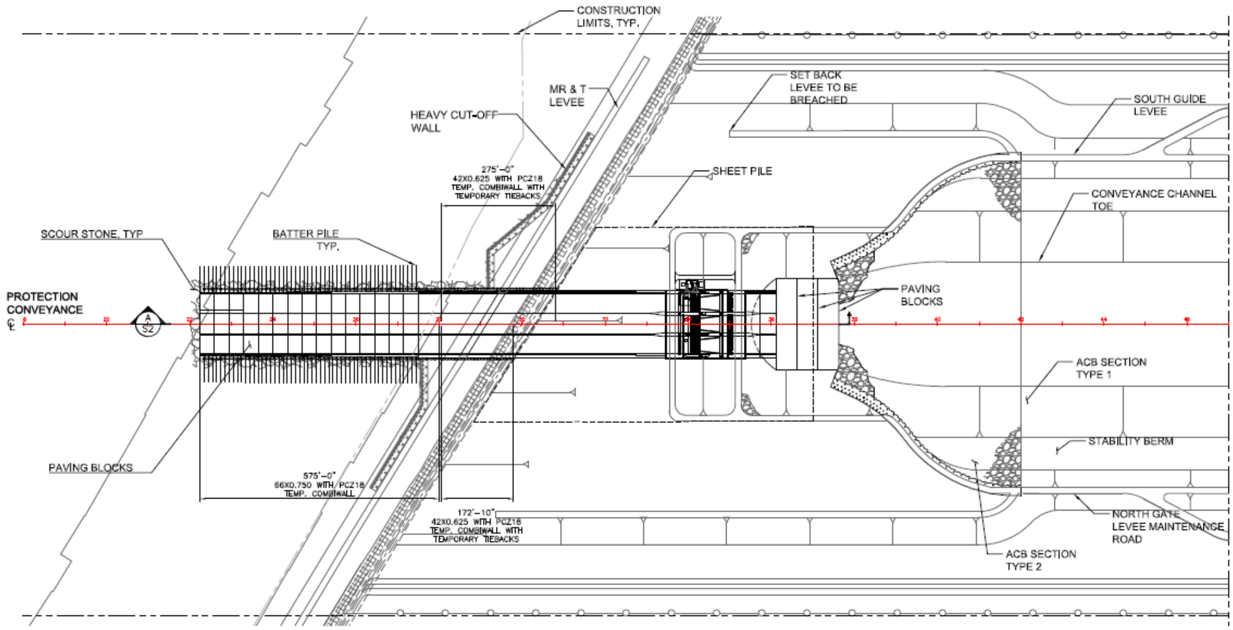

Figure C.5 Alt. A - Plan View of the Inlet/Approach Channel, Control Structure & Transition to the Conveyance Channel

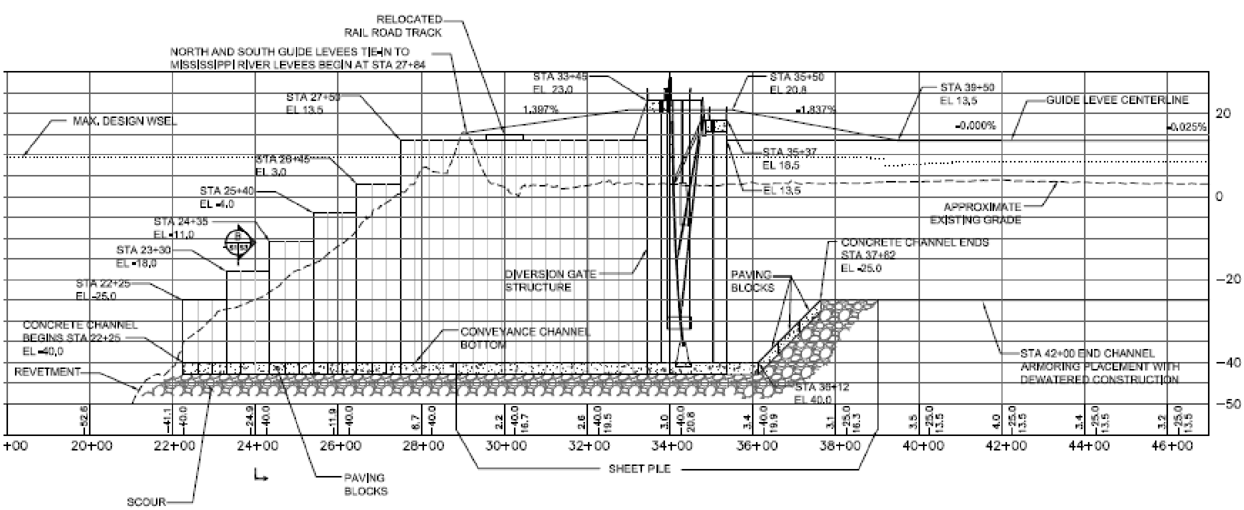

Figure C.6 Alt. A - Profile View of the Inlet/Approach Channel, Control Structure & Transition to the Conveyance Channel

Figure C.7 shows plan, profile and end, views illustrating how the Back Structure, possibly using stop logs with wheels (instead of tainter gates could be built using prefabricated lift-in concrete elements (possible precast at the site using tilt-up methodology). This feature is installed in-the-wet within a glory hole excavated at the end of the Conveyance Channel, in a manner similar to the construction of a short bridge across a body of water. The initial design direction from CPRA was that the back structure gates must close via remote controller in an hour. Lengthening this time frame would significantly reduce costs.

In this proposed construction sequence, after the glory hole is excavated, a 10-ft diameter CIDH (or drilled shafts with the steel casing installed with an oscillator) and a 42-inch diameter combi-wall system (estimated), would be installed progressively from one abutment, while an echelon precast concrete gatebay walls and decking would also be progressively installed (thus providing access from the land for land-based installation equipment, by essentially progressively building a bridge). Then precast concrete sill beams would be installed on top of the combi-wall, to create a sill for the stop logs.

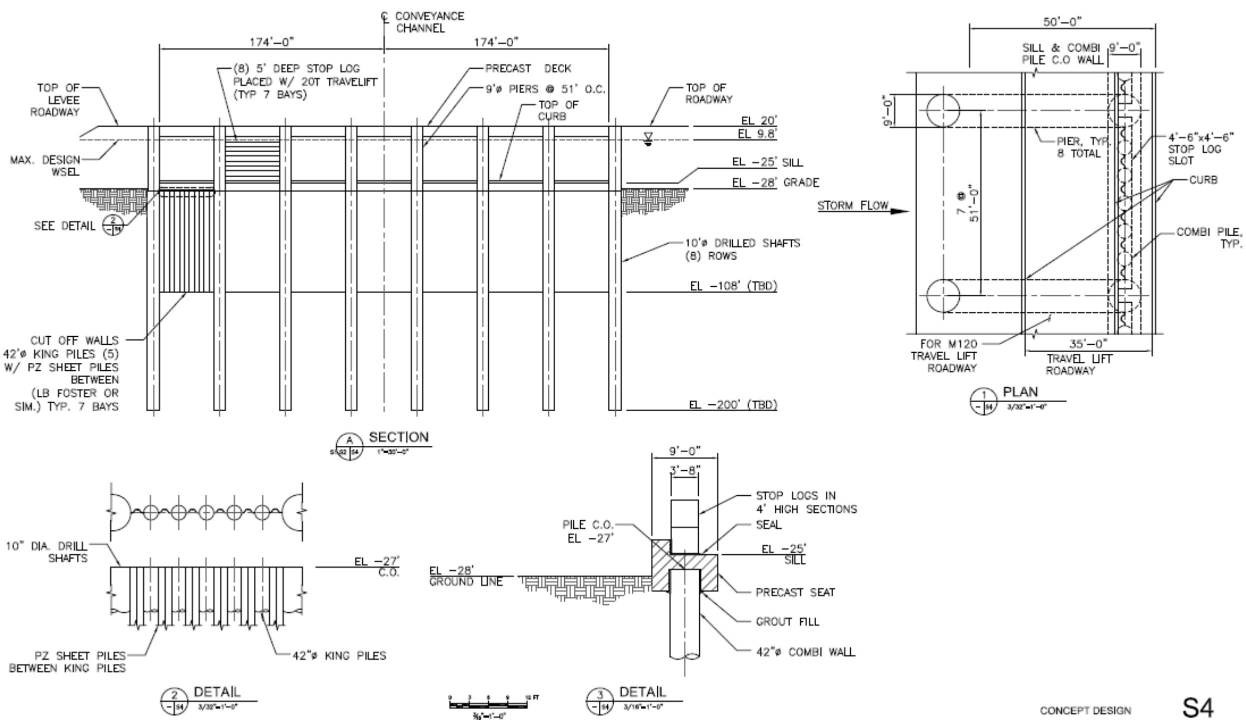

Figure C.7 Alt. A – Plan, Profile and End, Views of Back Structure, Built In-the-Wet.

Alternate C: "In the Wet" Open topped approach and immerse tube at -60-ft

The following discussion applies to Alternate C. Figure C.8 shows a plan view detail of the Alternate C Approach Channel; which is proposed to be built in-the-wet, using driven piles (note that batter piles on the perimeter retaining walls are not shown), scour stone, lift-in precast concrete jackets and panels, and paving blocks; however, the invert is taken to be El -60, and the upstream entrance to the open channel is angled towards the flow of the river/sediment.

Figure C.9, shows a plan view of how this open topped Approach Channel connects to an operating bulkhead (with wheels) type of Control Structure, located on the riverside of the MR&T levee. This leads into submerged box culverts that pass beneath the MR&T levee, beneath the railway, and beneath an end levee of the Conveyance Channel where the tube daylights with paving blocks in the transition area. Figure C.10 shows a plan view of an alternate configuration that could be considered if:

(a) it is elected to use a temporary set-back levee for additional safety during the mining of the submerged box culverts; and/or
(b) if it is elected to make the design allow for the expansion of the diversion from 75,000 cfs up to say 125,000 cfs in the future (by adding two more submerged box culvert channels and by widening the channel between the set-back Conveyance Levees).

Figure C.11 shows an alternate possible configuration for the end section of the Conveyance Levees.

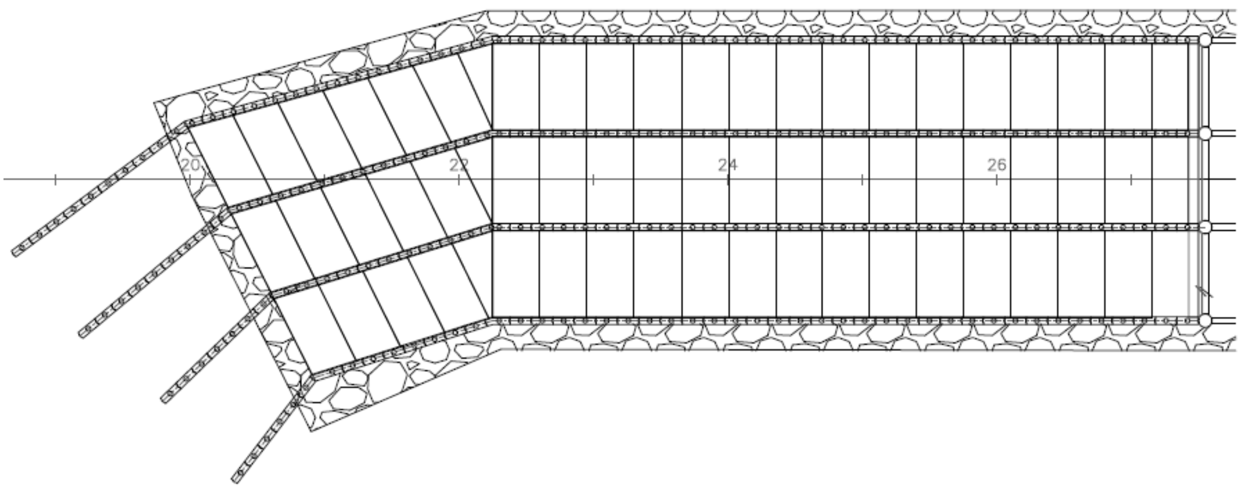

Figure C.8 Alt. C - Plan View of a Detail of the Inlet/Approach Channel

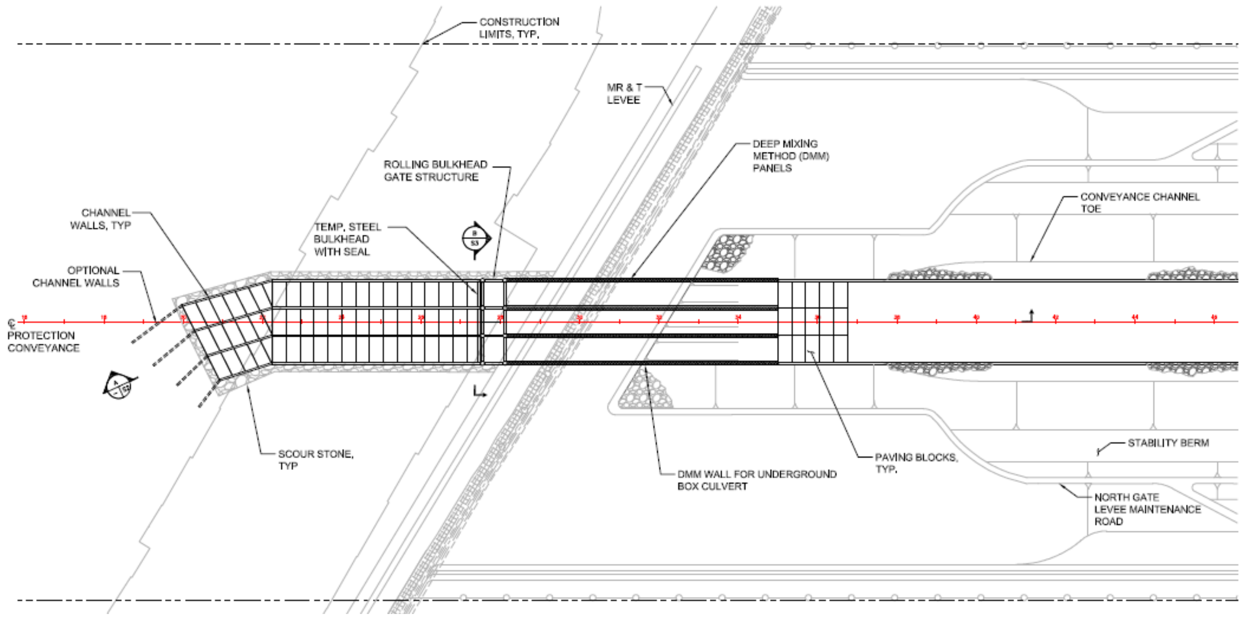

Figure C.9 Alt. C – Plan View of the Inlet/Approach Channel, Control Structure, Submerged Box Culverts & Transition to the Conveyance Channel

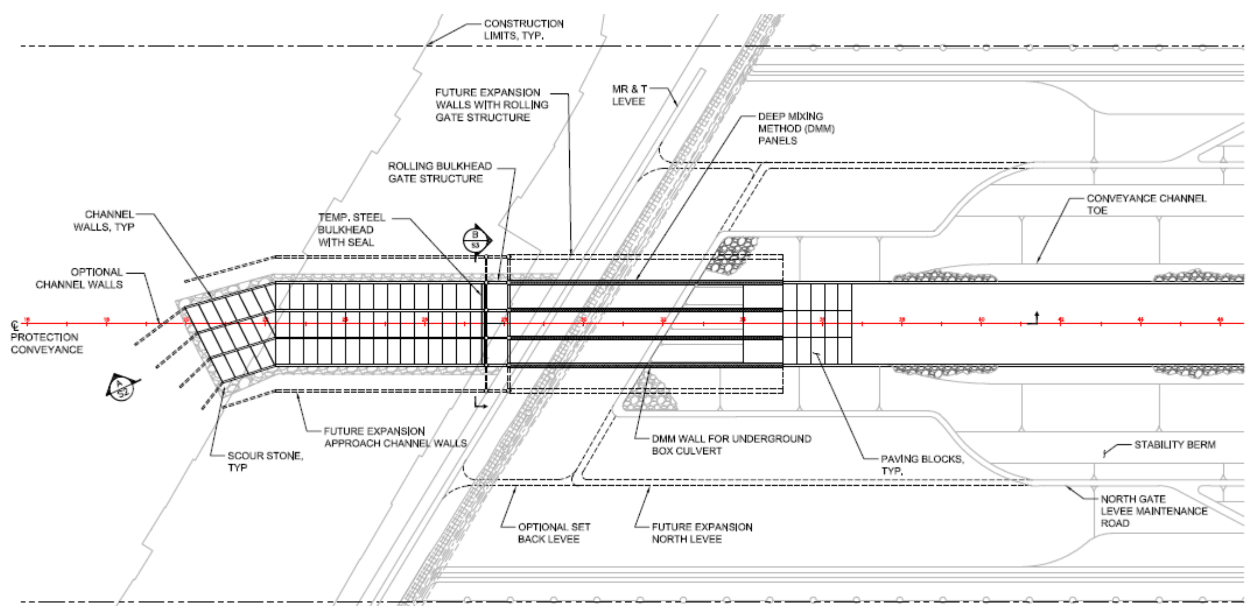

Figure C.10 Alt. C – Alternate Plan View & Construction Plan for the Inlet/Approach Channel, Control Structure, Submerged Box Culverts & Transition to the Conveyance Channel, with an Option for Future Expansion

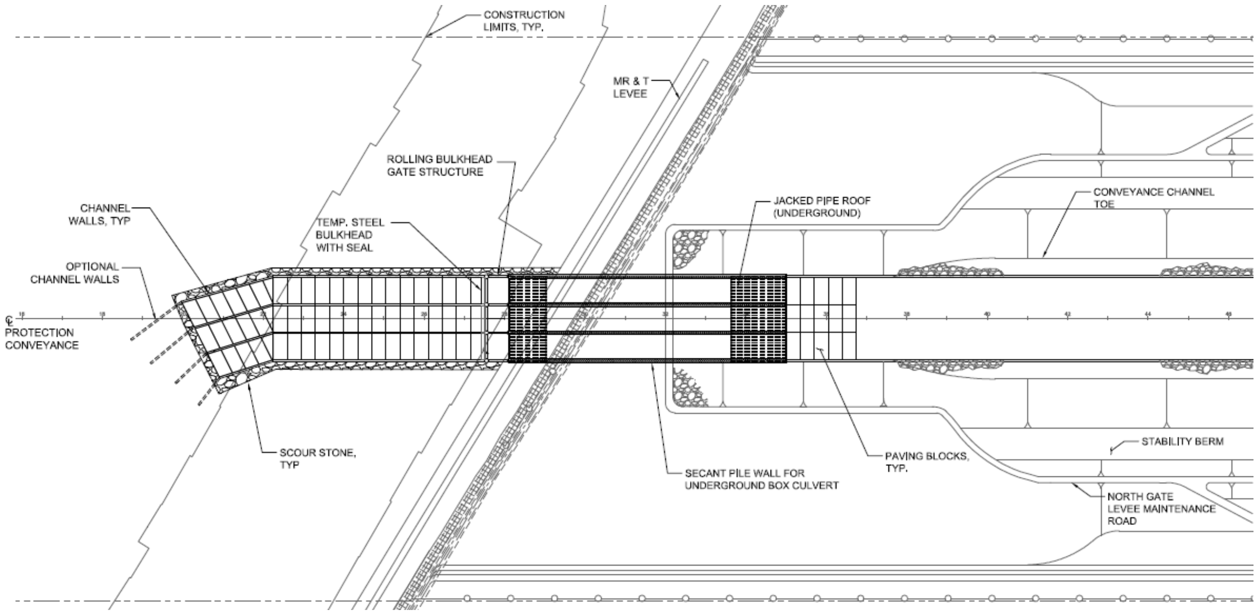

Figure C.11 Alt. C – Alternate Plan View of the Inlet/Approach Channel, Control Structure, Submerged Box Culverts & Transition to the Conveyance Channel

Figure C.12 shows a profile view of the deep mixing method (DMM) panels. This illustrates how the DMM side walls of the submerged box culverts can engage the Pleistocene layer to prevent the possible formation of a deep-seated failure surface through the soil near the MR&T Levee. Figure C.13 shows a profile view of the inlet/approach channel, control structure, submerged box culvert & transition to the conveyance channel and includes eductor jets (sand pumps) to prevent the Approach Channel and Submerged Box Culverts from plugging with sediment.

Figure C.14 shows a cross-sectional view of the submerged box culverts. The steel sections can be pushed through the fresh deep cement mixed soil columns in order to strengthen the side walls of the culverts prior to excavating/mining the soil between the panels, which would be followed by placing a cast-in-place concrete liner as the soil is excavated. This image also shows how eductor jets (sand pumps) can be positioned to prevent the submerged box culverts from plugging with sediment). Figure C.15 shows an alternate cross-sectional view of the submerged box culverts, illustrating how jacked pipes could be used to form the temporary roof if preferred.

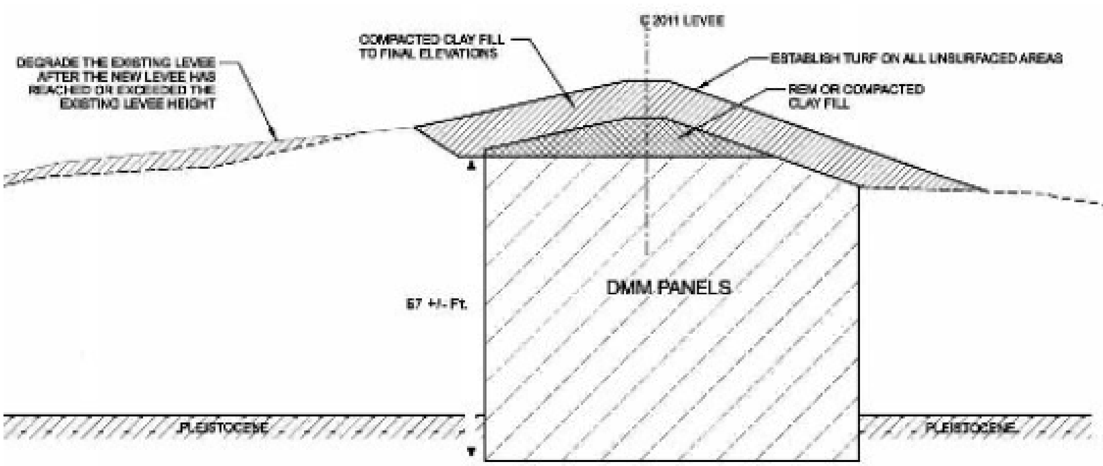

Figure C.12 Alt. C – Profile View of the Deep Mixing Method, DMM, Panels Which Illustrates How the DMM Side Walls of the Submerged Box Culverts Can Engage the Pleistocene Layer to Prevent the Possible Formation of a Deep Seated Failure Surface Through the Soil Near the MR&T Levee

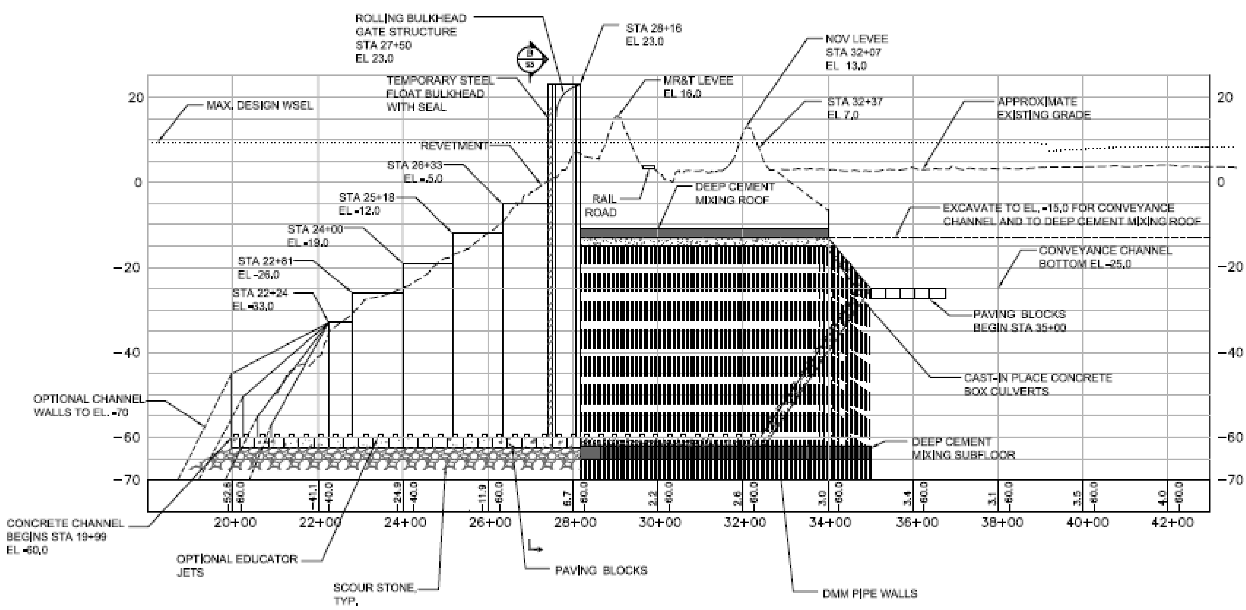

Figure C.13 Alt. C – Profile View of the Inlet/Approach Channel, Control Structure, Submerged Box Culvert & Transition to the Conveyance Channel (This Image Shows both: (1) How the DMM Panels Can Engage the Pleistocene Layer to Prevent the Possible Formation of a Deep Seated Failure Surface Through the Soil Near the MR&T Levee; and (2) How Eductor Jets Can Prevent the Approach Channel and Submerged Box Culverts from Plugging with Sediment)

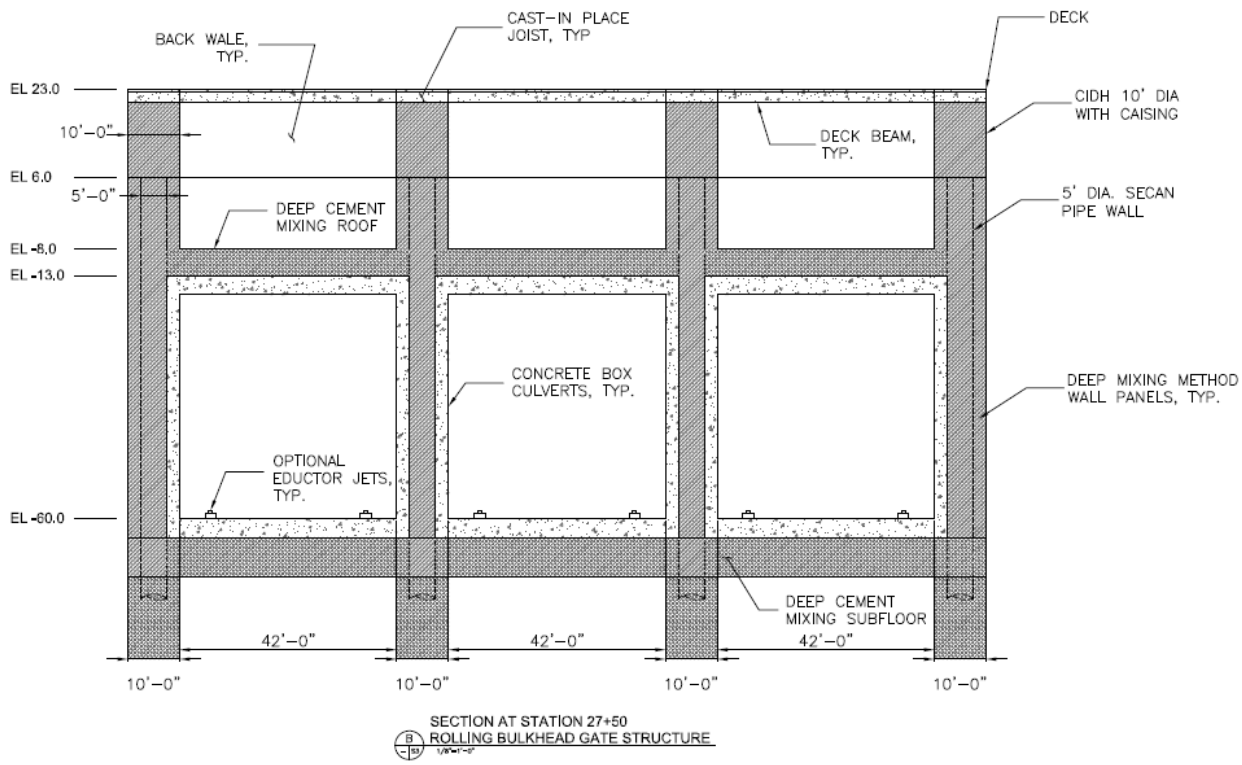

Figure C.14 Alt. C – Cross-Sectional View of the Submerged Box Culverts, with a Cast-In-Place Concrete Liner (This Image Shows How Eductor Jets (Sand Pumps) Can Prevent the Submerged Box Culverts from Plugging with Sediment)

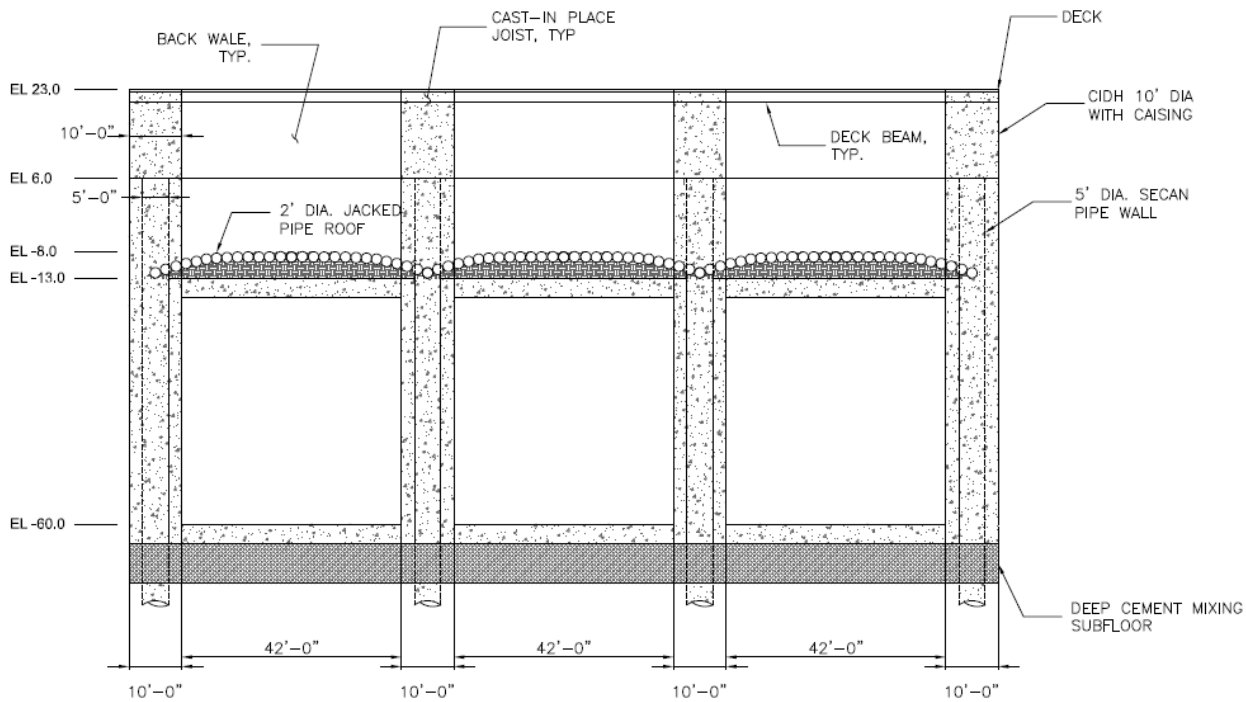

Figure C.15 Alt. C – Alternate Cross-Sectional View of the Submerged Box Culverts, Illustrating How Jacked Pipes Could be Used to Form the Roof if Preferred (note eductors are not shown)

Figure C.16 shows a plan view of the back structure, submerged box culverts & transition to the Barataria Basin. Similarly, Figure C.17 shows a profile view of the Back Structure, Submerged Box Culverts & Transition to the Barataria Basin (note that this image also shows how eductor jets (sand pumps) can be positioned to prevent the Submerged Box Culverts from plugging with sediment). Figure C.18 shows a cross-sectional view of the outlet Submerged Box Culverts, with a cast-in-place concrete liner (note that this image shows how eductor jets (sand pumps) can be positioned to prevent the Submerged Box Culverts from plugging with sediment). Figure C.19 shows an alternate cross-sectional view of the outlet Submerged Box Culverts, using a temporary horizontally directionally drilled pipe roof, and with a cast-in-place concrete liner (note that eductor jets are not shown in this image).

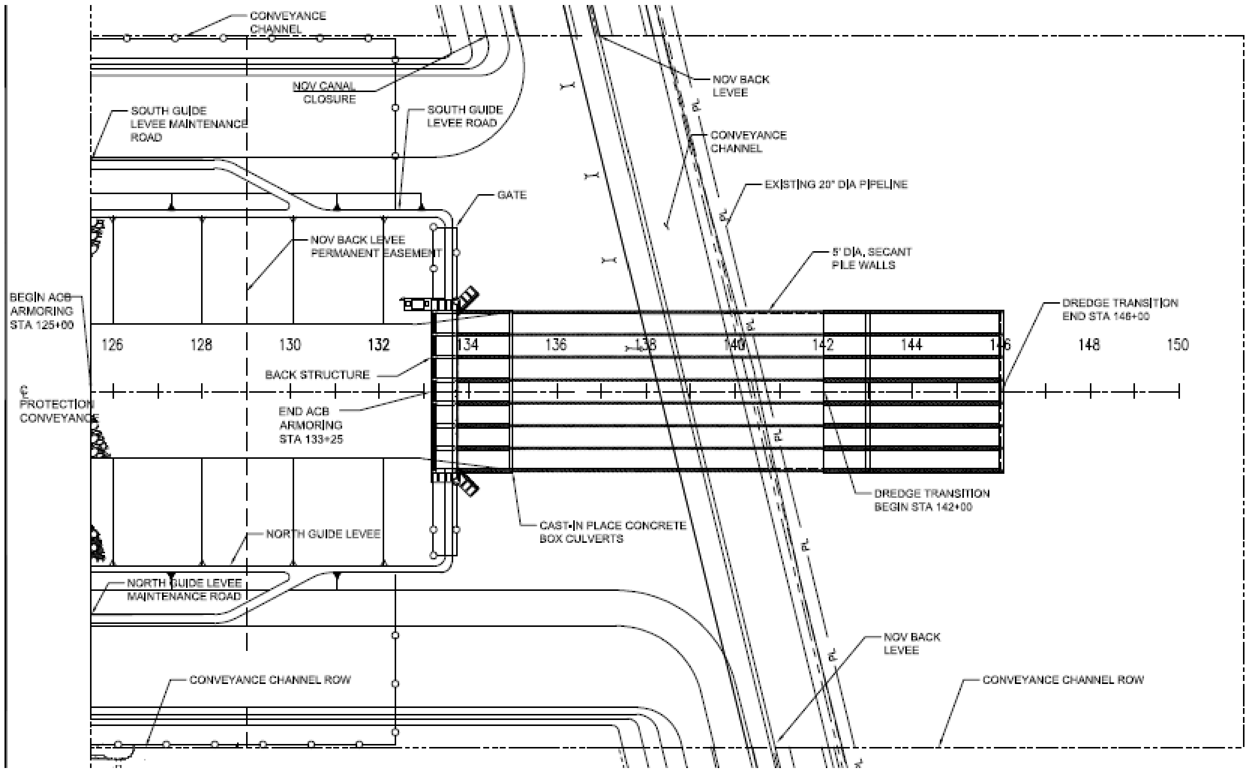

Figure C.16 Alt. C – Plan View of the Back Structure, Submerged Box Culverts & Transition to the Barataria Basin

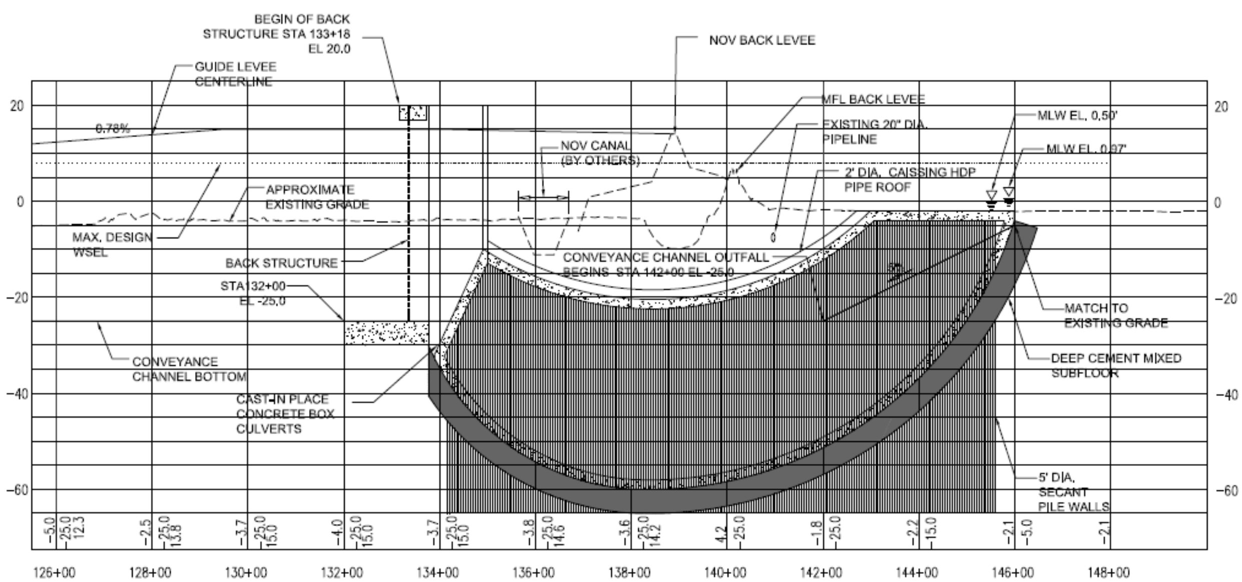

Figure C.17 Alt. C – Profile View of the Back Structure, Submerged Box Culverts & Transition to the Barataria Basin

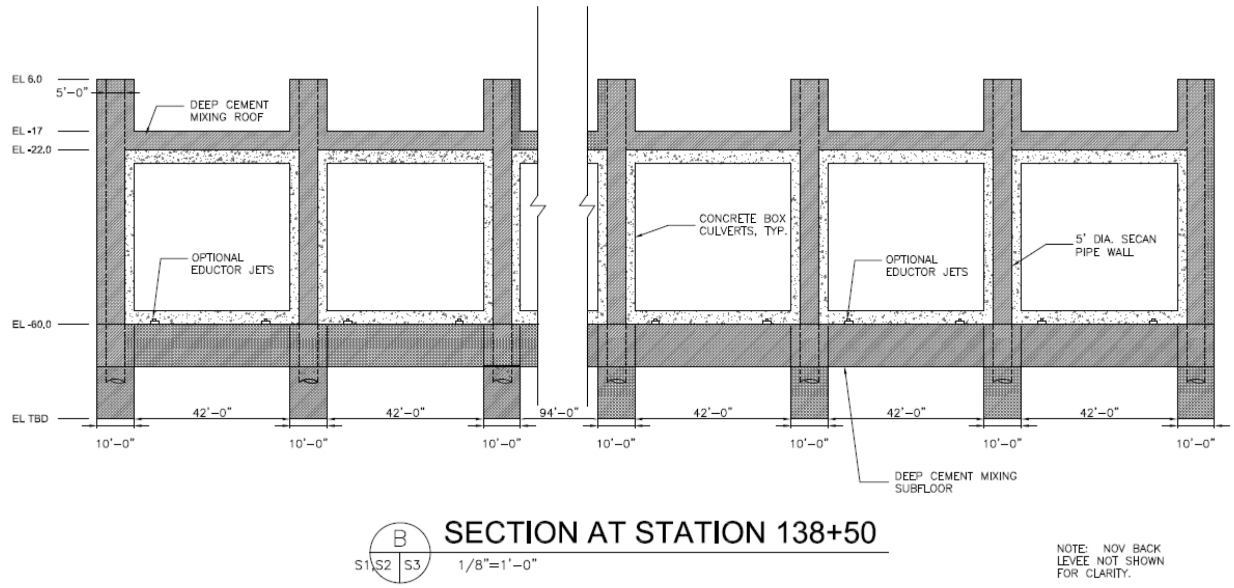

Figure C.18 Alt. C – Cross-Sectional View of the Outlet Submerged Box Culverts, with a Cast-In-Place Concrete Liner (This Image Shows How Eductor Jets (which could be either embedded in, or on top of, the floor slab) Can Prevent the Submerged Box Culverts from Plugging with Sediment)

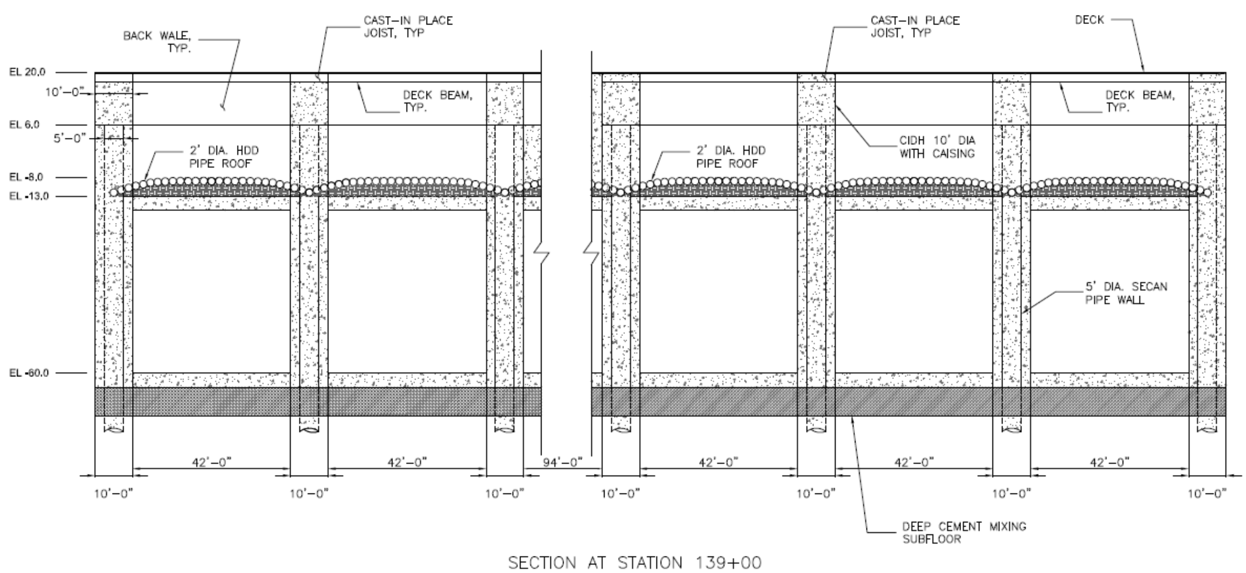

Figure C.19 Alt. C – Alternate Cross-Sectional View of the Outlet Submerged Box Culverts, with a Temporary Horizontally Directionally Drilled Pipe Roof, and with a Cast-In-Place Concrete Liner (eductor jets are not shown)

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