Mid-Breton Sound Sediment Diversion Independent Technical Design Review

ATKINS

COWI

FINAL REPORT

JANUARY 12, 2016

FOR

THE COASTAL PROTECTION AND RESTORATION AUTHORITY OF LOUISIANA

CONFIDENTIAL

COASTAL PROTECTION AND RESTORATION AUTHORITY CPRA

Plan Design Enable

JANUARY 2016
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)

Mid-Breton Sound Sediment Diversion Independent Technical Design Review

FINAL REPORT

FOR

THE COASTAL PROTECTION AND RESTORATION AUTHORITY OF LOUISIANA

CONFIDENTIAL

Mid Breton Sound Sediment Diversion Independent Technical Design Review

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 preliminary engineering design documents provided to this team.

DOCUMENT HISTORY

VERSION	PREPARED BY	DATE	REVIEWED BY	DATE	COMMENTS
DRAFT 01	WKJ, DB	4/5/15	DL, TW, LL		DRAFT SUBMITTAL FOR INITIAL REVIEW BY CPRA
FINAL	BKB	1/8/16	LEL	1/8/16	FINAL REPORT

Table of Contents

List of Figures:

List of Tables:

Executive Summary

The Coastal Protection & Restoration Authority (CPRA) requested that Atkins North America, Inc. (Atkins) perform an Independent Technical Review (ITR) of the major design deliverables for the Middle – Breton Sound Sediment Diversion (Mid Breton) project. To support this review, Atkins sub-contracted with COWI Marine North America, Inc. (COWI). Together, the Atkins/COWI team worked with the CPRA staff to evaluate project deliverables describing the primary project.

Unlike diversions at Mid Barataria, Lower Breton and Lower Barataria the engineering analysis on Mid Breton has not been advanced. The available engineering documentation is based on data gathered at an abandoned location (White Ditch, Location 3, RM 59); therefore, this review focuses on the final recommendations of the December 2013 report entitled: "Hydrodynamic and Sediment Transport Modeling using FLOW-3D for Siting and Optimization of the LCA Medium Diversion at White Ditch" (Water Institute 2013) that modified the selection of the site to Location 1 near Bertrandville, LA at RM 68.6. From an engineering perspective this work can at best be considered pre-feasibility or schematic. We note that this study was primarily focused on the hydrodynamic and sediment transport conditions at the preferred location and did little to frame up the design components of the structure.

The Atkins/COWI team fully concurs with the selection of Location 1, due to its favorable river conditions. We also concur with the Optimization 5 preliminary configuration (due to its favorable sediment load delivery). However, we find that detailed review of costs are not necessary nor beneficial for the USACE Feasibility Study (2010) OPCC of $387,620,000, the 2012 LCA cost provision of $123,000,000, or the 2013 LCA Medium Diversion at White Ditch report (OPCC of $324M later updated to $421M) due to differing conditions/characteristics between the two locations, including:

- Geotechnical conditions
- Inlet invert elevations
- Outlet conditions
- Conveyance lengths
- Types of control gates

The Atkins/COWI team used the baseline engineering information found in the Water Institute 2013 report and extrapolated from this concept a schematic design where a preliminary cost estimate could be developed, providing an initial budget. We used the prescribed 35,000 cubic feet per second (cfs) discharge rate identified though we did not find a process of how this flow rate was established. Unpublished correspondence with the Water Institute (March 5, 2015) indicate that basin size may constrain the discharge and that will need to be substantiated. It has been shown that higher flow may increase sediment loads to the receiving basin. Significant changes will change the costs that were developed and potentially improve the outcome.

To flush out estimated project costs, the Atkins/COWI team used similar engineering concepts established in the Mid Barataria ITR which demonstrated viable construction technologies and/or gate types. Based on this analysis, a diversion project could be developed here for a preliminary total project cost of approximately $380M (with an OPCC of $269,419,000).

Recommended Path Forward

The Atkins/COWI team recommends that the engineering aspects of the project be refined to meet two basic guidelines. First, can a structure be physically built at this site for a reasonable budget and second, will the structure deliver the intended benefits. Both of these guidelines need to be fully resolved prior to completing a 30% design package so that these issues and other project objectives are not continually questioned and readdressed. In the case of Mid Breton it appears that from the planning level work to date there is reasonable assurance that the structure could work as intended. However, there is no basis to determine whether the site conditions would support this structure for the cost basis established here.

To further define this project and understand how this diversion may positively impact Breton Sound, we suggest that CPRA re-establish project goals and constraints in response to information that has been developed to date. These could include:

(a) Project cost limitations: for example; is $400M a rational total project budget (less mitigation) for this project? Can this budget meet the other project targets?
(b) Develop a geotechnical data collection program to, at a minimum, confirm the idea that construction of a structure at this location is viable.
(c) Establish a land building (marsh creation) target. Is the discharge rate at the correct level to meet project goals?
(d) A flood protection target.
(e) Acceptable water levels in the basin.
(f) Sea level Rise Criteria
(g) Environmental constraints (once the above targets are defined).
(h) An operational scheme addressing the above and potentially mitigating impacts.
(i) An operational scheme in concert with the other three major diversion projects.
(j) Life cycle costs and durability.

The Atkins/COWI team recognizes that work continues on a number of these issues that will support decision making. Better documentation is needed that describes how the regional and local hydraulic models are coupled to each other as well as environmental models so that the findings can be used to clearly describe the physical impacts to the receiving basin.

Conclusion:

The Atkins/COWI team has demonstrated that, based on the information developed, a 35,000 cfs diversion appears that it can be built for costs similar to those established in the past. We recommend continued refinement of a most likely design alternative covering the variety of configurations and flow characteristics identified in the major works that remain pertinent as well as new information being generated by the ongoing planning efforts. The CPRA may want to consider engineering and development of this diversion (with current concepts) to the same level of the other three. The goal, whether to pursue now or in the future, should be to have a workable design to meet the project(s) objectives by the time the 30% documents are complete. This should include everything from environmental to operational concerns. It is not cost effective to redesign after this point in the project delivery.

Water levels in the Breton Sound Basin need to be quantified against flows through the structure to establish a maximum acceptable flow. Once this is known, sediment transport along with a variety of other environmental criteria can then be reviewed through a more focused assessment of those sets of flows that do not inappropriately impact water surface elevations.

A range of potential outcomes related to land building is required for the Mid Breton diversion project so that CPRA can make decisions on funding. Alternative analysis of conceptual Mid Breton designs must be performed iteratively with the performance of sediment delivery and their associated impacts. Sea level change factors may deem the upper diversion more valuable if sea level predictions and subsidence continues as estimated. The appropriate modeling platform must be applied to the corresponding structure configuration(s) in order to characterize a “best” performance structure ranked by sediment delivery and cost. A modeling platform must not dictate the type of structure selected. Once the project team has a preferred alternative that meets flow and land building targets without adversely impacting water levels in the Breton Sound Basin, the NEPA process can be initiated.

Section 1 Introduction

The Louisiana Coastal Protection and Restoration Authority (CPRA) designated a diversion at Mid Breton (001.DI.23) as one of the major Mississippi River sediment diversion projects listed in the Louisiana Comprehensive Management for the Coast (LA 2012 MP). The Mid Breton diversion was cited in the LA 2012 MP as a 5,000 cubic feet per second (cfs) diversion to build land with a budget of $123M. In 2010, the United States Army Corps of Engineers (USACE) – Mississippi Valley, New Orleans District generated an Integrated Feasibility Study and supplementary Environmental Impact Statement (EIS) for the medium diversion at White Ditch, Plaquemines Parish LA. This plan recommended a 35,000 cfs diversion at Location 3 (Alternative 4) or White Ditch at River Mile (RM) 59. CPRA was the non-federal sponsor in this effort. As one of the four major diversions planned by CPRA in the 2012 MP, this project (diversion), as described in this report, would provide a source of river sediment, freshwater and nutrients to the River aux Chenes sub-basin and other nearby portions of the upper Breton Sound Basin, to restore and protect marsh soils and vegetation and maintain a functional salinity regime. The project would be expected to benefit approximately 98,000 acres of wildlife and fisheries habitat in this portion of the Breton Sound Basin. The fully funded cost of the plan recommended by the USACE is estimated to be $387,620,000.

This effort is now superseded by work conducted in the report entitled "Hydrodynamic and Sediment Transport Modeling using Flow-3D for Siting and Optimization of the LCA Medium Diversion at White Ditch Technical Report." CPRA authorized Arcadis US, Inc. and The Water Institute to develop this study to optimize the inlet configuration for the diversion structure at Location 3 at the river bend north of Phoenix near RM 59. In this study, the proposed location was changed to Location 1 near Bertrandville, LA at River Mile (RM) 68.6 (using the White Ditch nomenclature) and is now the preferred alternative. This study looked at multiple alternatives in this area and extensive modeling was conducted to define this feature. (Note that White Ditch continues to be used in a generic fashion for the location of this diversion. Many of the reports still refer to the selected alternative as White Ditch). While work is on-going at the Water Institute this Water Institute 2013 study provides the "most complete" Basis of Design to date.

Figure 1 Diversion Locations Alternatives Identified for the Mid Breton Sediment Diversion

The only engineering features are those described in the USACE Feasibility Study where the information was provided for location 3. This is substantially different in geometry and scope than the resultant recommendation at location 1. The engineering information was however moved and generally modified in the Water Institute 2013 report to the conditions at Location 1. This framework is schematic at best and provides only a basic framework for a structure at this location. We note that this study was primarily focused on the hydrodynamic and sediment transport conditions at the preferred location and did little to frame up the design components or costs associated with the structure.

To assist CPRA in reviewing the information for the Mid Breton diversion, the CPRA retained Atkins, including COWI Marine North America (COWI) as a major sub-consultant, to perform an independent technical review (ITR) of the preliminary information that is available and pertinent for the engineering design features of this project. In this case, the Atkins/COWI team further extended the framework established in the USACE Feasibility Study and work as developed by Arcadis and the Water Institute to generate concept level designs and costs consistent with the Location 1, RM 68.6 location.

The Atkins/COWI team used similar engineering concepts established in the Mid Barataria ITR which demonstrated viable construction technologies and/or gate types. This document represents a technical summary of the Atkins/COWI analysis which, together with our technical comments, mark-ups, and verbal contributions/meetings, represents the Atkins/COWI deliverables. The CPRA objective is a comparative review of all of the four major sediment diversions that frames up technically acceptable designs based on the available data for all of the sediment diversion projects. All diversion projects must be framed in the context of the other three major diversion projects (Mid Barataria, Lower Barataria and Lower Breton) and constructible for costs consistent with a favorable sediment/water ratio and other net positive impacts downstream. Value engineering concepts touch on alternative construction methodologies that have been discussed between the team. Some of these ideas could be expanded for additional savings. This will be further discussed in the VE section below.

There is a significant body of ancillary work that exists, especially for various modeling components of major geographic features related to this project and other diversions. Some are pertinent at some level for the work for this diversion. As this effort is to review the “engineering” components of the diversion structure, we did not attempt to characterize, through review of all of the major modeling studies, that which could ultimately be used to define the impacts to this structure. As such we focused on those issues that will ultimately drive the final engineering designs.

To date the modeling work has been performed by independent teams focusing on major planning issues that will need to be addressed prior to design. Much of this modeling is planning in nature and will be useful in the public coordination of the project and permitting. Coordination of the goals and objectives of each effort and information needed by each group to successfully reach the modeling goals that each has set appears to be on-going. Engineering design considerations in the modeling effort are still at a planning level. Some of the assumptions such as total flow required/needed may be changing, resulting in uncertainty in the design criteria. At this stage of a project these issues should be resolved or at a minimum identified. A statement defining the probability of success, risks assumed and a clear scope to be completed by the next phase is needed to make progress toward a specific goal.

To facilitate the Atkins/COWI's team's review, the following documents were received and reviewed:

- Ecosystem Restoration Study Volume VI of VI, Final Integrated Feasibility Study and Supplemental Environmental Impact Statement for the Medium Diversion at White Ditch Plaquemines Parish Louisiana September, USACE (CEMVN) September 2010
- Hydrodynamic and Sediment Transport Modeling using Flow-3D for Siting and Optimization of the LCA Medium Diversion at White Ditch, Arcadis; Water Institute December 2013
- Hydrodynamic, Salinity, and Morphological Modeling Study of the Proposed White Ditch Sediment Diversion USACE ERDC/CHL TR-OX-X March 2014
- Louisiana Coastal Area (LCA) Medium Diversion at White Ditch Preconstruction Engineering and Design Location Analysis, September 5, 2013
- Diversion Synopsis provided by CPRA Planning Division on March 6, 2015

Section 2 Modeling

A number of major modeling exercises were conducted for this scope of work. These include work conducted in the USACE Feasibility Study for White Ditch, the Arcadis/the Water Institute study, and work conducted by ERDC. Presently work continues through the Water Institute and a number of milestones including coupling of the various diversion structures in a comprehensive model are anticipated in summer of 2015.

The initial effort described in Appendix L of the USACE Feasibility Study for White Ditch: Engineering (dated August 2010) contains four Annexes that provides results of hydraulic and eco-hydrological modeling which are detailed within the Annexes. The three of the four Annexes primarily describe the receiving basin of the diversion flows and changes that will occur within the receiving basin in salinity due to fresh water diversion and in marsh building due to sediment diversion. Annex 3 is engineering related and discussed in Section 3.

- Annex 1 appears to be based on a technical paper addressing the general theory and start of theoretical model development for wetland acreage created by freshwater flow diversions to receiving basins.
- Annex 2 deals with a spreadsheet model “SAND2” for forecasting the building of wetland acreage that appears to be developed by ERDC.
- Annex 3 deals with a cost analysis and is discussed in Section 3.
- Annex 4 deals with salinity modeling in the receiving basin accomplished by URS (dated June 4, 2010). This URS report discusses HEC-RAS modeling conclusions (but provides no details of the modeling). URS notes the modeling is based on FTN work but does not reference reports to assess the work and no reports were provided to the reviewers on this modeling.

The Water Institute Report by Arcadis and prepared for USACE-New Orleans District and CPRA (dated December 2013) deals with hydrodynamic and sediment transport modeling using FLOW-3D for siting and optimization of the diversion project but does not cover the receiving basin. This document is key as it frames up the limited basis of design available for review at this time.

The ERDC/Corps of Engineers Report (dated March 2014) deals with the receiving basin hydrodynamics, salinity, and morphological modeling using the Adaptive Hydraulics Model (AdH) ERDC version of the model along with SEDLIB (a sediment transport library of ERDC/Corps of Engineers) for assessing impacts on the Breton Sound Marsh of the planned White Ditch Diversion (WDD).

Work continues to be conducted by the Water Institute and their selected sub-contractors and partners including Arcadis Inc., LSU, UNO and others as funded by CPRA. Currently the team is conducting 3D hydrodynamic and sediment transport/river modeling to determine sediment capture. This work is intended to refine the 2012 Coastal Master Plan modeling (eco-hydrology, vegetation, and wetland morphology) to estimate basin-side response. Site specific data is being collected for inclusion in local and regional 3D hydrodynamic and morphological river modeling and local Delft multidimensional basin modeling using the West Bay Sediment Diversion Project as an analogue to provide details needed for conceptual engineering (CPRA Planning, Diversion Synopsis, 2014). Limited discussion of the models utilized in the Mid Breton-White Ditch studies is provided in Appendix A.

Table 1 Major modeling studies for the Mid Breton Diversion

Study	Team	Year competed	Models	Selected Alternative
Feasibility Study	USACE, ERDC, URS	2010	CMS	White Ditch RM 59 (Location 3)
Hydrodynamic and Sediment Transport	Water Institute, Arcadis	2013	FLOW 3D	RM 68 (Location 1)
Breton Sound hydrodynamic and morphological	ERDC, Water Institute	2014	AdH, SEDLIB	RM 68 (Location 1)
Present Studies	Water Institute, Arcadis, LSU, UNO	On-going	Delft-3D	RM 68 (Location 1)

The development of the modeling platforms by each team has come from the view point of the specific team doing the selected work and often provides results based on assumptions provided within the report and on earlier modeling work that has not been made available to the review team. Additionally, versions of the models or a repository/archive for model code have not been provided, and in most cases parameters set within the models by the modelers have not been stated, therefore, considerable questions regarding model capabilities, calibration/validation remain. In situations where the models cannot be truly calibrated or verified due to lack of known boundary conditions, no references have been provided to assess the modeling performance on similar projects.

From the modeling team viewpoints, the diversion is primarily expected to perform for peak diversion discharge rates ranging from 5,000cfs to 100,000 cfs although as noted in Annex 1 of Appendix L: Engineering, overtopping of River Aux Chenes ridge will occur with diversions over 70,000cfs.

Flow 3D Modeling

FLOW-3D (Arcadis & Water Institute): FLOW-3D provides the ability to do non-hydrostatic modeling via momentum considerations in the vertical. Although recent versions of the model allow erosion/scour considerations for course grained sediments, the primary usage of the model for sediment transport appears to be via a Lagrangian particle tracking approach which is utilized within the work done for WRI by assessing particle tracking of various grain sized sediment through the diversion structure to assess SWR's (sediment water ratios) as a measure of efficiency in the project concepts to divert the available river sediment to the receiving basin. Model information is not clear as to its capability of dealing with flocculation, or cohesion considerations as may be seen in the clay sized portion of sediments encountered in the diversion process. In the Mid-Breton study, FLOW-3D addresses hydrodynamics and sediment transport in the river with the purpose of assessing the most promising location for the diversion and best alignment for the diversion to maximize sediment concentrations and sediment capture capabilities.

Particular concerns in the FLOW-3D model usage and reporting are statements made to the effect that model calibrations and validations for both the initial domain and extended domain are good although considerable differences exist between the measured data and the model results, especially in the lower portions of the vertical for sediment concentrations. As most sediment will be found in the lower portions of the vertical, a calibration and validation on concentration alone would not seem to be a very reasonable gauge of the adequacy of the model in carrying sediment load.

Sediment calibration write-up needs clarification and metrics to determine what a successful calibration and/or verification should consist of. One such metric should be total load carried at a given location for assessing the model capability of providing a true picture of sediment transport by the model. Model discussion is not clear with regard to particle interaction with the bed and report discussion notes that "This ad hoc way to handle erosion and deposition is not strictly correct" which suggests that comparisons provided may be fortuitous. Although the model is noted to be validated, this is not clear to the reviewers from figures provided.

AdH Modeling

The 2014 study by ERDC for Mid Breton-Whites Ditch used the AdH model and SEDLIB library to determine the impacts on the Breton Sound Marsh of the planned development of the Mid Breton Diversion of the Mississippi River. This is the most comprehensive model to date and is run in a 2D depth averaged mode with unspecified and undocumented semi-analytic corrections to allow quasi-3D behavior for important 3D sediment considerations such as sediment stratification, mass flux, and bendway effects which need to be documented with further references and discussion. The modeling efforts appear to be based partly on an earlier version of a Caernarvon Diversion Study which is not referenced nor provided to the reviewers but only alluded to within the modeling report. Model validation appears to be based on this Caernarvon Diversion Study but a validation is not clearly provided within the review documents given to the reviewers and much of the model discussion that suggests validation appears to be more calibration. To clarify this process, calibration and validation should be addressed separately within the modeling discussion.

Although the model invokes the SEDLIB library, no information is provided on what this details (i.e. what modules are utilized and for what reasons?). Although flow is assumed to be vertically well mixed within the Breton Sound system, no data is shown to assess the adequacy of this assumption. Throughout the model discussion of boundary conditions there is confusion as to whether the Dauphin Island and/or Pensacola gage is chosen. Within the calibration, wind data is used and filtered but no discussion of the filtering process or the rationale for filtering the data is provided. Additional concerns regarding "… unexplained loss of river discharge between Baton Rouge and Belle Chasse…" need further clarification to ensure that proper river discharge is accounted for in the model at the diversion sites investigated. Rationale with regard to filtering out the tidal signal need to be explained since this reach of the river clearly has tidal influence. Explanation needs to be made as to why the modeled water surface elevation comparison at Pensacola (on the domain boundary) has major differences with the measured data. A wind attenuation factor on the marsh is provided but no rationale is given within the report which should be addressed. Statements such as "…. many mesh changes were made in an attempt to understand the flow patterns…." suggest the model is not capable of capturing the existing flows correctly and suggests improvement needs to be made by collection of more data for adequate modeling. Overall the modeling effort suggests "acceptable" accuracy for the hydrodynamics of the system although no metric is provided for what is acceptable.

As salinity modeling and sediment modeling are directly dependent on the hydrodynamic modeling, it would be expected (as is found) that modeling and measurements diverge for these processes. With regard to salinity modeling, the text states "…only qualitative results from the model are included in this report…" which contradicts the following statement that "results are sufficiently robust". As salinity plots do not show good comparison with measured data, it is felt by reviewers that the salinity modeling needs improvement based on improved hydrodynamic modeling of the system. Further qualitative modeling is provided on sediment transport but as the procedure for addressing sediment transport is lacking in detail and data for calibration or verification, it would not be reasonable to validate the modeling effort at the present time. It is not clear from the modeling report or other available details as to the ability of the model (coupled with SEDLIB) to handle the clay portion of the sediments where potential flocculation and cohesion are important. It is not clear what differences there are between the ERDC/Corp of Engineer AdH model used for this project from a commercially available version of AdH. It is not known what version of AdH or of SEDLIB are used for the Mid-Breton modeling work and it appears that both models are proprietary to ERDC/Corps of Engineers.

Discussion

To date, the modeling work has been performed by independent teams with little coordination of the goals and objectives of each effort and information needed by each group to successfully reach the modeling goals that each has set. There appears to be no cohesive design guidance focused on the engineering aspects needed by the different groups. This may be due to the presumption at the initiation of the project that key features had been determined and the focus was to build an appropriate structure under changing guidance and changing target diversion rates and river flows. The reports were written over an extended period of time and that none of the modeling covers the entire domain of the project which would incorporate boundary conditions at only the Mississippi River and the open water at/near the Gulf of Mexico.

The Atkins/COWI team feels that the manner in which the reports were accomplished along with a lack of sufficient documentation within the reports has detracted from the intent to show the project viability in various areas including (but not inclusive of):

- Assurance that the diversion structure will convey the entrained sediment in the river through the structure to the Mid-Breton basin;
- Continuity of flow volumes (i.e. water volume conveyed through the diversion structure is either contained within the Mid-Breton basin or diverted through the basin to the Gulf or elsewhere;
- Continuity of sediment volumes (i.e. sediment conveyed through the diversion structure is dependent of flow and is transported in such a way as to build land)

- Effects of diversion on potential of shoaling downstream from diversion;
- Effects of sediment diversion on Mississippi River terminus delta(s);
- Effects of project on flooding in project area;
- Effects of project on navigation safety in vicinity of project;
- Concerns regarding history of river in area of diversion such as future meandering of river or main channel;
- Effects of river flood sand waves on project;
- Measured boundary conditions referenced to known accurate consistent vertical datum in the Mississippi River;
- Assessment of sensitivity of assumed internal boundary conditions at the diversion structure for the modeling efforts;
- Sufficient documentation on models, model versions, model parameters utilized, and on calibration and verification for models for hydrodynamic, sediment, salinity modeling.
- Effects of waves within the river (boat and wind waves) are not included for both navigation safety concerns and design aspects of the diversion structure;
- Effects of wind on shallow flows in the receiving basin needs to be expanded upon (i.e. wind shear description and coefficient utilized, wind attenuation, etc.);

Robust alternative feasibility analysis of conceptual Mid-Breton Sound Sediment Diversion design should be performed iteratively and in a coordinated approach with the performance of sediment delivery and associated impacts (i.e. water levels, etc.) documented in a continuously updated timeline chart. The appropriate modeling platform(s) must be applied to the corresponding structure configuration(s) in order to optimize the best performance structure(s) and ranked by sediment delivery and cost. The modeling platform(s) should not dictate the type of structure selected as the modeling is only intended as a tool in selecting the most efficient plan for adding wetland acreage while not degrading the environment, and leading to the most cost effective structure to be considered for construction.

Although many of the models utilized appear to be in wide usage in many aspects of research (i.e. FLOW-3D, AdH, CMS), a clear outline of model capabilities is needed for clarity in utilizing for present project needs. In particular project documentation should include a detailed reference list as to where projects similar to the Mid-Breton project have been calibrated and verified (i.e. for other built diversion projects). Additionally models should be cross checked for modeling results (i.e. hydrodynamic, sediment, salinity) where feasible within the project, especially when other well documented and non-proprietary models (i.e. DELFT-3D, etc.) have similar capabilities. At this stage of study, future plans for a complete modeling (from Mississippi River to open water/Gulf) should be looked into with the thought that perhaps the existing models are not capable of being utilized on the entire project domain. Models such as SAND2 which appear to be undocumented and not in wide usage should be further explored to assess validity through calibration and verification on existing diversion projects where possible.

Various detailed review comments have been provided that would be necessary to clarify the reviewed reports prior to a complete review of this project. The detailed review comments made in the present review address much of the project documentation needed within those reviewed reports without discussing added documentation needed and not provided for review. A future review should be done after addressing the present report comments and after compiling a listing of all reports and work which preceded the presently reviewed reports.

It is believed that insufficient justification has been provided for the selection of a nominal 35,000 cfs design discharge for Mid Breton, as it is noted that higher discharge rates would have higher SWRs. Furthermore, the March 10 2015, Water Institute's Draft Technical Memorandum with a subject of:

"Summarized Master Plan Model Output – TO30 (Mid-Breton Sediment Diversion)" Figure 8 (reproduced below as Figure 2) indicates moderate land building compared to the size of the Mid-Breton Sound Basin. Thus if the nominal 35,000 cfs discharge size was selected due to concerns that the receiving basin could not accept more sediment, then it is recommended that supplemental dredging be evaluated to promote sediment distribution in the receiving basin.

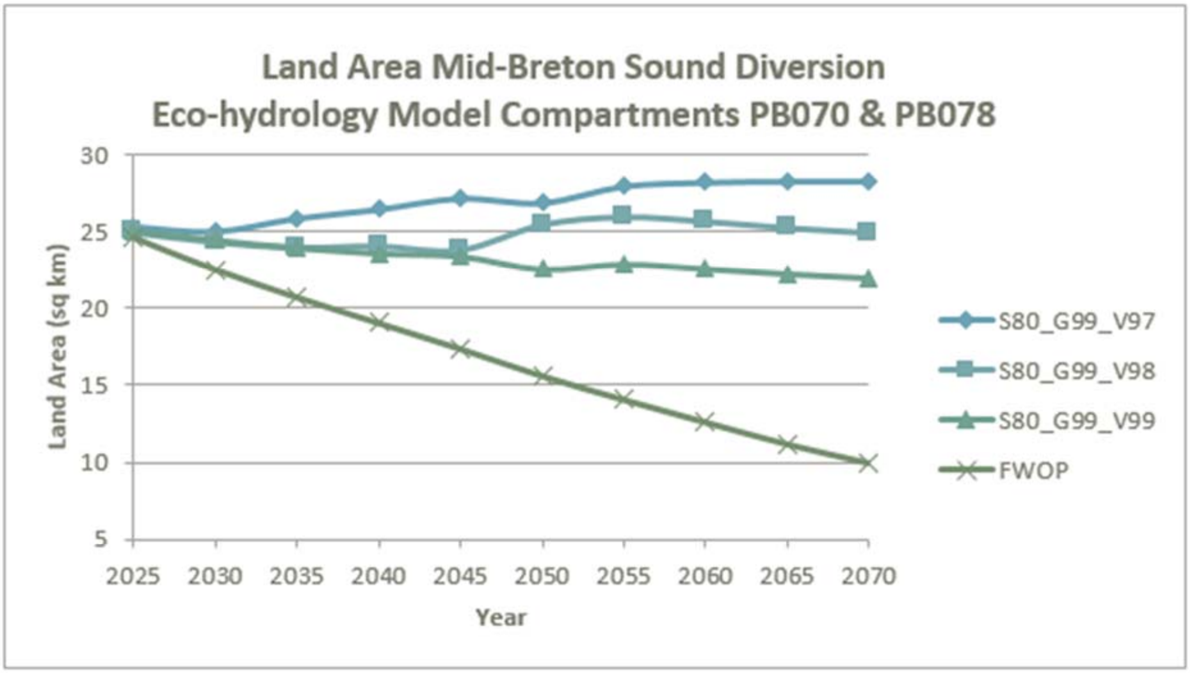

Figure 8. Land area change (sq. km.) (loss and gain by year 2070) in the immediate vicinity of the Mid-Breton diversion alternatives versus the FWOP condition; Eco-hydrology model compartments PB070 & PB078.

Figure 2: Reproduction of Figure 8, Mid-Breton Sound Diversion Land Building

Furthermore, it is noted that as Mid Breton has a greater hydraulic head differential than either of the two Lower Sediment Diversions, that it will be proportionately less susceptible to future head loss due to relative sea level rise, RSLR, than either of the two Lower Sediment Diversions.

In summary, prior to moving on to specific engineering design (above conceptual in nature), the model conducted for the preferred location for the Mid Breton diversion should entail:

(a) An expectation that most of the questions that will define the design have been asked, considered, and subsequently answered. If answers are not complete, then there are reasonable approximations and a clear path to finalize any ambiguity by the next stage. The modeling is not yet sufficiently completed or the analysis has not yet been performed to address the questions posed at this time.

(b) The expectation that the hydraulic performance of the project will be acceptable. Flow of water and sediment through the Mid-Breton results in appropriate land building without major impacts from water levels in the basin. There should be assurances that no sedimentation problems will occur with the assumed diversion flows. Although considerable modeling effort has gone into the basis of the design reports at this time, much of the modeling effort has not been documented and hence results of project performance are not clear from the reports as written or from the documents provided for review. Lack of an overall modeling effort for the entire project from Mississippi River through the diversion structure and through the receiving basin would be needed to clarify and reinforce internal boundary conditions chosen within the various component elements chosen.

(c) Both flood risk and conceptual flood risk reduction and resiliency design should at least have begun to be addressed. Although it appears from the reports that some storm surge modeling has been accomplished, documentation as to what has been done on the project to address project impacts on storm surge is still an unanswered question.

Modeling Recommendations

The series of pertinent Mid-Breton reports reviewed at the present time should be rewritten (and comments addressed) as one report with appendices for the intent to establish the project viability while clearly stating any and all assumptions necessary in the analysis. It would be beneficial to provide sensitivity analysis to help assess uncertainty in areas where assumptions have been made. An expedient suggestion to confirm viability of the approach would be to use a maximum Mississippi River flow and diversion design within the existing modeling framework and show that the concepts are valid through a step-by-step explanation of input and output as well as boundary calibrations for the entire system of models used covering the region from the Mississippi River to the Gulf of Mexico. This work could be reported on as a first step in checking various alternative diversion flows. Some of this effort is being conducted by the Water Institute in their comprehensive and on-going studies.

An ideal “Proof of Concept” for a diversion project from a hydraulic engineering standpoint requires the following three parts:

1. Conclusive modeling and engineering findings that the Mississippi River can provide the necessary flows and sediment to a planned diversion control structure;
2. Conclusive modeling and engineering findings that the planned diversion control structure can access and route the flows and sediment through the planned diversion control structure and that the control structure will not provide a danger to boating/navigation concerns in the Mississippi River.
3. Conclusive modeling and engineering findings that the sediment will deposit in the planned areas downdrift from the diversion control structure and that salinity changes within the downdrift system will not be altered beyond the bounds of a healthy ecosystem.

This requires both engineering calculations, judgment, and historical knowledge and data to define potential problems that may occur in design. This set of criteria does not acknowledge that there are substantial questions to be answered regarding environmental and social issues that will be need to be resolved.

Section 3 Engineering - Opinion of Probable Cost

An opinion of probable construction cost, OPCC, is provided in the USACE Feasibility Study (2010) of $387,620,000 for a 35,000 cfs diversion. The 2012 LCA Master Plan lists a project at White Ditch to divert 5,000 cfs for a cost of $123,000,000. Both projects are for a project at Location 3 White Ditch. We also received and reviewed an updated report titled “Louisiana Coastal Area (LCA) Medium Diversion at White Ditch which went into more detail including rough estimate costs for Location 1 as the preferred alternative (with hydraulic Optimization 5 as the preferred configuration). This location has significantly different geometry, and geotechnical conditions, than that of Location 3.

The Atkins/COWI team fully concurs with the selection of Location 1, due to its favorable river conditions. We also concur with the Optimization 5 preliminary configuration (due to its favorable sediment load delivery). However, we find that detailed review of costs are not necessary nor beneficial forthe USACE Feasibility Study (2010) OPCC of $387,620,000, the 2012 LCA cost provision of $123,000,000, or the 2013 LCA Medium Diversion at White Ditch report (OPCC of $324M later updated to $421M) due to differing conditions/characteristics between the two locations, including:

- Geotechnical conditions
- Inlet invert elevations
- Outlet conditions
- Conveyance lengths
- Types of control gates

Figure 3 shows the assumed baseline configuration for the Mid-Breton Sediment Diversion taken from the , "Hydrodynamic and Sediment Transport Modeling using FLOW-3D for Siting and Optimization of the LCA Medium Diversion at White Ditch" (Water Institute 2013) which appears to be an extrapolation of the 2010 USACE Feasibility Study configuration developed for the White Ditch location. This baseline configuration appears to be positioned at the Location 1 shown in Figure 3. Figures 4 thru 10 are graphics and tables from the Water Institute 2013. Figure 4 indicates that this baseline configuration is located at River Mile 68.6 (Location 1). Furthermore, it is assumed that the baseline configuration is an extrapolation of the Location 1 Optimization 5 with a gate as indicated in Figure 5.

Figures 6 and 7 show that the hydraulic model for Optimization 5 had a uniform bathymetric elevation for both the intake and discharge channels. Figures 8 and 9 show the calculated bottom, and average, water velocities for the Optimization 5 for two dredged intake channel bathymetry layouts. Finally, Figure 10 is a table indicating that the Optimization 5 configuration has reasonable (but not optimized) calculated sediment discharge parameters.

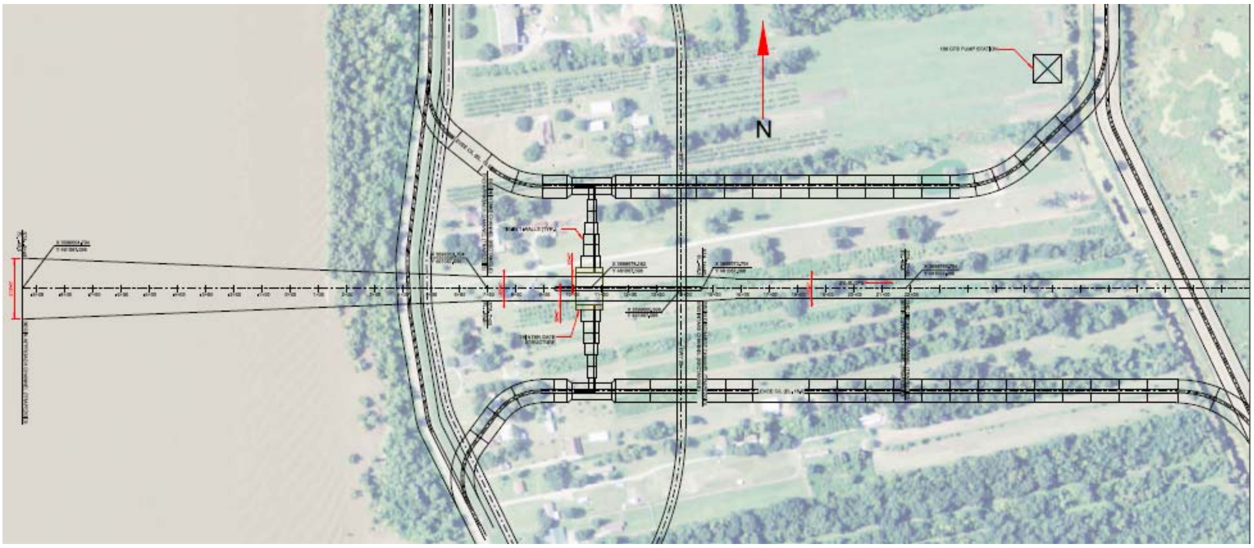

Figure 3. Assumed Baseline Mid-Breton Sediment Diversion Configuration taken from Water Institute 2013

Locations	Alternative	Model Applied	River Mile	Entrance of Approach Channel		Outfall Channel Boundary	
				Latitude	Longitude	Latitude	Longitude
1	G	Extended	68.6	29°45’40.59”N	90°01’08.53”W	29°45’25.73”N	90°00’03.98”W
2	F	Extended	63.7	29°41’57.00”N	89°58’22.15”W	29°41’57.98”N	89°57’46.74”W
2.5	F	Extended	62.0	29°41’03.49”N	89°57’48.31”W	29°41’02.00”N	89°57’09.51”W
3	A	Initial	60.0	29°39’1.91”N	89°57’11.20”W	29°39’59.00”N	89°55’43.85”W
3	B	Initial	60.0	29°39’1.91”N	89°57’11.20”W	29°39’59.00”N	89°55’43.85”W
3	C	Initial	59.8	29°38’59.23”N	89°57’09.98”W	29°39’12.82”N	89°56’22.75”W
3	D	Initial	59.8	29°38’59.23”N	89°57’09.98”W	29°39’12.82”N	89°56’22.75”W
3	F	Extended	60.0	29°39’1.91”N	89°57’11.20”W	29°39’59.00”N	89°55’43.85”W
4	E	Initial	57.5	29°38’14.20”N	89°55’31.08”W	29°38’12.00”N	89°54’46.56”W
4	F	Extended	57.5	29°38’14.20”N	89°55’31.08”W	29°38’12.00”N	89°54’46.56”W

Figure 4. Locations of Diversions Analyzed, taken from Water Institute 2013

Design Variations	Type of Intake Structure	Invert Elev. (ft. NAVD88)	Effective Width (feet)	Length (feet)	Approach Channel Bottom	Angle of Intersection with the River	Shape of Inflow/ Approach Channel	Shape of Outfall Channel (Trapezoid)
Base	open channel	-40	72	360	sloped to the -50 foot contour	90 degree	wide entrance	Base: 72' Side Slope: 1:3
Optimization 1	open channel	-30	89	360	flat	90 degree	wide entrance	Base: 380' Side Slope: 1:3
Optimization 2	open channel	-25	89	360	flat	90 degree	wide entrance	Base: 380' Side Slope: 1:3
Optimization 3	open channel	-40	72	360	flat	90 degree	wide entrance	Base: 380' Side Slope: 1:3
Optimization 4	open channel	-40	60	360	flat	45 degree (curve)	wide entrance	Base: 380' Side Slope: 1:3
Optimization 5	open channel	-40	72	360	flat	90 degree (rounded leading edge)	wide entrance	Base: 380' Side Slope: 1:3
	with gate	-40	72	360	flat	90 degree (rounded leading edge)	wide entrance	Base: 380' Side Slope: 1:3

Figure 5. Location 1 Diversion Structure Design Variations (Water Institute 2013)

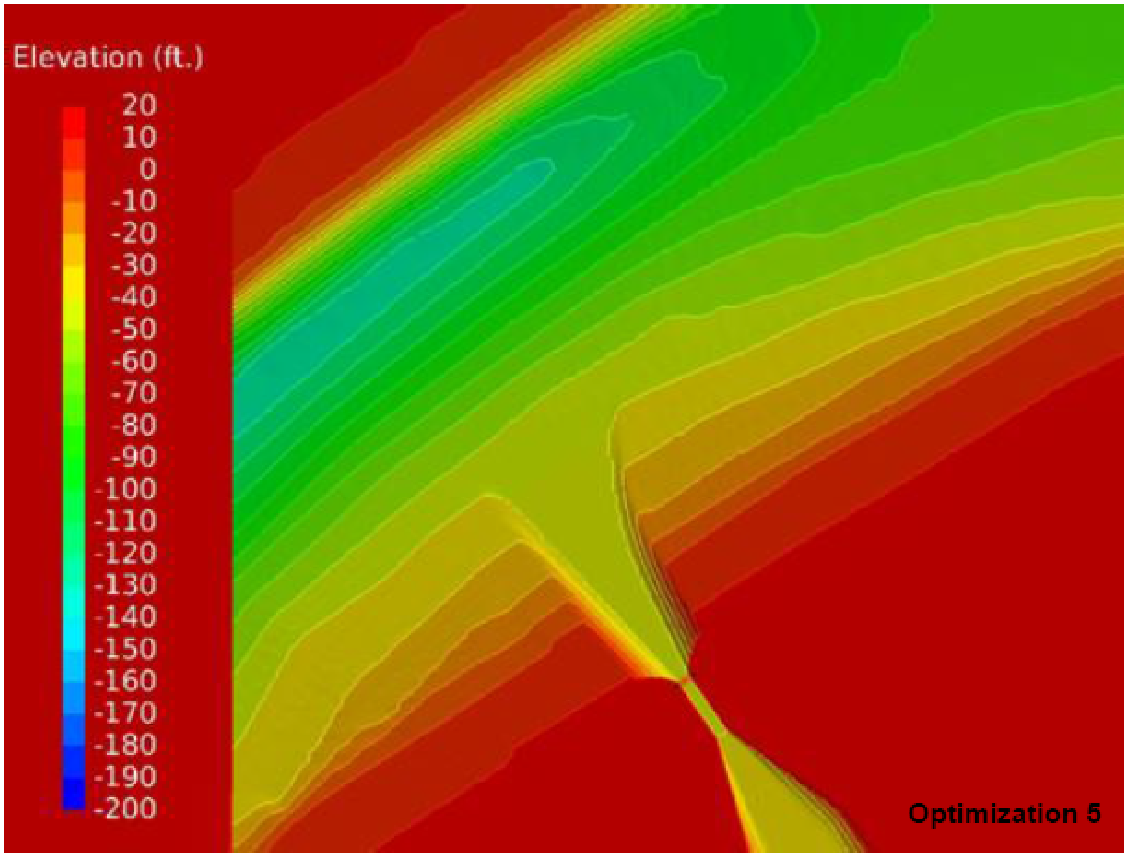

Figure 6. Model Development of Optimization 5 (Plan View with bathymetry) (Water Institute, 2013)

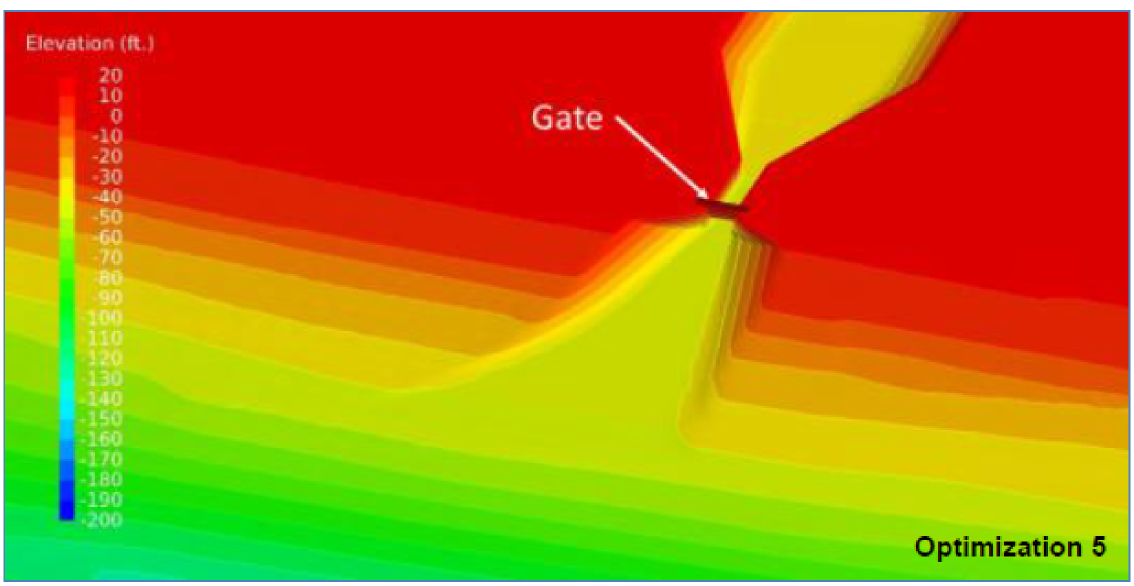

Figure 7. Model Development for Optimization 5 with a Gate Structure (Isometric View with bathymetry) (Water Institute, 2013)

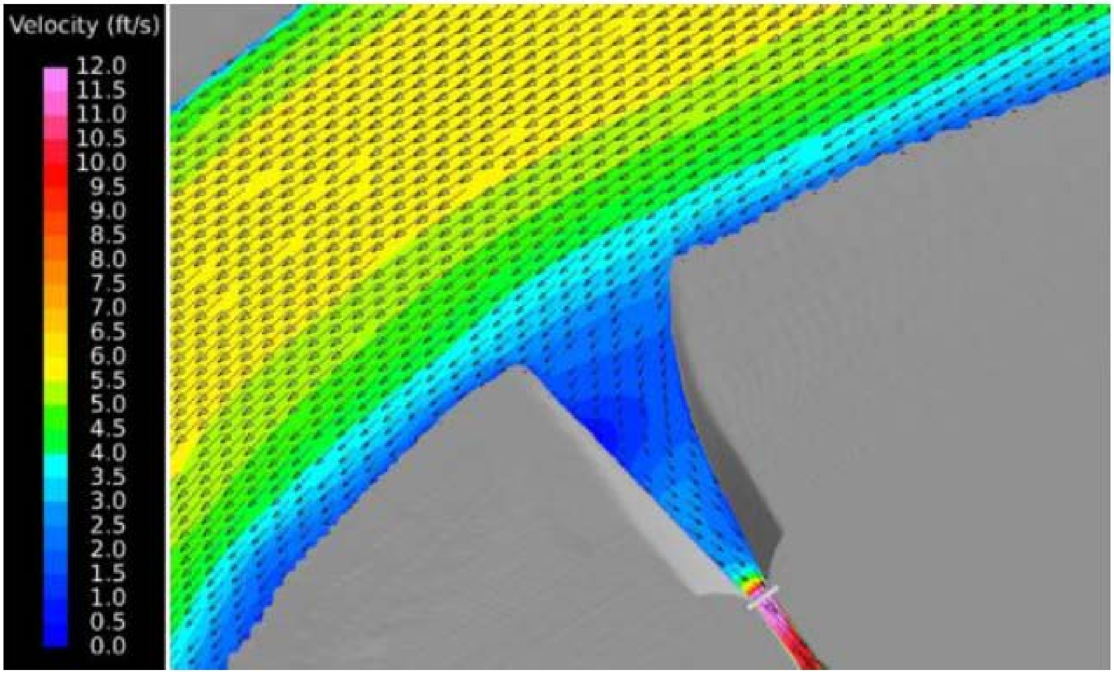

Figure 8. Water Velocity with Vectors at the Intake Channel Floor for Optimization 5, River Flow Equals 975,000 cfs. (Water Institute, 2013)

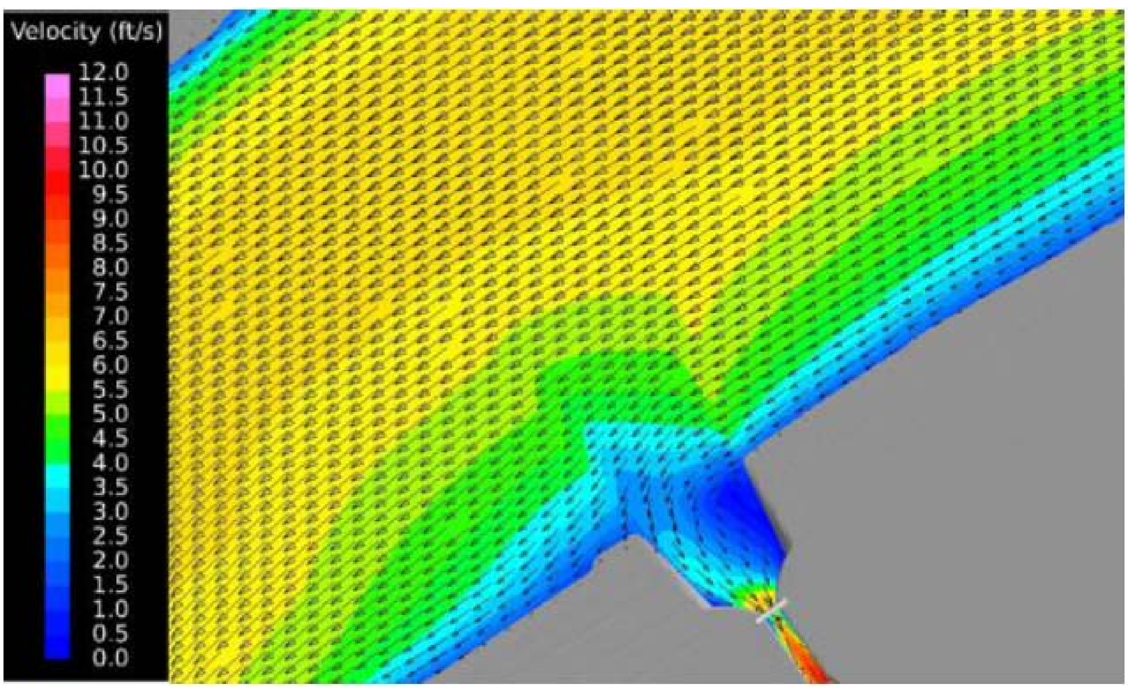

Figure 9. Water Velocity with Vectors at the Intake Channel Floor for Optimization 5, River Flow Equals 975,000 cfs. (Water Institute, 2013)

Description	Flow Rate		Sediment Load (metric ton/day)							Total
	(m3/s)	(cfs)	2 Microns	8 Microns	32 Microns	64 Microns	96 Microns	125 Microns	250 Microns	Load (metric ton/day)
Mississippi River	27,630	975,000	47,013	158,668	88,149	3,270	19,652	74,327	53,338	444,417
Optimization 5 - No Gate	1,706	60,203	2,903	9,797	4,082	220	1,565	8,949	11,395	38,912
Optimization 5 - With Gate (Lower End at El. 5 ft.)	1,692	59,707	2,879	9,716	3,617	208	1,528	8,876	11,497	38,322
Optimization 5 - With Gate (Lower End at El. -10 ft.)	1,082	38,181	1,841	6,213	1,726	90	693	4,366	6,266	21,195

Figure 10. Diversion Structure Optimization Calculated Sediment Capture (metric tons per day), River Flow Equals 975,000 cfs. (Water Institute, 2013)

Section 4 Value Engineering

As the display of engineering alternatives in the studies to date are nominally the transference of a general design to a different location no value engineering has occurred. The following sub-section presents variations of VE opportunities identified by the Atkins/COWI team for this site to better define a potential “conceptual design”. An OPCC for the Alternate Configuration B developed by this team is offered for consideration for further evaluation.

Variations of the VE Opportunities as Identified by the Atkins/COWI team:

All of the nominally 35,000 cfs VE opportunities identified by the Atkins/COWI team are located at River Mile 68.6 consistent with the Location 1 Optimization 5 siting as defined in the Water Institute 2013 study.

Figure 11 is from the "2007 Flood Control and Navigation Maps Mississippi River – Cairo, Illinois to the Gulf of Mexico Mile 953 to Mile 0 A.H.P", Map No. 87, and shows the general navigation logistics near River Mile 68.6. Figure 12 is from the 2004 Mississippi River Hydrographic Survey Sheet 56 and shows the river bathymetry near River Mil 68.6 used in the VE opportunities identified by the Atkins/COWI team.

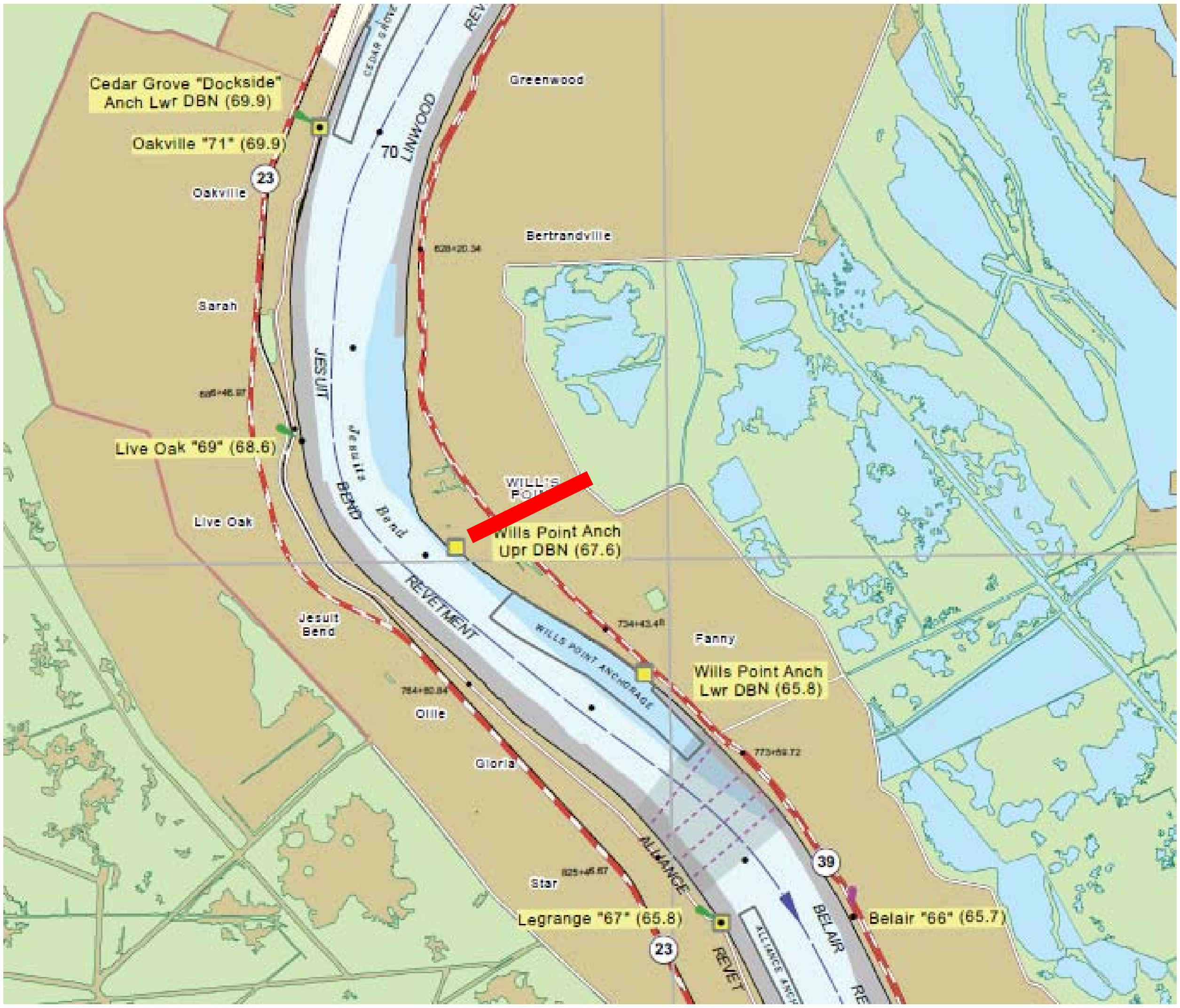

Figure 11. USACE Navigation Chart from Greenwood to Belair (the red line indicates the location of the proposed diversion)

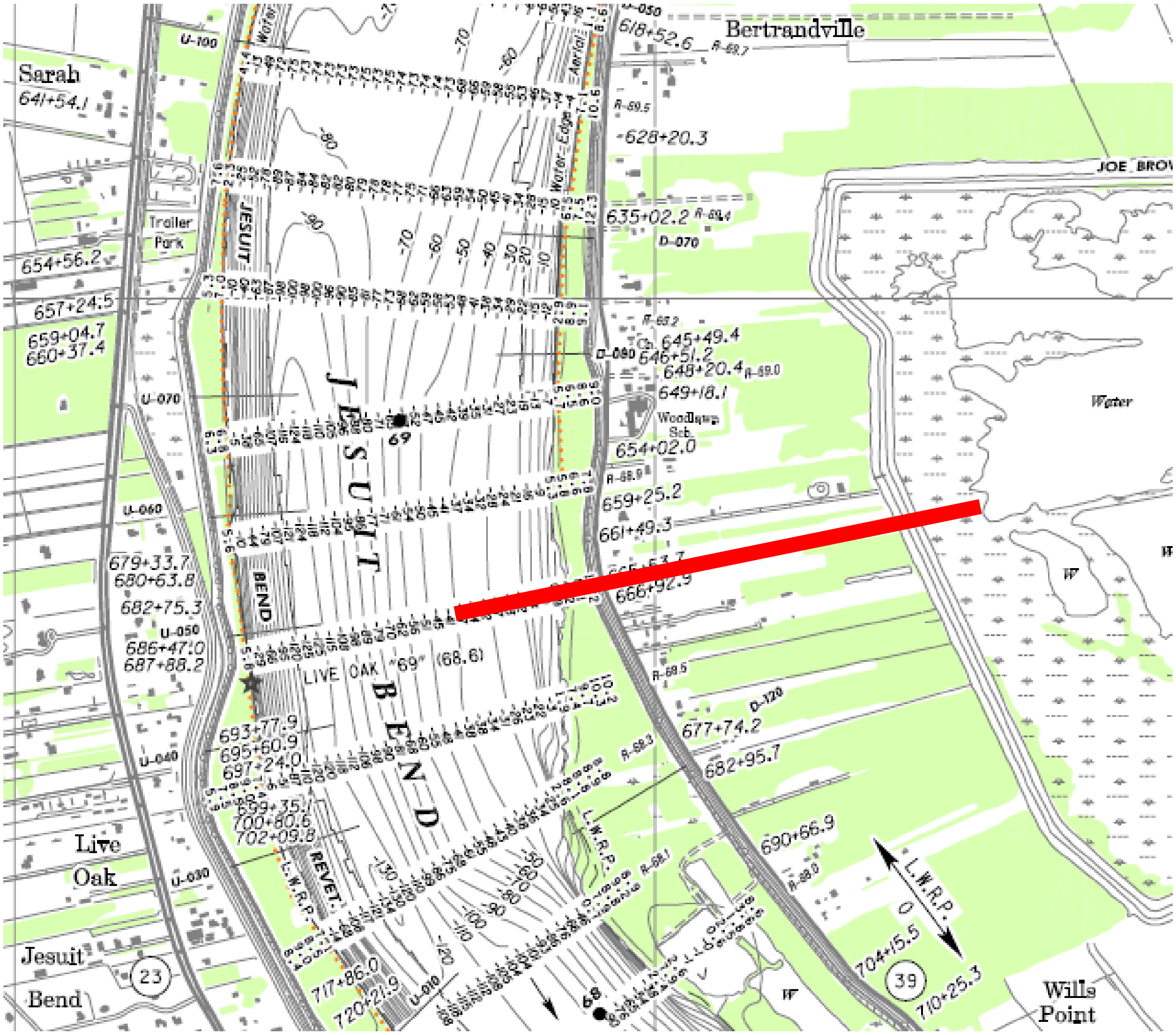

Figure 12. Hydrographic Survey Bertrandville to Wills Point (the red line indicates the location of the proposed diversion)

Risk Management and Sea Level Rise Guidelines

On January 30, 2015, President Obama issued an Executive Order entitled: "ESTABLISHING A FEDERAL FLOOD RISK MANAGEMENT STANDARD AND A PROCESS FOR FURTHER SOLICITING AND CONSIDERING STAKEHOLDER INPUT". The new standard gives agencies three options for establishing the flood elevation and hazard area they use in siting, design and construction of federal projects. They can use data and methods “informed by best-available, actionable climate science”; build two feet above the 100-year flood elevation for standard projects and three feet above for critical buildings such as hospitals and evacuation centers; or build to the 500-year flood elevation.

Therefore, the VE opportunities identified assume that the CPRA will satisfy this Executive Order using the 1m (with a range of 0.4m to 1.98m) of Gulf sea level rise criteria (see the red dot in Figure 13) by

2100 identified in Figures 13 and 14 from the 2014 CEER presentation "Incorporating Sea Level Rise in Louisiana's Coastal Master Plan" by James W. Pahl, Ph.D., Coastal Resources Scientist Senior CPRA Planning and Research Division.

Furthermore, the March 10, 2015, Water Institute's Draft Technical Memorandum with a subject of: " Summarized Master Plan Model Output – TO30 (Mid-Breton Sediment Diversion)", specifies the following relative sea level rise, RSLR, values for sediment and water transport analysis:

- "Eustatic Seal Level Rise (ESLR) – 1m by 2100 (2012 Master Plan 'less optimistic')
- Subsidence– 20% value of the documented 2012 Master Plan subsidence rates (2012 'moderate')"

While the 1m of ESLR by 2100 is appropriate for sediment transport and hydrologic analysis, the scope for a design of structures involved with flood protection may want to consider the adoption of an ESLR value with a higher confidence level closer to the 1.98m level by 2100. Furthermore, this Gulf SLR guidance may suggest the need for a provision of a back structure for the VE Alternates discussed in the next sub-section.

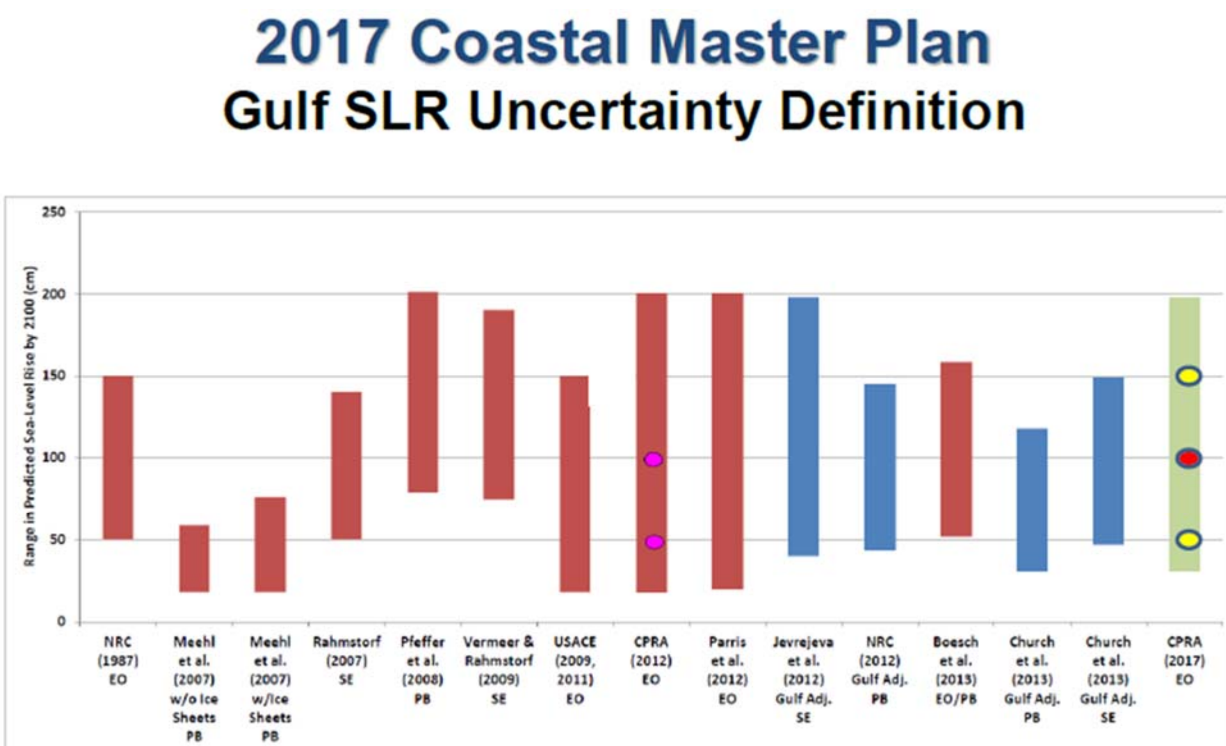

Figure 13. Proposed 2017 Coastal Master Plan Gulf SLR Guidance vs Other Guidelines.

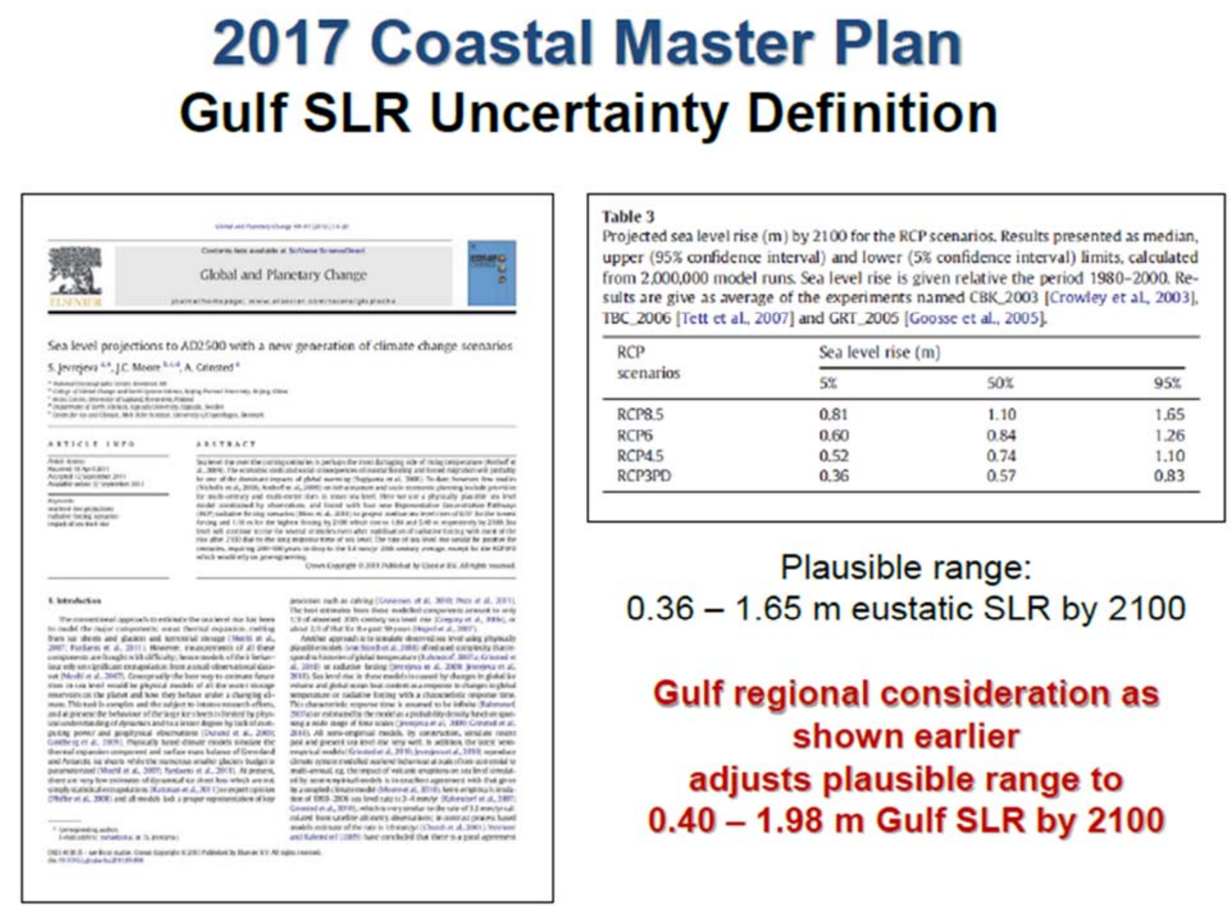

Figure 14. Proposed 2017 Coastal Master Plan Gulf SLR Uncertainty Guidance

In reviewing the assumed baseline configuration, we are able to develop variations on this concept that the CPRA could consider in order to further reduce CAPEX (Capital Expense) while likely maintaining the cited objectives of the Mid-Breton Sediment Diversion. Furthermore, our technical review indicates the potential for using two tainter gate control structures while achieving CAPEX cost savings using "in-the-wet" construction methodology following VE concepts designated Alternative A, B and C. A complete discuss is included in Appendix C.

Alternate A; entails:

(a) Building the Approach Channel, Control Structure and Back Structure, using "in-the-wet" methodology;
(b) Using concrete in drilled hole, CIDH, technology for the foundations of both the Control, and Back, Structure;
(c) Designing the Back Structure with maintenance bulkheads, or roller-bulkheads, controlled by hoists built into the bulkhead slots;
(d) Using inverted siphon drains;
(e) Temporarily relocating the highway and then permanently routing over the covered conveyance channel.

Alternate B is a variation of Alternate A (both conveying approximately 35,000 cfs), by the following measures (see also Appendix C):

(a) Replacing the immersed tube section (with at top level of El +13.5, and a ceiling elevation of +10.0 to allow for open channel flow) behind the MR&T levee with a cut and concrete covered box culverts design (using deep mixing method) cast-in-place concrete box culverts (also with a ceiling elevation of El +10, and an invert at El -40, resulting in open channel flow); and replace the tainter gate control structure with an operating bulkhead gate structure located on the Mississippi River side of the MR&T levee.
(b) Designing the Back Structure with maintenance bulkheads, or roller-bulkheads, controlled by hoists built into the bulkhead slots, and inverted siphons for drainage across the diversion.

Alternate C is a variation of Alternate B (both conveying approximately 35,000 cfs), by the following measures (see also Appendix C):

(a) Replacing the cut & cover box culvert intake section (with at top level of El +13.5, and a ceiling elevation of +10.0 to allow for open channel flow) behind the MR&T levee with a mined (using deep mixing method) cast-in-place concrete box culverts (with a ceiling elevation of El -15, and an invert at El -60, resulting in closed channel flow).
(b) Replacing the Back Structure Outlet Channel with a mined (using deep mixing method) cast-in-place concrete box culverts (with a ceiling elevation of El -15, and an invert at El -60, resulting in closed channel flow, at the low point) underneath a new drainage canal, and the back levee. This also eliminates the need for the inverted siphons for drainage.
(c) It is possible/probable that Alternate C will also improve the Sand to Water ratio for the diversion, thus improving the Benefit/Cost ratio for this option. Note that it is proposed to provide sand-pumps/educator jets in both the Approach and Outlet Channels/Box Culverts, in order to prevent blockage of these areas by sediment; and it is proposed that these educator jets could be piped to the drainage pump facilities. Also, note that if designed properly, the alignments of wall panels at the entrance to the Approach Channel in Alternate C could be adjustable in order to match future sand/sediment conveyance patterns.

Construction Cost Estimate, Focused on the VE Concepts:

Based on preliminary reviews Alternate B was determined to be the most cost effective VE concept considered, and Table 2 provides a break-down of the opinion of probable construction cost, OPCC, of $378,893,000 with a possible range of $315,871,000 to $466,468,000. It is noted that if it is determined that a back structure is not desired then the $11.7 million cost of the back structure should be deleted from the OPCC, but an undermined cost should be added to make the conveyance channel and associate levees resilient against over-topping.

Furthermore, the layout for Alternate B allows for relatively efficient future expansion (by adding two new parallel intake channels and associated roller gates, excavating a portion of the bench in the conveyance channel and adding more gates to the back structure and by dredging an extended outlet channel beyond the local embayment).

Alternate B Conceptual Design	Low %	High %	OPCC	Low	High
Construction Costs	-20%	24%	$269,419,090	$215,535,272	$334,079,672
Land Costs	-5%	30%	$4,310,705	$4,095,170	$5,603,917
NEPA, Third Party EIS, permitting	-5%	15%	$3,592,255	$3,412,642	$4,131,093
USACE 214	-10%	25%	$538,838	$484,954	$673,548
Owner Costs (2% on OPCC)	-10%	10%	$5,388,382	$4,849,544	$5,927,220
Engineering Costs (5.5% on OPCC)	-5%	15%	$14,818,050	$14,077,147	$17,040,757
Construction Management (5% on OPCC)	-5%	10%	$13,470,955	$12,797,407	$14,818,050
Unforeseen conditions (25% on OPCC)	-10%	25%	$67,354,773	$60,619,295	$84,193,466
Project Totals			**$378,893,047**	**$315,871,431**	**$466,467,722**

1. Back structure Cost is $11.7M.
2. Owner costs is applied in the event that CPRA will expend resources to accomplish this project and that funding should be accounted in the costs (Atkins/COWI).
3. Unforeseen conditions budget of 25% is applied to construction costs only.

Table 2 Table of Costs Prepared by Atkins/COWI for the preferred option (Alternative B)

Project Delivery

It has been estimated that the VE Alternate B could be constructed in approximately 2-years after notice to proceed, using the indicated "in-the-wet" construction methodology. Whether Design-Build, or Design-Bid-Build, contracting methodology is used, if innovative construction methods (such as the "in-the-wet" methodology) are adopted/allowed, it is important that such innovative construction methodologies be thoroughly evaluated in-light of the relatively poor geotechnical conditions and hydrological challenges, existent at this site.

The construction of multiple diversion structures in series or parallel could also allow for significant savings overall with the use of common pre-cast yards and launching facilities along the river. These considerations should be developed early in the design process so that land acquisition and public procurement processes can be efficiently used.

Section 5 Recommendations

The Atkins/COWI team found that the recommended location and size of the Mid Breton diversion were reasonable given the limitations of the receiving basin without supplemental dredging. Similarly, as we found in the Mid Barataria review we believe that defining or limiting the flow rate through the structure is premature and that higher rates may generate greater land building capabilities at lower unit costs. Additional information needs to be developed before the project should be modified. This includes much more rigorous modeling of the water surface elevation which continues to be advanced and in conjunction with geomorphologic studies that have not started. To the extent possible, planning level engineering design should be conducted to advance the limited work in Water Institute 2013 and the concepts outlined in Alternative "B" here to confirm the criteria identified for the Location 1 site. This should include:

(a) Development of geometric criteria for the diversion
(b) Definition of river bathymetry and bar configurations
(c) Geomorphological studies
(d) Utility studies
(e) Construction issues related to highway 39
(f) Better definition of project cost criteria based on various discharge scenarios

This concept design information and costs will be valuable as the project goals continue to be defined. Important goals that will drive engineering decisions are:

(a) Project cost limitations: for example; is $400M a rational total project budget (less mitigation) for this project? Can this budget meet the other project targets?
(b) A land building (marsh creation) target,
(c) A flood protection target,
(d) Acceptable water levels in the basin,
(e) Sea Level Rise criteria
(f) Environmental constraints (once the above targets are defined).

Life cycle costs for the proposed diversion should be developed considering:

(a) a 50 vs 100-year operational life;
(b) a 100-year durability life;
(c) full operational and maintenance costs; and
(d) future case considerations for relative sea level rise.

Furthermore, it is recommended that an initial operations plan be developed for the project and begin development of the required operational expenses (OPEX). Work needs to be conducted to begin understanding the criteria that will regulate the structure. This will allow operators to participate in developing key environmental criteria for monitoring in order to regulate the flow through the diversion. Maintaining acceptable environmental criteria while striving to optimize the Sediment to Water Ratio will increase acceptance and improve performance. Initiating the 30% design should only occur once the concept is proven and the engineering criteria for the design is defined we recommend that prior to

Recommendations Regarding Key Objectives

We recommend that additional study be conducted with regard to such matters as:

(a) Additional construction evaluations to test viability of concept, these may include deep soil mixing and modular structural components;
(b) additional numerical hydraulic models specifically focused on the structure;
(c) investigations of means to prevent sediment blockage from debris of either/both of the inlet and outlet channels; and
(d) use of a physical model if deemed necessary to verify numerical models.

Recommended Path Forward Regarding Diversion Configuration and Construction Methodology

See the Appendix C for drawings that outline a project base on the Atkins/COWI concepts. This effort along with the additional data collection to advance the drawing and cost criteria to a level consistent with those associated with the other diversions. Cost criteria developed for Mid-Breton is not sufficient. Innovative concepts have been considered but not vetted to a point to reinforce the need to use other construction methodologies.

Recommended Path Forward Regarding Hydraulic Modeling

There is a lack of consideration on the specific engineering parameters that will influence design considerations. Robust alternative feasibility analysis of conceptual Mid-Breton designs must be performed iteratively with the performance of sediment delivery and their associated impacts (i.e., water levels, etc.). The appropriate modeling platform(s) must be applied to the corresponding structure configuration(s) in order to optimize the best performance structure(s) as ranked by sediment delivery and cost. We recommend that tailwater elevations in Breton Sound and flows be determined using the planned hydraulic model developed by the Water Institute. This methodology will continuously model the water flow from the Mississippi River through the diversion and then through the Breton Sound Basin. Modeling platform(s) must not dictate the type of structure selected as the modeling is only intended as a tool in selecting the most efficient and cost effective structure to be considered for construction.

A suggested plan of action regarding reporting for all Diversion Structure hydraulic modeling is as follows:

Outline all models utilized for each of the 3 POC (proof of concept) areas defined (i.e. river, diversion structure, downdrift area). For each model utilized in the design process the following requirements should be assured/compiled for reporting purposes:

- The modeling tool must be proved to be viable by calibration and verification either within the existing project frame of reference of the lower Mississippi River and the LA wetland receiving basin system based on (1) modeling from river to diversion structure outlet using assumed tailwater at diversion structure exit; (2)modeling from receiving basin assumed tailwater just downdrift of diversion structure outlet; and (3) modeling of the complete system as planned based on model parameters used in (1) and (2) which should be the same.

Or

If verification within the Mississippi River and LA wetland system is not feasible due to a lack of data or project, then calibration and verification should be required within a similar independent river and wetland system and the same model parameters should be used for verification of the planned diversion project except for changes to specific data parameters such as grain size considerations of sediment load, soil cohesion in basin, etc. In this situation, further data collection and model runs should be outlined in advance (for the initially constructed diversion project) to provide future verification of all models utilized for the remaining diversion projects.

- Define each model's usage (i.e. water flow only, hydrodynamics-water/wave force considerations, sediment transport, salinity) and provide evidence of the following:
    - Require data input to the model at the updrift boundary and downdrift boundary be defined (If no boundary conditions are provided at the downdrift end of the model, this should be explained as to why BC's are not necessary at this boundary).
    - Assure each model provides similar results for output (within the bounds of engineering requirements that should be established). Should differences exist, explanation is necessary to determine why differences exist and whether one of the models should be chosen in preference to others utilized to do the same task
    - Assure continuity of transport constituent (water, salinity, sediment) is conserved between boundaries.
    - Assure momentum is conserved in the case of diversion structures (i.e. if there is flow on sidewalls or if hydraulic jumps exist within structures)

  - Assure sediment does not congest the diversion structure intakes, outfalls, or within the structure by deposition (except where engineering provisions have been taken to correct these measures, i.e. external agitation mixing, jet pumps, etc.).

  - Assure flocculation of finer sediment does not occur due to the inherent salinity changes within the system

- Define through modeling and engineering calculations what the effects of diversions will be on the Mississippi River delta at terminus in the Gulf of Mexico.

- Provide evidence both through historical data as well as possible modeling efforts that changes in the river course and potential breakthroughs (and consequent ox-bow lake formation) will not be a concern for the planned diversion

- Provide evidence both through historical data as well as possible modeling efforts that sand waves in Mississippi River will not block the intake structure and the availability of sediment inflow to the diversion structure.

- Provide evidence through model water flow studies and navigation simulation work that boating and shipping navigation safety will not be impacted significantly by construction of the diversion project.

Expanded step-by-step considerations for the development of a diversion project are provided below for further thought.

Step 1. Show that the Mississippi River can provide the necessary flows and sediment to a planned diversion control structure with minimal degradation to the river (i.e. shoaling below diversion) and minimal degradation to the present Mississippi River delta at terminus of river. It is also necessary to show that navigation safety will not be degraded by the diversions of flow from the river (i.e. changing current patterns during diversion will not provide added hazards to vessel traffic on the river). Another critical concern of design is that conditions for which the model is run will not change dramatically during the projected lifetime of the project (i.e. is the river geomorphic shape stationary and if not, what will the effects be during the lifetime of the project? Will future Mississippi River extreme floods change the system dynamics (say sand wave size, point bar location, etc. in the vicinity of the project?)

Many considerations must be addressed in this step above and beyond calibration and verification of river hydrodynamics (i.e. velocity and stage), some of which are noted as follows:

- Can the model utilized adequately reproduce changing bedforms/sand waves and therefore shape friction realistically?

- Can the model utilized model the dynamics of bottom accretion/erosion patterns in the river (i.e. potential shoaling downstream from diversion, etc.)?

- Can the model utilized provide both sediment concentrations and bed-load transport as well as proper mix of sediment sizes throughout the water column such that an open diversion structure will correctly model the captured sediment load?

Step 2. Show findings that the planned diversion control structure can access and route the flows and sediment through the planned diversion control structure and that the control structure will not provide a danger to boating/navigation concerns in the Mississippi River. Additional considerations as to the stability of the structure itself from a hydraulic standpoint must also be taken into consideration.

Many considerations must be addressed in this step above and beyond calibration and verification of the diversion flow hydrodynamic models, some of which are noted as follows:

- Will the system design of the diversions create large velocity changes/transitions that will cause undesired deposition within the system?

- Will design structure on river's edge and/or extending into river proper create a navigation hazard?

- Will intake design create a navigation hazard by velocity patterns in near-field hydrodynamics?

- Will the structure withstand hydrostatic/dynamic pressures exerted by the flows and sediment load as well as potential wind/ship waves on the river?

- Are seepage considerations taken into consideration for stability of the structure and to prevent undermining/settlement?

- Are scour considerations taken into account at entrance and exit of the structure?

- As a check on modeling, is continuity maintained for both water and sediment throughout the structure?

Step 3. Show findings that the planned diversion control structure can route the flows and sediment through the planned diversion control structure into the receiving basin. Demonstrate that the projected benefits from wetland marsh/acreage created will offset negative impacts from the freshwater diversion impacts to the natural basin salinities. Many considerations must be addressed in this step above and beyond calibration and verification of the diversion flow hydrodynamic models, some of which are noted as follows:

- Will the system design of the diversion allow proper distribution of sediment into the receiving basin without an immediate buildup of sediment directly downdrift of the diversion (It may be undesirable to consider the construction or anticipation of levees within the receiving basin similar to those created by flooding on the Mississippi River.)

- Are scour/deposition considerations taken into account at basin side of diversion structure exit?
- What additional flooding risk occurs in the receiving basin as a result of the diversion?
- What salinity changes will occur in the basin (i.e. pre versus post diversion operations)?
- What wetland acreage will accrue due to the project?
- Will hurricanes/tropical storms have major impacts on the receiving basin (over and above without project changes) that will negate project benefits?
- In all modeling situations it would be most useful as a check to run the models on an existing diversion system OR on the first diversion system to be built which has adequate accurate (no assumptions) data for both calibration and verification of a sufficient time period. The models should be run in a "blindfold" situation where the modelers do not have the verification data available to them.
- A comparison of the model predictions to the actual data should allow for a serious testing of the hydraulic modeling utilized and true ability to prognosticate future results of other diversions planned. At present numerous questions regarding the ability of the models, the data uncertainty in gages, and the numerous assumptions used in the modeling do not provide a meaningful "Proof of Concept" for the project although further documentation, data, modeling, and oversight may lead to successful
- "Proof of Concept" results.

Recommended Path Forward Regarding Permits

With regard to the 408 permit, previously, the USACE has expressed concerns about the risks of the formation of a deep-seated failure plane through the soil when working in the Mississippi River revetment and MR&T levee areas. The development of appropriate design details/calculations for Alternate B should demonstrate that this configuration / construction methodology, has reduced risk of the formation of a deep-seated failure plane in this area than does any of the alternates presented in this submittal. The project does not have a preferred alternative nor does it begin to address environmental issues that will dominate the conversation once CPRA has specifically finalized the goals and targets of the diversion. Though the NEPA process for the project has been initiated it is imperative for CPRA to begin discussing the potential impacts of the diversion to all of the stakeholders in the basin. Modelers and designers should both become more acquainted with these issues so that they can continually be addressed as work is being conducted. Beyond the specifics of this diversion, consideration of all of the four major diversions working independently and/or comprehensively will surely be contemplated by other agencies and the public.

Appendix A

Overview of hydrodynamic models used in these studies

Appendix A – Overview of hydrodynamic models used in these studies

CMS, CMS-Flow (URS & ERDC/Corps of Engineers). CMS-Flow is a 2D depth averaged hydrodynamic, sediment transport, and morphology rectangular grid structure model developed under contract and internal by ERDC/Corps of Engineers and accessible via the Surface water Modeling System (SMS) graphical user interface. CMS-Flow model features are as follows: robust flooding and drying; efficient grid storage in memory; time-varying wind and wave stress forcing; time-varying water level, tidal, and flow-rate forcing; variably-spaced bottom friction; and ability to independently turn on or off advective terms, mixing terms, salinity, sediment transport, morphology, and flooding/drying calculations. The primary purpose of the CMS,CMS-Flow model in the Mid-Breton studies reviewed is to provide hydrodynamic and salinity transport to assess alternative diversion design flow rates and locations via initial screening of alternatives, sea level rise simulations, and long term simulations of a 35,000cfs flow rate. Although the model(s) used are proprietary of the ERDC/Corps of Engineers, aspects of CMS-Flow are embedded within the commercially available package Surface water Modeling System (SMS) graphical user interface.

FLOW-3D (Arcadis & Water Institute): FLOW-3D provides the ability to do non-hydrostatic modeling via momentum considerations in the vertical. It can utilize an unstructured or structured grid and both finite difference and volume of fluid approaches to hydrodynamic modeling. Although recent versions of the model allow erosion/scour considerations for course grained sediments, the primary usage of the model for sediment transport appears to be via a Lagrangian particle tracking approach which is utilized within the work done for WRI by assessing particle tracking of various grain sized sediment through the diversion structure to assess SWR's (sediment water ratios) as a measure of efficiency in the project concepts to divert the available river sediment to the receiving basin. Model information is not clear as to its capability of dealing with flocculation, or cohesion considerations as may be seen in the clay sized portion of sediments encountered in the diversion process. In the Mid-Breton study, FLOW-3D addresses hydrodynamics and sediment transport in the river with the purpose of assessing the most promising location for the diversion and best alignment for the diversion to maximize sediment concentrations and sediment capture capabilities.

Particular concerns in the FLOW-3D model usage and reporting are statements made to the effect that model calibrations and validations for both the initial domain and extended domain are good although considerable differences exist between the measured data and the model results, especially in the lower portions of the vertical for sediment concentrations. As most sediment will be found in the lower portions of the vertical, a calibration and validation on concentration alone would not seem to be a very reasonable gauge of the adequacy of the model in carrying sediment load. Discussion of changes and modifications to the FLOW-3D code are unexplained and undocumented although this work is utilized within the calibration and verification work listed. Sediment calibration write-up needs clarification and metrics to determine what a successful calibration and/or verification should consist of. One such metric should be total load carried at a given location for assessing the model capability of providing a true picture of sediment transport by the model. Model discussion is not clear with regard to particle interaction with the bed and report discussion notes that "This ad hoc way to handle erosion and deposition is not strictly correct" which suggests that comparisons provided may be fortuitous. Although the model is noted to be validated, this is not clear to the reviewers from figures provided.

HEC-RAS (HEC/Corps of Engineers): HEC-RAS is a widely used 1D river model developed by HEC/Corps of Engineers and is well documented and widely available to the public. In the Mid-Breton studies no references are provided as to the versions used and/or work accomplished other than in setting a downstream river boundary condition.

HY-8: HY-8 is a culvert hydraulic analysis tool developed by the Federal Highway Administration (FHWA). The software is intended to aid in the design of culverts and is primarily based upon the FHWA white papers HDS-05 (Hydraulic Design of Highway Culverts, Third Edition) and HEC-14 (Hydraulic Design of Energy Dissipators for Culverts and Channels), which are both available on the FHWA website as published documents. HY-8 is used for culvert calculation input into FLOW-3D.

SAND2 (ERDC/Corps of Engineers): SAND2 appears to be an undocumented, non-peer reviewed spreadsheet model that has been developed by ERDC/Corps of Engineers based on minor modifications to earlier research and spreadsheet models used in the Coastal Louisiana Ecosystem Assessment and Restoration (CLEAR) Program. The acronym SAND appears to stand for "Sediment and Nutrient Diversion" and the main purpose of the model appears to be to assess/forecast (in a preliminary project assessment) the ability of the project diversion flows and sediment load to build land acreage within the receiving basin of the diversion project. No references or model documentation have been provided to the reviewers, but only a five page brief overview of suggested model verification. Lack of sufficient modeling documentation provided does not allow for assessment of the model within the Mid-Breton project even though the five page brief suggests that a validation of the project has been accomplished. At present the spreadsheet model appears proprietary, undocumented, and not peer-reviewed, hence results from usage of the model should be recognized as preliminary non-validated research.

AdH (ERDC/Corps of Engineers): AdH is a finite element model capable of simulating 3-D Navier-Stokes equation, 2 and 3D shallow water equations, and groundwater equations. The AdH model can simulate the transport of conservative constituents (i.e. water, salt, and sediment [with the SEDLIB library) and has the ability to allow the modeled domain marsh area to wet and dry as the tide changes.

SEDLIB (ERDC/Corps of Engineers): SEDLIB is not a model but rather a sediment transport library developed by ERDC/Corps of Engineers and is proprietary software to ERDC. It provides an ability of providing calculations for sediment transport consisting of multiple grain sizes, cohesive and cohesionless sediment types, and multiple layers. It calculates erosion and deposition processes simultaneously, and simulates such bed processes as armoring, consolidation, and discrete depositional strata evolution. The SEDLIB library system is designed to link to any appropriate hydrodynamic code as long as the hydrodynamic code is capable of performing advection diffusion calculations for a constituent. It appears to date that the only linking of the code to a model has been for the AdH model. The SEDLIB library has been utilized within the Mid Breton study via linking with the AdH model although insufficient details are presented within the reporting to adequately assess the ability of the library. At present time it appears that this is primarily a research tool as limited documentation and no references to peer review and/or external review appear to exist.

Appendix B

Comment Review Tables

Appendix B – Comment Review Tables

Comment Table – General & Structural

Comment Table – LCA Engineering Appendix

Comment Table – ERDC Report

Comment Table – Modeling Report

ATKINS COWI

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: General & Structural Comments

Documents Under Review: MDWD Structure Drawings

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
New Comments on DOCUMENT TITLE														
1	mkos@cowi.com	S-101	3/11/2015	Ten Barrel Configuation Site Plan X Note that this plan is not included in the Arcadis/Water Institite of the Gulf report dated December 2013.										
2	mkos@cowi.com	S-101	3/11/2015	Ten Barrel Configuation Site Plan X The geometry shown does not match the Location 1 Optimazation 5 Arrangement in the Arcadis/Water Institute of the Gulf report dated December 2013; so it will need to be revised to provide for continued design development.										
3	mkos@cowi.com	S-101	3/11/2015	Ten Barrel Configuation Site Plan X The geometry shown indicates a 150 foot wide total width opening subdivided into ten 15 foot wide indiviually operated gates.										
4	mkos@cowi.com	S-101	3/11/2015	Ten Barrel Configuation Site Plan X The geometry shown indicates a 172.5 foot wide invert for the discharge channel with side slopes laid back at 1V to 3H.										
5	mkos@cowi.com	S-101	3/11/2015	Ten Barrel Configuation Site Plan X The geometry shown indicates an entry invert elevation of -16.0 ft held constant through the gate structure, then sloping down to the discharge invert elevation of -20.0 ft. Thus the invert geometry shown will need to be revised to provide for continued design development.										
6	mkos@cowi.com	S-101	3/11/2015	Drawing S-101 - Ten Barrel Configuation Site Plan X The drawing indicates an arrangement with a box culvert through the MR Levee and under the roadway.										

Comment Response Table

Coastal Protection and Restoration Authority
Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: General & Structural Comments

Documents Under Review: MDWD Structure Drawings
-
-
-
-
-

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
7	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - Note that this plan is not included in the Arcadis/Water Institite of the Gulf report dated December 2013.										
8	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - The drawing indicates an arrangement with a box culvert through the MR Levee and under the roadway with a soffit elevation of -1.0 ft. Top of MR Levee is indicated at elevation +15.0' and top of roadway is indicated at elevation +7.0'.										
9	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - The drawing indicates 15' x 15' sluice gates in 15' x 15' square openings.										
10	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - The drawing indicates 18 inch riprap on entry channel invert.										
11	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - The drawing indicates 12 inch riprap on entry channel side slopes.										
12	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - The drawing indicates 30 inch riprap on discharge channel invert transitioning to 18 inch then to 12 inch.										
13	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - The top of the discharge channel sides is indicated to match existing grade.										
14	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - No riprap is indicated on the sides of the discharge channel sloped at 1V to 3H.										
15	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - Foundation bearing piles are intended for vertical support under concrete structure as drawing indicates they are not shown for clarity.										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: General & Structural Comments

Documents Under Review: MDWD Structure Drawings

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
16	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - Three sheet pile cut off walls are shown. 1) under the upstream face of the invert slab and 2) under the sluice gate monolith and 3) under the Downstream Bulkhead Monolith.										
17	mkos@cowi.com	S-201	3/11/2015	Location 2 Sectional Elevation - The sluice gates are shown located on the riverside toe of the MR Levee.										
18	delm@COWI.com	General	3/12/2015	It is recommended that the diversion consider the addition of a back structure in the event that the back levee is ever raised										
19	delm@COWI.com	General	3/12/2015	It is recommended that the diversion consider replacing the two tainter gate control structure with a two roller gate control structure on the river side of the MR&T levee, with the MR&T levee stabilized with deep cement mixing ground improvement.										
20	delm@COWI.com	General	3/12/2015	In order to improve the efficiency of sand capture, it is recommended that the diversion consider using vertical side walls for the intake channel.										
21	delm@COWI.com	General	3/12/2015	The hydraulic sediment transport modeling performed by the Water Institute of the Gulf assumed a sea level rise, SLR, value of 1m by 2100 (per the "less optimistic" case from the 2012 Master Plan). While this SLR value may be appropriate for sediment transport calculations, a value with a great confidence level needs to be adopted for structures (such as the control structure) involved with flood protection, as the range of SLR likely to be adopted for the 2017 Master Plan may range upto approximately 1.98m by 2100 with an appropriate confidence level for flood protection design.										
22	delm@COWI.com	General	3/12/2015	It is recommended that the operations plan include provisions for the deployment and monitoring of apparatus appropriate for near real-time measurement of key hydraulic parameters, so that the operations can limit these parameters to within acceptable limits, including: (a) the water level near populated areas of the Breton Basin; (b) near surface current velocities near the Mississippi River intake that could affect navigation; and (c) water velocities within the conveyance channel that could affect scour and/or sedimentation.										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: General & Structural Comments

Documents Under Review: MDWD Structure Drawings

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
23	delm@COWI.com	General	3/12/2015	The design characteristics of the MR&T for 1% and 2% hurricane risk reduction are not given and should include toe elevation (ft), slope, berm elevation (ft) if provided and overtopping rate for both q50 and q90 in cubic feet per second per foot.										
24	delm@COWI.com	General	3/11/2015	For conceptual design, resiliency analysis, from appropriate modeling efforts, needed to be performed for MR&T and any proposed structures (i.e., tie-ins with floodwalls). Only the 1% designs for the MR&T should be computed for the overtopping rate for the 0.2% event for each design which should include height (ft), surge level (ft) and overtopping rate (cfs/ft). The water level and overtopping rate should be determined for the 50% assurance during the 0.2% event.										
25	delm@COWI.com	General	3/11/2015	For all sections, the 0.2% surge elevation should remain below the top of the 1% flood defense elevations and the overtopping rates relatively low (< 1.0 cfs/ft). This information will be used to determine armoring the backside of the MR&T near the proposed tie-ins to prevent catastrophic failure during this event.										
26	delm@COWI.com	General	3/12/2015	A chart depicting the design elevations per river mile or stationing for the MR&T should be for the elevations at the 50yr existing (new), 100yr existing (new), 50yr future (new), 100yr future (new), 500yr still water level (SWL) future, 500yr SWL existing and the 100yr surge.										
27	delm@COWI.com	General	3/12/2015	The tailwater elevation assumptions should be clarified.										
28	mkos@cowi.com	S-101 & S-201	3/12/2015	Drawing S-101 - Ten Barrel Configuation Site Plan X and Drawing S-201 - Location 2 Sectional Elevation - With the understanding that these drawings were prepared for a different location than currently being considered it is of interest to note the USACE approach. The invert elevation was established at elevation -16' to be similar to previous USACE diversion structures. (The current invert elevations are recommended at -40' to take advantage of available sand sediments.) The USACE approach appears to be one to minimize costs by minimizing invert depth and widening the gate as needed to develop design flows.										

ATKINS COWI

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: LCA Engineering Appendix

Documents Under

Apndx-L-White Ditch LCA-Engineering Apprendix_096210

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
New Comments on DOCUMENT TITLE														
Main document														
1	todd.walton@atkinsglobal.com	General Comments	2/2/2015	Models utilized in main report and Annexes need version used described along with all parameters used (and/or set) to be listed (preferrably in a Table) with units provided.										
2	todd.walton@atkinsglobal.com	General Comments	1/28/2015	An overview of historical changes in MS river and sand waves is necessary to assess the importance of such future changes to impact the existing study of the diversion structure performed herein. Information is also necessary as to the effects on MS river terminus delta effects (i.e. erosion) if sediment is diverted through structure rather than continuing downstream. Considerable more information on model parameters used, calibration and verification is needed to assure the models perform as per assessment herein. If model calibration and/or verification are not capable of being performed due to fact that diversion is not built yet, this should be clearly noted and references provided of studies where the models have been used on similar projects and diversion structures.										
3	todd.walton@atkinsglobal.com	General Comments	2/4/2015	Potential flooding downstream of diversion is not addressed or mentioned. Should there be a section on this possibility?										
4	todd.walton@atkinsglobal.com	General Comments	2/4/2015	Where elevations are mentioned, datums should be provided.										
5	todd.walton@atkinsglobal.com	General Comments	2/4/2015	No mention is made of navigation safety concerns or of studies performed to assess effects of diversion on navigation safety in the MS river. Should this be addressed within this report?										
6	todd.walton@atkinsglobal.com	pg L-3 thru L-44	2/4/2015	see all notes on Annex 4 which is a detailed commentary of much of this material since Annex 4 was used to draft this document.										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: LCA Engineering Appendix

Documents Under Apndx-L-White Ditch LCA-Engineering Apprendix_096210

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
7	todd.walton@atkinsglobal.com	pg L-7, para 5	2/5/2015	text notes calibration needs to be redone when accurate survey data is complete. It should also note that daturm uncertainty in Bay Gardene gage also needs to be resolved. Concur that calibration (and verification) both need to be done at this point in time. As this may require considerably more field data be collected, it is vital to "proof of concept" that sufficient data be collected to both calibrate and verify the model.										
8	todd.walton@atkinsglobal.com	pg L-9, para 3	2/5/2015	Caernarvon structure needs to be shown (with RM) on a Figure along with model domain.										
9	todd.walton@atkinsglobal.com	pg L-10, para 2	2/6/2015	"Based on discussions with local land managers" needs to be documented with reference of such conversations. Paragraph in general needs supporting figure to show the various areas being discussed. The statement " it is believed that only 5 to 10 percent...." needs to be supported with references and/or supporting documents to support assumption.										
10	todd.walton@atkinsglobal.com	pg L-14, para 2	2/7/2015	Figure L.2.8 needs to show White Ditch, Oak River, Caernarvon, RM's , along with N. arrow										
11	todd.walton@atkinsglobal.com	pg L-14, para 4	2/8/2015	It would be good to discuss theoretical rationale for the 10 to 30 meter citation for resolution. Note area would be meters squared (i.e. clarifcation needed here).										
12	todd.walton@atkinsglobal.com	pg L-21, para 3	2/9/2015	"resolution determined to be optimal....." needs clarification as to why optimal										
13	todd.walton@atkinsglobal.com	pg L-26, para 4	2/10/2015	" A model..." needs definition as to "what model and version of model?????" . As models often change versions, documentation of models should be noted for record should future discrepancies exist in model results for same input.										
14	todd.walton@atkinsglobal.com	pg L-27, para 7	2/11/2015	"The best reduction level....via salinity calibration" needs to be clarified.										
15	todd.walton@atkinsglobal.com	pg L-27, para 8	2/12/2015	"portion flowing to west.... 20 to 30% ..." Need further clarification on this as well as documentation by "local land managers" beliefs and "Hurricane Katrina" changes in flow patterns.										
16	todd.walton@atkinsglobal.com	pg L-28, para 2	2/13/2015	m2/s typo needs correction										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: LCA Engineering Appendix

Documents Under Apndx-L-White Ditch LCA-Engineering Apprendix_096210

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
17	todd.walton@atkinsglobal.com	pg L-31, para 1	2/14/2015	Figure L.2.19 needs "Alternative number noted (instead of an X); Additionally the 70,000 and 100,000 diversions should be noted to be invalid as per last para on page L-34 where overtopping of the River Aux Chene ridge will occur.										
18	todd.walton@atkinsglobal.com	pg L-45, para 1	2/15/2015	Sea level rise does not cause loss of marsh directly, only an apparent loss). Is the loss due to higher wave activity that comes with sea level rise?? Also, subsidence has the same effect as sea level rise. Perhaps separate actual volumetric loss (i.e. due to compaction) and slr/subsidence "apparent" loss, and higher wave activity (due to subsidence loss , i.e. area loss). Define reasons for subsidence (i.e. not compaction, hence from fluid (water,gas, oil, etc) extraction???)										
19	todd.walton@atkinsglobal.com	pg L-45, para 3	2/16/2015	"Medium Diversion…" needs quantification, i.e. what flow rate is discussed??										
20	todd.walton@atkinsglobal.com	pg L-46, para 1	2/17/2015	"Calculations within the model distribute the sediment over open water" needs reference as to how the distribution is made and why is the sediment not distributed over non-open water (i.e. marsh).										
21	todd.walton@atkinsglobal.com	pg L-46, para 2	2/18/2015	Provide references that show such benefits from "higher nutrient rates" and "increased plant productivity".										
22	todd.walton@atkinsglobal.com	General Comment	2/19/2015	It appears this effort is an "initial modeling" effort as stated on pg L-34. As such it should be noted that these efforts are not final products early in the text. It is clear from statements throughout the text and in Annex 4 that much more modeling needs to take place prior to this being a "proof of concept" document.										
Annex 1- technical paper "Quantifying Benefits of Freshwater Flow Diversions to Coastal Marshes"														
23	todd.walton@atkinsglobal.com	pg 4, para 3	2/5/2015	BM model discussed notes a "simple, screening-level model". This would not be sufficient for "proof of concept"										
24	todd.walton@atkinsglobal.com	pg 5, para 1	2/4/2015	reference is made to a more detailed model "LACPR program". Be careful of the word "program" especially when describing numerical modeling programs. I believe the overall LACPR project would be more appropriate.										

Comment Response Table

Coastal Protection and Restoration Authority
Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: LCA Engineering Appendix

Documents Under

Apndx-L-White Ditch LCA-Engineering Apprendix_096210

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
25	todd.walton@atkinsglobal.com	pg 7, para 3	2/4/2015	a1, a2 are noted as dimensionless coefficients but this is only true if a2=1 which it is not. This begs the question as to validity of Table 1 which needs to be referenced and the data and work provided for review. As the basis for diversion sediment concentration appears to rely on this, such verification is necessary in proof of concept. Sediment concentration also needs to be defined as "depth averaged" sediment concentration or what??????										
26	todd.walton@atkinsglobal.com	pg 9, para 3	2/4/2015	Development of eqs 14 through 21 is not clear as eq 14 suggests left hand side of eq is 0 according to eq 13 (at least for steady state). Is the process being modeled as an unsteady "dynamic" time changing process? Derivation is not clear as time subscripts are not provided suggesting steady state. Additionally,after Eq.20, assumptions are made on height of bed, z0, and Kz for which no basis is noted (i.e. appear to be assumptions except for Kz).										
27	todd.walton@atkinsglobal.com	pg 9, last para	2/4/2015	"verify the ability..." should not be construed as a verification of the model. Appears that parts of the model need independent calibration and verification to assure the ability of this simplified model to do what it purports to do for "proof of concept".										
28	todd.walton@atkinsglobal.com	pg 13, para 4	2/4/2015	"model verification at Caernarvon.." as noted previously should not be considered a verification for the reasons discussed above.										
29	todd.walton@atkinsglobal.com	pg 15, para 3	2/4/2015	It is not clear where weir coefficient is from (i.e. White(2003)???). If so, cite page number.										
30	todd.walton@atkinsglobal.com	pg 16, para 1	2/4/2015	Should data be collected here to provide a better assumption to a total sediment rating at Belle Chase??, especially in light of the next para which notes benefits of flow diversion are "extremely sensitive to size fraction and concentration..."										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: LCA Engineering Appendix

Documents Under

Apndx-L-White Ditch LCA-Engineering Apprendix_096210

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
31	todd.walton@atkinsglobal.com	pg 17, para 1	2/4/2015	notes "some of major assumptions" are listed. All major and minor assumptions should be clearly listed to point out the potential problems in utilizing the model for "proof of concept" work. Note next para says " these assumptions significantly limit the model's ability to quantify benefits".										
Annex 2- ERDC-SAND2 Model Verification														
32	todd.walton@atkinsglobal.com	General Comments-Annex 2		Document is ~5 pages of mostly figures and very limited descriptive text and is insufficient to evaluate model results. Verification is claimed although calibration is not discussed. Entire report needs to be expanded to include all aspects of field data used, model calibration and verification as two separate steps.										
33	todd.walton@atkinsglobal.com	pg L-314	2/4/2015	Starting paragraph needs 1) Purpose of model; 2) Developer of model (ERDC or contractor for ERDC?); 3) Type of model; and 4) References to model and documentation										
34	todd.walton@atkinsglobal.com	pg L-314, para 1	2/4/2015	Fig A needs River Miles on MS river shown as well as RM's on diversion locations.										
35	todd.walton@atkinsglobal.com	pg L-314, para 2	2/4/2015	"model used to predict post-operation wetland acreages…." Explain how was this done (a short description of approach at least)										
36	todd.walton@atkinsglobal.com	pg L-314, para 2	2/4/2015	"..SAND2 model did a reasonably good job forecasting…" needs references to back up statement as next sentence seems to contradict the "good job forecasting" stated.										
37	todd.walton@atkinsglobal.com	pg L-315	2/4/2015	Figure B needs better Legend description, i.e. What is FWOP? , FWP?; Also name the "2 siphons" (i.e. Naomi, West Pointe)										
38	todd.walton@atkinsglobal.com	pg L-316	2/4/2015	Figure C -> see above note on Legend; Also, what is the metric used to determine good or bad job of forecasting?? Except for first point on graph, a linear regression of the observed appears considerably higher than the red predicted line.										
39	todd.walton@atkinsglobal.com	pg L-316, para 1	2/4/2015	"Ideally, a hydrologic model…." Please clarify this sentence with more description of what type of model you are referring to.										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: LCA Engineering Appendix

Documents Under Apndx-L-White Ditch LCA-Engineering Apprendix_096210

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
40	todd.walton@atkinsglobal.com	pg L-316, para 1	2/4/2015	"ARTM diversion" ?? Spell out acronym.										
41	todd.walton@atkinsglobal.com	pg L-317	2/4/2015	Figure D-> see above discussion on Fig C										
42	todd.walton@atkinsglobal.com	pg L-317, para 2	2/4/2015	Provide supporting discussion and references for statement that the SAND2 model " is most applicable in interior marsh systems"										
Annex 3 - n/a- No Comments														
Annex 4 URS (June 4,2010) Hydro&Salinity Transport Modeling)														
43	todd.walton@atkinsglobal.com	General Comments	1/28/2015	Document needs a discussion of historical changes (i.e. meandering and sand waves) in MS river to assure that assumptions used in this report will not future impact the results provided within this report. Additional discussion of how sediment removed via this planned diversion will impact the terminus deltas of the MS river is needed (i.e. downriver delta erosion?). Calibration and verification should be provided for all models used along with all calibration parameters provided (with units) if feasible; Where future structure is being discussed and calibration/verification can not be provided, this should be clearly noted and added references and documentation provided for cases where the models have been utilized to address similar scenarios.										
44	todd.walton@atkinsglobal.com	General Comments	2/2/2015	Version of model utilized needs to be noted and all parameters (default or set by user) listed (preferrably in a Table) with units described.										
45	todd.walton@atkinsglobal.com	General Comments	2/3/2015	All figures showing modeling domain or portions thereof should show a North arrow as well as full modeling domain and subdomain (where appropriate in full size figures) with a figure relating subdomain to full domain. Legends should be clear and readable, River miles should be provided in MS river for each figure. All diversions or structures discussed that are within the domain should be located on the figure.										
46	todd.walton@atkinsglobal.com	General Comments	2/4/2015	Where elevations are mentioned, datum should be provided.										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: LCA Engineering Appendix

Documents Under

Apndx-L-White Ditch LCA-Engineering Apprendix_096210

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
47	todd.walton@atkinsglobal.com	General Comments-Section 6-1	2/5/2015	As no verification of the model has taken place, should simulations be done at this stage of analysis??										
48	todd.walton@atkinsglobal.com	General Comments-Section 7-1	2/5/2015	What are the metrics for a successful calibration?? The calibration (as noted earlier) provided salinity values which were not in the min-max range and coupled with the fact that no verification has taken place, this model should not be considered as a "proof of concept" for any planned work at present. Further discussion of data needed in Section 7 shows that the authors do not view this as a completed project due to data and other limitations noted in Section Seven discussion.										
49	todd.walton@atkinsglobal.com	page 1-1, para 1	1/19/2015	Figure needed to show location described with River Miles noted in text to describe area. White Ditch needs to be defined via River Mile locator here and in Figure 1.										
50	todd.walton@atkinsglobal.com	1-1,para 2	1/20/2015	References needed to describe hurricane damage to area discussed in text										
51	todd.walton@atkinsglobal.com	1-1, para 3	1/21/2015	Figure 1 does not adequately describe or outline Breton Sound estuary area or bay. This should probably be 2 figures (1 zoomed and 1 overview) with areas noted located on Figure. It would be good to put River Mile (RM) locations for features where possible.										
52	todd.walton@atkinsglobal.com	1-1, para 4	1/22/2015	Fig 1 needs the Caernarvon diversion structure located on it.										
53	todd.walton@atkinsglobal.com	1-1, para 5	1/23/2015	RM's should be shown on Figure 2.										
54	todd.walton@atkinsglobal.com	1-1, para 6	1/24/2015	Wetland Assessment model is noted, reference should be provided.										
55	todd.walton@atkinsglobal.com	1-1, para 6	1/25/2015	paragraph notes flooding effects are investigated but does not say where this information is discussed (i.e. in another report?, if so reference it)										
56	todd.walton@atkinsglobal.com	2-1, para 2	1/26/2015	Figure 3 needs RM's shown; also upper left figure appears incomplete(i.e. does not show portion of entire river within domain										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: LCA Engineering Appendix

Documents Under Apndx-L-White Ditch LCA-Engineering Apprendix_096210

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
57	todd.walton@atkinsglobal.com	2-1, para 3	1/27/2015	Figure 4 is so dark that tidal stations relation to open water are not clear. RM's should be provided on river in figure.										
58	todd.walton@atkinsglobal.com	2-1, para 4	1/28/2015	Fig 5 needs datum for elevations. Is NOAA Pilot Point= Pilots Station on Fig 4??										
59	todd.walton@atkinsglobal.com	2-1, para 5	1/29/2015	Fig 6 needs datum for tide stage average										
60	todd.walton@atkinsglobal.com	2-1, para 6	1/30/2015	Figure 7 should place Station numbers with names, also include RM's on Fig.										
61	todd.walton@atkinsglobal.com	2-1, para 6	1/31/2015	Wind Rose should note if this is 1 min average, hourly average, or what wind speed										
62	todd.walton@atkinsglobal.com	2-1, para 7	2/1/2015	Belle Chasee station notes "Annual" in last sentence, but Fig 9 shows daily.										
63	todd.walton@atkinsglobal.com	2-2, para 6	2/2/2015	1st sentence "form" -> "from"? ; A sketch would be helpful on discussion of flow paths for this para										
64	todd.walton@atkinsglobal.com	2-3, para 1	2/3/2015	RM's should be shown on Figure 12; elevation datum should be shown on Figs 13 & 14.										
65	todd.walton@atkinsglobal.com	2-3, para 4	2/4/2015	RM's needed on Figs 15 & 16; Oak River Channel needs to be shown on Fig.15.										

ATKINS COWI

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: ERDC Report

Documents Under ERDC_White_DitchReport_DRAFT_29MAR14

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
New Comments on DOCUMENT TITLE														
1	todd.walton@atkinsglobal.com	General Comments	1/30/15	This report specifies throughout that it is a "Validation" of the model for the proposed project but it is really a "Calibration". Throughout the report discussion is made of numerous calibration parameters (i.e. calibration coefficient for discharge, calibration factor for wind attenuation across marsh, etc.). All references to validation should be changed to calibration. Report also notes that better bathymetric data is needed to get better results, hence this report should be considered as a PRELIMINARY CALIBRATION report. Metrics for acceptance as an acceptable representation of the modeling data are not provided and results show that large differences exist in both the field data and the modeled data in the calibration.										
2	todd.walton@atkinsglobal.com	General Comments	1/30/15	Version of the AhD model should be noted and all parameters utilized in the modeling work done herein listed in a separate appendix.										
3	todd.walton@atkinsglobal.com	General Comments	1/30/15	All figures (where appropriate) should show North arrow, scale, River Mile (if MS river is shown)										
4	todd.walton@atkinsglobal.com	General Comments	2/1/15	Often throughout report, references cited in text are missing from the Reference List. As many of these references document many of the underlying critical parameters of the model, it is vital to document to provide References in the Reference Listing. This lack of references is most apparent in Section 4 of the document on Morphological Modeling.										
5	todd.walton@atkinsglobal.com	General Comments	2/3/15	A section on history of the MS river (meandering and sand waves) should be provided and a discussion of how potential historical changes might impact the findings of this report should be included.										
6	todd.walton@atkinsglobal.com	General Comments	2/3/15	A discussion of potential flooding in the basin as a result of diversion should be provided.										
7	todd.walton@atkinsglobal.com	General Comments	2/3/15	A section on effects on the MS river ebb delta terminus as a result of diversion should be included (i.e. erosion at delta terminus?)										
8	todd.walton@atkinsglobal.com	General Comments	2/3/15	Where elevations are provided, datum should be included.										
9	todd.walton@atkinsglobal.com	page 3, Figure 1-2	2/3/15	MS river should show river miles (RM's) and a North Arrow provided.										
10	todd.walton@atkinsglobal.com	page 3, para 4	2/3/15	References need to be provided for Caernarvon Diversion study and AdH model										
11	todd.walton@atkinsglobal.com	page 6, para 1	2/3/15	Reference to SEDLIB Sediment Transport Library and version number needs to be provided.										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: ERDC Report

Documents Under ERDC_White_DitchReport_DRAFT_29MAR14

ADMIN USE ONLY	REVIEWER				RESPONDENT								REVIEWER	
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
12	todd.walton@atkinsglobal.com	page 6, para 2	2/3/15	As AdH appears to be a commercial developed product, reference should be made to developer and any changes made to the commercial product by ERDC as well as version numbers of both the commercial version and the ERDC version (if different) and where the model being used can be obtained (i.e. coded version and documentation). If this is a proprietary model it should be clearly stated, otherwise if a "finished available" product, it should be so noted.										
13	todd.walton@atkinsglobal.com	page 6, para 3	2/3/15	Explain "quasi-3D" and "semi-analytic" aspects of the model. Can it handle flocculation of clay particles?										
14	todd.walton@atkinsglobal.com	page 7, para 2	2/3/15	"flow assumed to be vertically well-mixed..." Is this shown by the data? If so, show example to document assumption is reasonably valid.										
15	todd.walton@atkinsglobal.com	page 8, Figure 2-1	2/3/15	provide North Arrow and scale.										
16	todd.walton@atkinsglobal.com	page 9, Figure 2-2	2/3/15	Show RM's on river: show boundary of domain (in red); provide North arrow										
17	todd.walton@atkinsglobal.com	page 9, para 1	2/3/15	State vertical accuracy of Lidar data and provide references.										
18	todd.walton@atkinsglobal.com	page 10, para 1	2/3/15	"USGS 3m National Elevation Dataset" Reference? ; Explain what the 3m refers to; Discuss vertical accuracy of data set as in page 9 comment.										
19	todd.walton@atkinsglobal.com	page 10, para 2	2/3/15	Explain what is meant by "One meter imagery" and provide reference to "Global Mapper".										
20	todd.walton@atkinsglobal.com	page 10, Figure 2-3	2/3/15	Figure needs RM's shown, North arrow, scale.										
21	todd.walton@atkinsglobal.com	page 11, para 4	2/3/15	"shift" should be "vertical shift"; Explain what is meant by "non-harmonic portion" (i.e. due to wind, etc ??)										
22	todd.walton@atkinsglobal.com	page 12, para 1	2/3/15	Figure 2-4 notes the Dalphin Isld gage but text shows "Pensacola" gage for boundary conditions. This is further confused by Table 2-1, Figure 2-7, and numerous data plots throughout report. From what is provided and confusion in report it is not clear what the 3 tidal boundary condition stations are OR what has been "calibrated" with field data. As this is vital to the entire report and purpose of the report, this needs to be clarified throughout report to assess whether a preliminary reasonable calibration has been made.										
23	todd.walton@atkinsglobal.com	page 13 Figs 2-5 through 2-7	2/3/15	Figures are too small to show what potential phase change differences are in the modeled and actual tide data. Zooms of the plots should be shown to clarify whether phase changes create large differences between the measured and actual tides and if they are large, what effects this has on the calibration.										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: ERDC Report

Documents Under ERDC_White_DitchReport_DRAFT_29MAR14

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
24	todd.walton@atkinsglobal.com	page 16, Figure 2-8	2/4/15	clarify stations with arrows to stations on Eastern portion of figure. North arrow needed.										
25	todd.walton@atkinsglobal.com	page 16, para 1	2/4/15	Explain "4 hour filter" (i.e. moving average filter or what?); Why is filtering needed?.. Shouldn't the raw data be used?										
26	todd.walton@atkinsglobal.com	page 18, para 2	2/4/15	This approach ensures that the proper river discharge reaches…" Please explain.. Not clear.										
27	todd.walton@atkinsglobal.com	page 19, para 1	2/4/15	"Figure 2-13" is an incorrect reference for this hydrograph										
28	todd.walton@atkinsglobal.com	page 19, para 2	2/4/15	"until such time as the Sound is flushed of salt…" How long is this initialization phase?										
29	todd.walton@atkinsglobal.com	page 20, para 2	2/4/15	Note what the ERDC-CHL gages measure (i.e. water level? Salinity?, discharge?)										
30	todd.walton@atkinsglobal.com	page 23, Figs 2-15 thru 2-31	2/4/15	As figures are so small and on such a compressed time scale, it is not clear how well the modeled and measured data compare. What are the metrics for comparison? Should an rms error be provided to compare the results?										
31	todd.walton@atkinsglobal.com	page 30, Figure 2-29	2/4/15	As this location is on Gulf boundary of model, please explain how the modeled and measured data are vastly different.										
32	todd.walton@atkinsglobal.com	page 32, para 1	2/4/15	Is this "0.85" attenuation factor a dimensionless reduction of the "actual wind data speed" or what?										
33	todd.walton@atkinsglobal.com	page 32, para 2	2/4/15	"FR URV card"? Please explain (this needs to be done for all internal & external calibration factors set in the model. "friction of 0.018" ? Is this dimensionless friction factor? (units?)										
34	todd.walton@atkinsglobal.com	page 32, para 2	2/4/15	"exceptionally accurate" clearly is incorrect wording. By what metrics would this be considered accurate?										
35	todd.walton@atkinsglobal.com	page 32, para 3	2/4/15	"Figure 2-13" is incorrect for "Caernarvon Diversion flow rates"										
36	todd.walton@atkinsglobal.com	page 32, para 4	2/4/15	Better explanation of difference in ADCP and HADCP (i.e. one is boat mounted and spacially changing with time?")										
37	todd.walton@atkinsglobal.com	page 34, Figs 2-32 thru 2-39	2/4/15	As noted for water level comparisons, figures need to be larger and less time compression to show modeled versus measured differences. Again metric such as rms error needs to be provided and perhaps maximum deviation noted also for comparisons.										
38	todd.walton@atkinsglobal.com	page 39, para 1 and 2	2/4/15	Statements such as "deemed acceptable" and acceptable accuracy" need to be backed up with a metric. Not clear what is acceptable.										
39	todd.walton@atkinsglobal.com	page 40, para 1	2/4/15	"the and" ??										

Comment Response Table

Coastal Protection and Restoration Authority
Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: ERDC Report

Documents Under

ERDC_White_DitchReport_DRAFT_29MAR14

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
40	todd.walton@atkinsglobal.com	page 41, Figs 2-41 thru 2-49	2/4/15	Is start-up time in the model shown in these plots as modeled and measured are not equal at beginning of plots in many of the plots? There are major differences in ppt in many plots (i.e. see Fig 2-45) and what appears to be stability problems in some (i.e. Fig 2-56) which need to be discussed.										
41	todd.walton@atkinsglobal.com	page 50, para 1	2/4/15	spelling "mathes" ; also missing "model and field [data]" ; Entire paragraph needs to be spell and grammer checked; Additionally, "delay" is not adequately explained.										
42	todd.walton@atkinsglobal.com	page 50, para 2	2/4/15	"results are sufficiently robust that they can be trusted" ??? By what metric? Salinity modeled versus measured results seem to contradict this statement completely.										
43	todd.walton@atkinsglobal.com	page 52 para 1	2/4/15	Replace "freshen" with "reduce salinity levels"?????										
44	todd.walton@atkinsglobal.com	page 58, para 2	2/4/15	It is stated that "modeled differences in land gain/loss.... only quantities considered valid..." yet no calibration/verification is provided over the basin to assess confidence in the model being able to predict land loss and/or gain. Only an "observed pattern of land gain" is shown in Fig 4-12.										
45	todd.walton@atkinsglobal.com	page 61, Table 4-1	2/4/15	Explain (or reference) what the "Erosion Rate Constant" is.										
46	todd.walton@atkinsglobal.com	page 64, para 1	2/4/15	Olga Compressor NOAA gage"?? Location?? Were tidal constitutants constructed with limited tidal harmonics discussed earlier in report??										
47	todd.walton@atkinsglobal.com	page 66, para 3	2/4/15	"estimated subsidence for Breton Sound is..." This needs a reference as to where this value is from.										
48	todd.walton@atkinsglobal.com	page 84, para 1	2/4/15	"average porisity ... estimated to be 0.565" Provide reference for estimate.										
49	todd.walton@atkinsglobal.com	page 89	2/4/15	Where is Appendix ??? This appears to be last page of document?										

ATKINS COWI

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: Modeling Report

Documents White Ditch LCA Medium Report_12-24-2013_FINAL

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
New Comments on DOCUMENT TITLE														
1	todd.walton@atkinsglobal.com	General Comments	2/2/15	A table of LocationNumber-RiverMile-LocationName would be most helpful in preventing confusion of alternatives and for readability										
2	todd.walton@atkinsglobal.com	General Comments	2/2/15	Report needs an overview history of MS river in area of these diversions (i.e. sand waves, meandering, depths, & channel shifts) to assess importance of possible future river history to impact of the projects which have assumed stationarity of MS river channel at time of investigation. This is especially important in light of the sediment carrying capacity of the river for the locations chosen and potential intake capture of sediment.										
3	todd.walton@atkinsglobal.com	General Comments	2/2/15	Version of model needs to be included at first reference to model. All parameters either set by user and or default within model should be provided in a table or listing and units provided. This needs to be done for calibration (and verification if any parameters are changed from calibration)										
4	todd.walton@atkinsglobal.com	General Comments	2/2/15	Although report notes that calibration and verification have been provided for initial domain, there is no comparison of data versus modeled data provided in report nor are metrics discussed to ascertain the reasonableness of a calibration or verification (i.e. rms error might be one metric employed to compare field data to modeled data). Although initial domain calibration and verification may be discussed in another report, its importance is such that any calibration and verification work done should be within the present report.										
5	todd.walton@atkinsglobal.com	General Comments	2/2/15	For proper calibration and verification, boundary conditions must be known. It appears that due to a lack of field data on tailwater, a true calibration and verification cannot be provided.										
6	todd.walton@atkinsglobal.com	General Comments	2/3/15	Numerous figures in section "4. Analysis" and Appendix A are fuzzy and too small to see the description discussed in text. Figures often also lack RM's , scales, North arrows, on drawings. Sketches/Figures are needed to clarify text description of alternatives investigated in this section of report as well as transects through the diversion structure showing structure bottom elevation as well as modeled water surface elevation [along with average cross section velocities of flow] to identify energy transitions (i.e. critical flow locations as well as hydraulic jumps)										
7	todd.walton@atkinsglobal.com	General Comments	2/3/15	A particular concern is that downstream river boundary conditions appear not to be based on data but were set through artificial means (i.e. other numerical model(s). This is not clear how potential differences in actual bc's compared to modeling set bc's will effect the results of report and whether a more rigorous verification of the modeling is needed.										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: Modeling Report

Documents White Ditch LCA Medium Report_12-24-2013_FINAL

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
8	todd.walton@atkinsglobal.com	General Comments	2/4/15	Where elevations are provided, datums need to be given.										
9	todd.walton@atkinsglobal.com	General Comments	2/4/15	Where a diversion structure alternative is provided, a transect through the diversion with water levels, flow velocities, and channel/structure bottom needs to be provided for clarity and possible spotting of potential sedimentation problems within structure (i.e. hydraulic jumps, sharp transitions in velocity, etc.)										
10	todd.walton@atkinsglobal.com	General Comments	2/4/15	No mention is made of navigation safety concerns or of studies made to assess potential navigation safety concerns caused by the diversion structure. Should this be included herein?										
11	todd.walton@atkinsglobal.com	General Comments	2/5/15	It appears that bed load is not incorporated in the approach utilized to compute total sediment load as only concentrations are utilized. Please explain what impact this will have on the overall availability of sediment for transport, SWR's, and sediment transport within the diversion structure.										
12	todd.walton@atkinsglobal.com	page 1-1, Figure 1-1	2/5/15	River miles, North arrow, scale, should be placed on figure. Also, River aux Chenes subbasin and upper Breton Sound basin should be delineated with shading. Also show River aux Chenes and project alternate locations.										
13	todd.walton@atkinsglobal.com	page 1-2, Figure 1-2	2/5/15	similar comments as to Figure 1-1; Additionally show location 2.5										
14	todd.walton@atkinsglobal.com	page 1-2, para 2	2/5/15	Project suggests testing under "Steady-flow patterns" whereas large river flows would seem to be dynamic (i.e. during river flood waves). A discussion of whether this aspect of study needs to be assessed with further modeling is needed here.										
15	todd.walton@atkinsglobal.com	page 1-3, para 1	2/5/15	"Location 1 is ..recommended" As White Ditch Location is #2 according to Fig 1-2, why is report entitled "White Ditch"??										
16	todd.walton@atkinsglobal.com	page 2-1, para 2	2/5/15	"ability to calculate movement of individual sediment particles.." does not describe the model's capability to describe the transport of a reasonable high concentration mix of sand,silt, and clay size particles. Please provide assurance that the model can deal with this mix of material and provide reasonable answers of sediment transport through a complex diversion structure.										
17	todd.walton@atkinsglobal.com	page 2-5, para 1	2/5/15	"assuming that sediment concentrations were relatively small…" begs the question if the model can handle concentrations as large as those being captured within the MS river??? Please assure that the model can handle this. Also is cohesion and/or flocculation of clay particles considered OR is this portion of the material so small as to make this size distribution not revelant to results??										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: Modeling Report

Documents White Ditch LCA Medium Report_12-24-2013_FINAL

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
18	todd.walton@atkinsglobal.com	page 3-2, Figure 3-1	2/5/15	Figure 3-1 needs scale, RM's shown as well as project locations. Additionally a zoom is needed of measurement area, existing Fig is too small to understand the measurement scheme.										
19	todd.walton@atkinsglobal.com	page 3-3, Figure 3-2	2/5/15	same comments as per Figure 3-1										
20	todd.walton@atkinsglobal.com	page 3-4, Figure 3-3	2/5/15	same comments as per Figure 3-1										
21	todd.walton@atkinsglobal.com	page 3-5, Figure 3-4	2/5/15	same comments as per Figure 3-1										
22	todd.walton@atkinsglobal.com	page 3-6, para 1	2/5/15	As form drag appears to be set as a constant, what is it? Shouldn't both numbers be flexible in model since form drag would also change during the time of a flood? How is form drag set?(i.e. seemes using default parameter of FLOW-3D might be very misleading.										
23	todd.walton@atkinsglobal.com	page 3-6, para 2	2/5/15	Figure(s) showing river currents are needed to explain what is being discussed herein.										
24	todd.walton@atkinsglobal.com	page 3-6, para 3	2/5/15	"model results and field data compared well" There is absolutely no figure comparisons of measured or modeled data shown to provide any confidence for this statement. Figures are needed here to show if this is true.										
25	todd.walton@atkinsglobal.com	page 3-7, para 1 & 2	2/5/15	The approach taken assumes a linear approach to assume that the particle mix in concentration represents the actual concentration. As often sediment transport is a non-linear process, it would seem that verification for this assumption needs to be shown. Although a nice exposition of modeling methods used has been presented, unfortunately no evidence is provided that the modeling method represents the reality of the physical sediment transport in the prototype model.										
26	todd.walton@atkinsglobal.com	page 3-8, para 2	2/5/15	In the clay size fraction, shouldn't it be mentioned that cohesion, flocculation, and water chemistry are not considered in the sediment transport considerations??										
27	todd.walton@atkinsglobal.com	page 3-8, para 3	2/5/15	"ad hoc.......in the future..." It is bothersome that the ad hoc approach is being used yet it appears modeler is suggesting further refinements to the model in the future. Was the agreement between the modeled transport and field data a fortitious event??										
28	todd.walton@atkinsglobal.com	page 3-8, para 4	2/5/15	Text states " model was validated.... As shown in Figure 3-3 and Figure 3-4." NO data calibration and/or validation is shown where model and measured data are shown together. There appears no evidence that the model calibration nor verification provides evidence that the model is sufficient for the modeling purposes stated herein (at least in this section).										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: Modeling Report

Documents White Ditch LCA Medium Report_12-24-2013_FINAL

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
29	todd.walton@atkinsglobal.com	page 3-9, para 4	2/5/15	"no tailwater data available..." AS tailwater was only estimated by another model (HEC-RAS) and then used herein, it suggests that no tailwater was known for the independent bc estimation used herein. Since bc data is not available, it appears that the model cannot be calibrated and or verified at the present time. What is stated as calibration and verification is not a true calibration or verification. How can measurements at "Conoco-Phillis station" be used to calibrate HEC-RAS but not be able to be used to calibrate FLOW-3D??										
30	todd.walton@atkinsglobal.com	page 3-15, para 2	2/5/15	" three cast locations" ??? Please explain what this means.										
31	todd.walton@atkinsglobal.com	page 3-17, Figure 3-11	2/5/15	Concentration observations are often different from modeled concentrations toward the bottom of water column where the maximum transport would be expected. A sensitivity study should be made to show how much influence this discrepancy in the measured versus modeled values influences the overall transport. It appears from approach utilized that bedload is not considered in the approach but only suspended load based on concentration values. Please detail what difference this makes on total sediment load available for diverting as well as sediment load within the diversion.										
32	todd.walton@atkinsglobal.com	page 3-16, last paragraph	2/5/15	"Disagreements between measured and modeled data.... Deficiencies associated with FLOW-3D sediment transport method." suggests that the model used cannot predict the sediment transport adequately. Please explain this statement in light of earlier discussion that model had been verified??										
33	todd.walton@atkinsglobal.com	page 3-19, para 1	2/5/15	"good agreement... at all three sites" does not appear valid in view of Figure 3-14[c] which shows modeled bottom C's over 3 times higher than measured C's. This suggest a much higher modeled transport than measured transport.										
34	todd.walton@atkinsglobal.com	page 4-7, para 1	2/5/15	"..boundary condition was established ....." Please detail this estimation in this report and provide assurance that this is a reasonable assumption given the lack of field data. Additionally state consequences of an incorrect assumption on the modeling results provided herein.										
35	todd.walton@atkinsglobal.com	page 4-17, para 2	2/3/15	"boundary condition was a tail water elevation of 4.1 feet...." Datum needed and further explanation of this sentence is needed for understanding as to setting of bc										
36	todd.walton@atkinsglobal.com	page 4-35, para 2	2/3/15	"..trend highlights importance of diverting a sufficient flow rate..." Mention should be made of intake and diversion requirements regarding velocity throughout the structure to keep various components of sediment from settling out.										

Comment Response Table

Coastal Protection and Restoration Authority

Mid Breton Sediment Diversion (White's Ditch)

Work Product Under Review: Modeling Report

Documents White Ditch LCA Medium Report_12-24-2013_FINAL

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER		
COMMENT ID	REVIEWER CONTACT INFO	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
37	todd.walton@atkinsglobal.com	page 4-39, para 2	2/3/15	"simulations ...completed assuming a tail water elevatio of 5 feet NAVD88 ..." Does this agree with page 4-17, para 2 comment of tail water of 4.1 feet?? Also, what is the basis of this assumption (i.e. it appears this was just taken from ERDC-AdH modeling report?)??										
38	todd.walton@atkinsglobal.com	page 5-1, para 2	2/3/15	More discussion and documentation on this location needs to be provided as it is not clear that the sediment within the sand bar is of the same material intended to be captured in the river?? If the sand bar material is all of a sand size, will the material being modeled within the diversion move through the diversion as bed load since it may be considerably courser?										
39	todd.walton@atkinsglobal.com	page 5-1, para 4	2/3/15	"... future analyses be performed..." Please provide details of analyses needed, especially in light of fact that steady flow is being modeled herein but "consideration of unsteady flow" is needed as well. Also a detailed description of needed additional field data to verify the model under steady and unsteady flow conditions should be discussed.										
40	todd.walton@atkinsglobal.com	page A4-1	2/3/15	Mannings n is a dimensional quantity hence units should be shown for the value used. Is ve= vo a reasonable assumption? This is clearly not the case for the HW and TW shown as there appears to be a backwater at the head of culvert suggesting flow through culvert is different from entrance velocity?)										

Appendix C

Alternate Concepts

Appendix C –Alternate Concepts

Alternative A – "In the Wet" Concrete Immersed Tube and Stop Log Back Structure

Alternative B – "In the Wet"Roller Gate Control Structure and open channel flow box culvert intake channels with inverts at -40-ft and Stop Log Back Structure

Alternative C – "In the Wet"Roller Gate Control Structure and submerged intake & outlet culverts with inverts at -60-ft and use of eductors.

List of Figures

Figure C.22 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)

Appendix C –Alternate Concepts

Note that Alternate A, Alternate B and Alternate C, are laid-out to accommodate 35,000 cfs.

Alternate A – "In the Wet" Concrete Immersed tube w/ invert at -40-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. In this alternate, 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.2.

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.

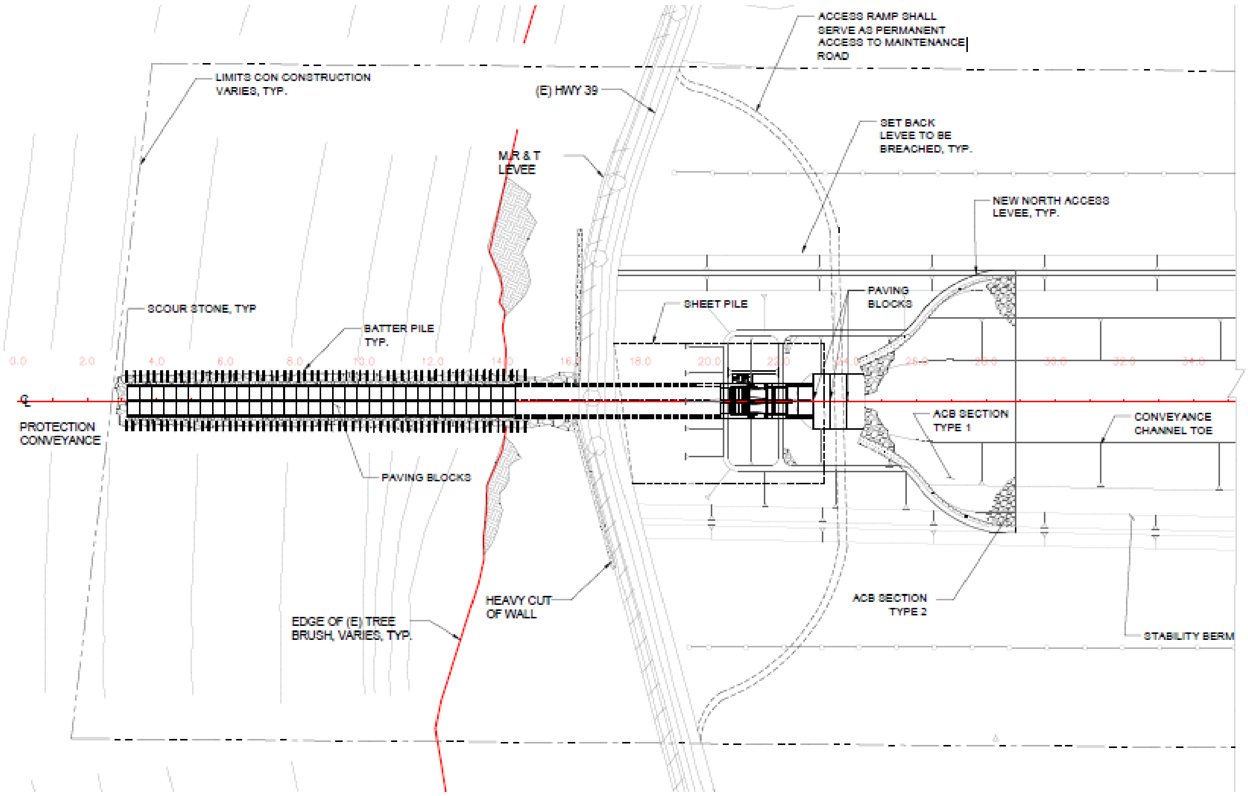

Figure C.1 Alt. A – Construction Stage Plan View of the Inlet/Approach Channel, Control Structure & Transition to the Conveyance Channel, Showing the Sheet Pile Limits of the Glory Hole and Temporarily Relocated Hwy 39

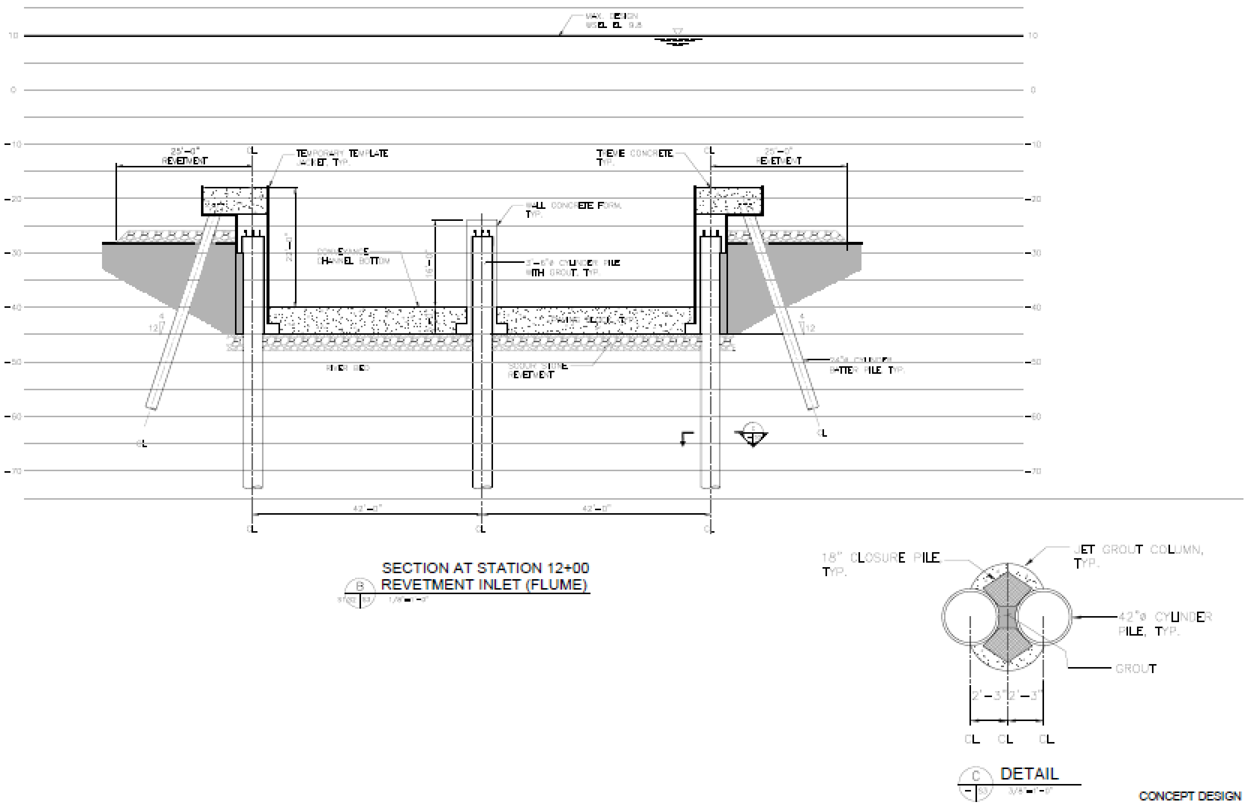

Figure C.2 Alt. A - End View of the Inlet/Approach Channel

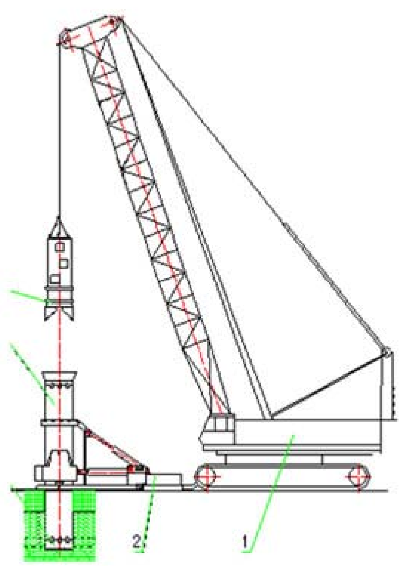

Figure C.3 Alt. A – Representative Large Diameter Casing Installation Using an Oscillator, Similar to That Proposed for the CIDH Construction.

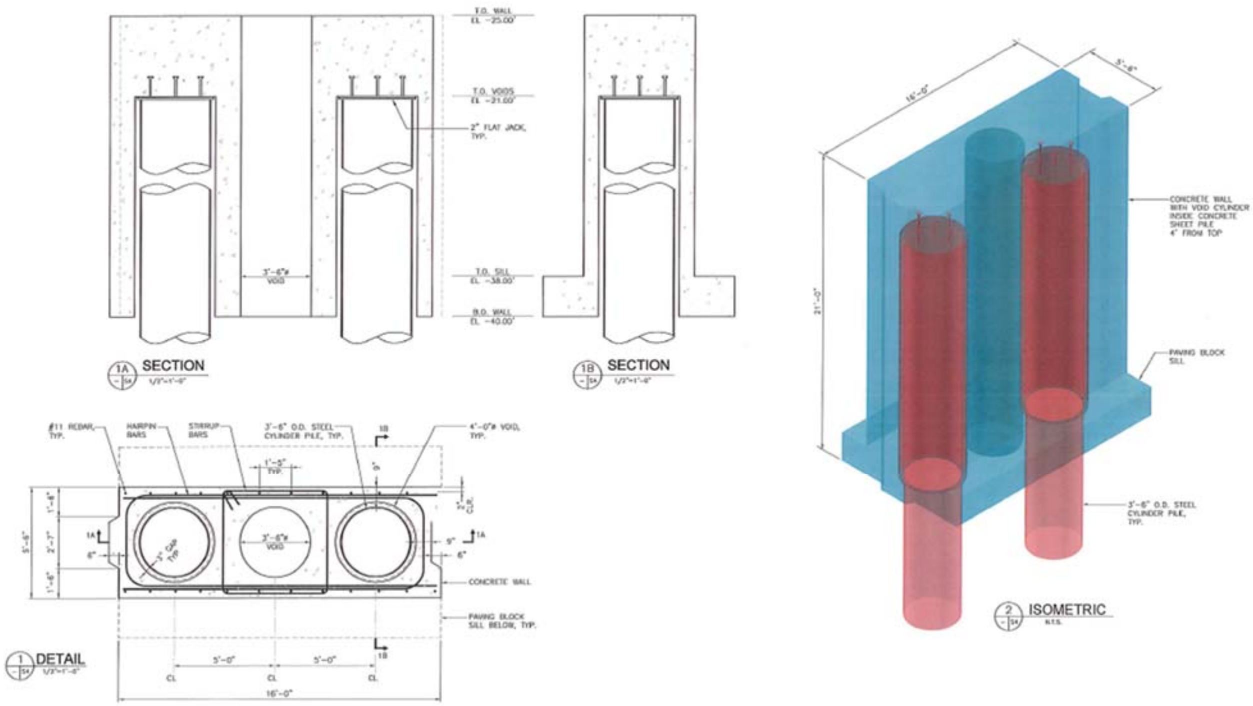

Figure C.4 Alt. A - Detail of the Inlet/Approach Channel Intermediate Wall Design for In-The-Wet Construction

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 Hwy 39 to be relocated 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).

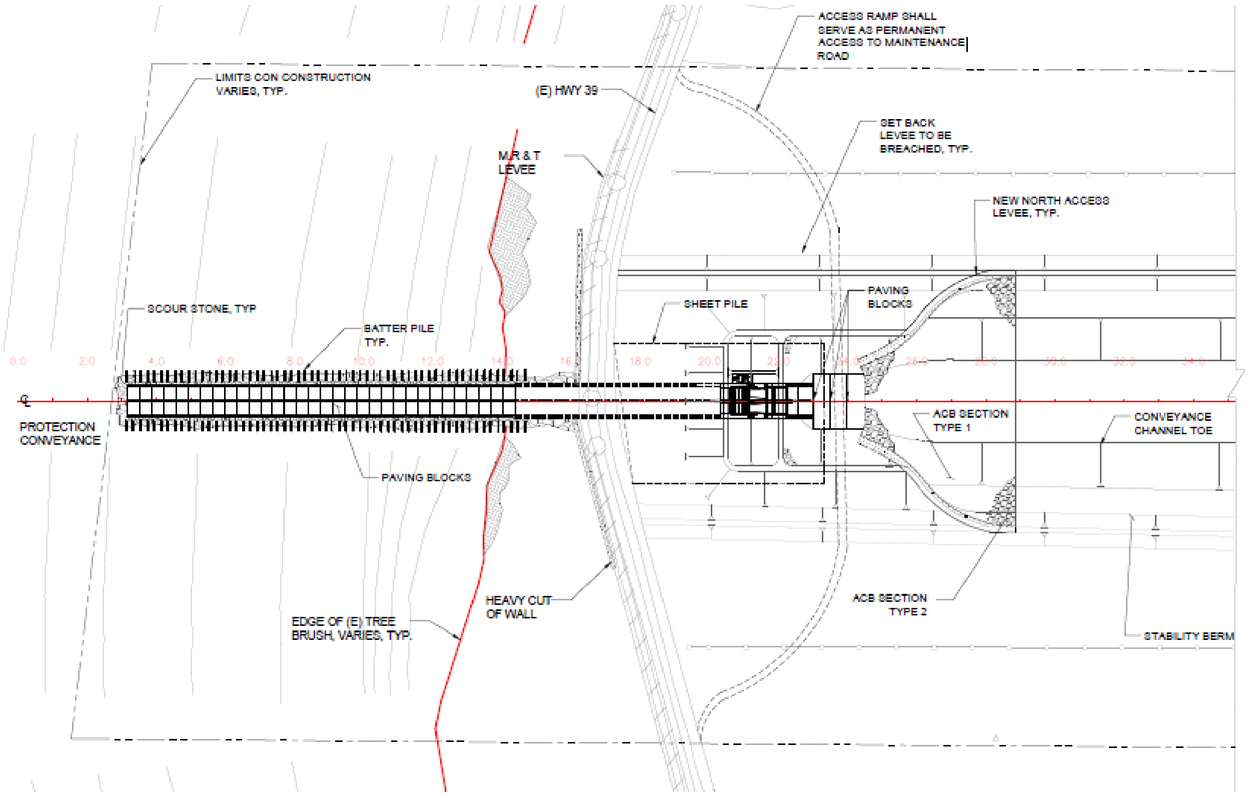

Figure C.5 Alt. A - Plan View of the Inlet/Approach Channel, Control Structure & Transition to the Conveyance Channel

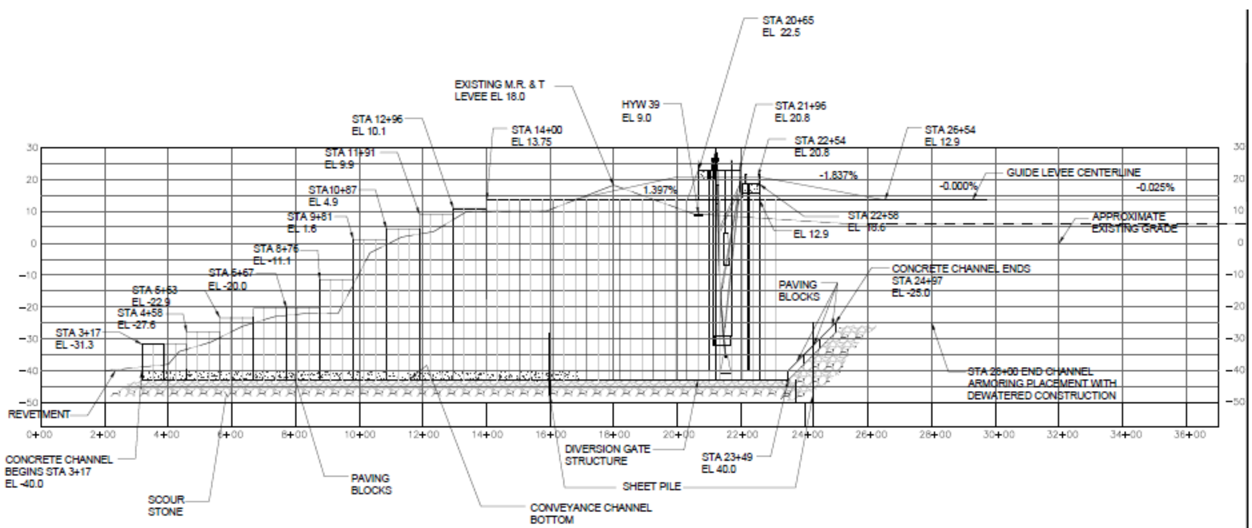

Figure C.6 Alt. A - Profile View of the Inlet/Approach Channel, Control Structure & Transition to the Conveyance Channel

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.

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.

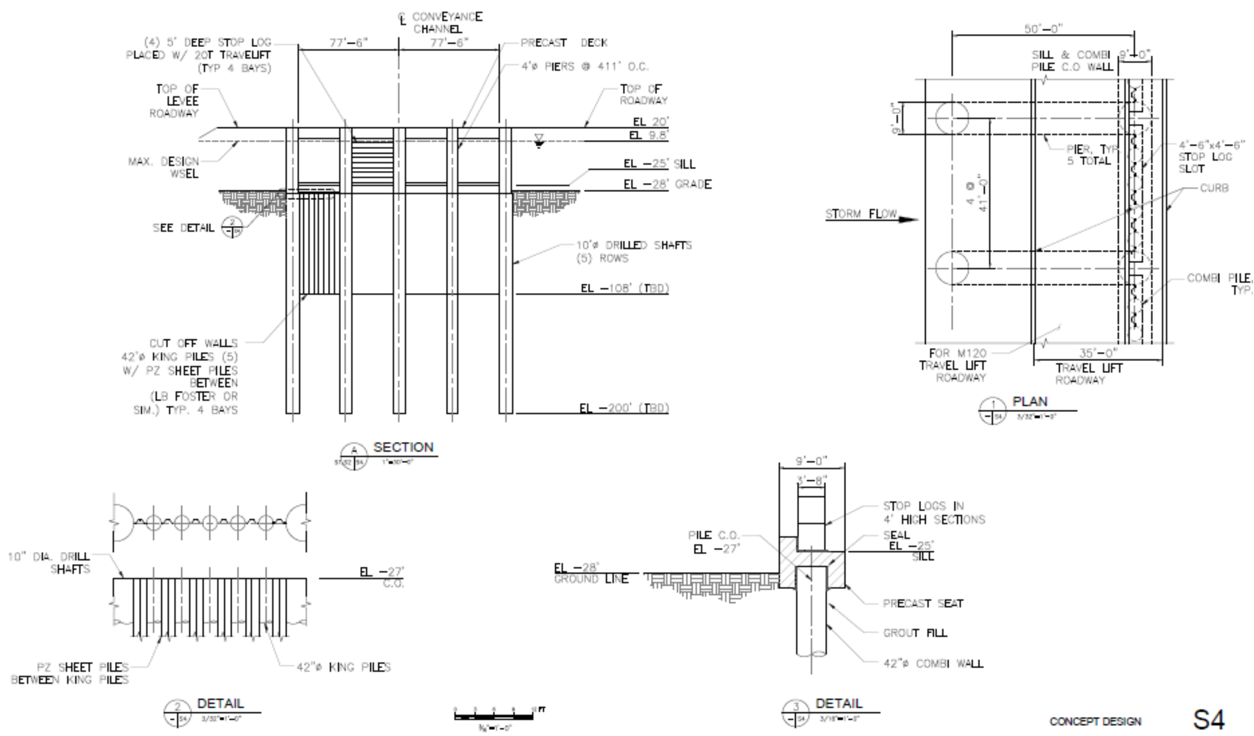

Figure C.7 Alt. A – Plan, Profile and End, Views of Back Structure, Built In-the-Wet.

Alternate B: "In the Wet" Roller Gate Control Structure and open channel flow box culvert intake channels with inverts at -40-ft and Stop Log Back Structure

The following discussion applies to Alternate B. In this alternate, first the set-back levee would be built and Hwy 39 relocated around the set-back levee, and combi-walls would be installed on the sides of a braced trench to be excavated inside the set-back levee and through the MR&T levee once the lift-in roller gate control structure is installed. Concurrently, both the Approach Channel, the Back Structure and Outlet Channel would be constructed using in-the-wet technology as described for Alternate A.

Figure C.8 shows a plan view detail of the Alternate B 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; note, the invert is taken to be El -40, 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 roller bulkhead (with wheels) type of Control Structure, located on the riverside of the MR&T levee. This leads into open-channel-flow box culverts that pass beneath Hwy 39, and beneath an end levee of the Conveyance Channel where the tube daylights with paving blocks in the transition area to the Conveyance Canals.

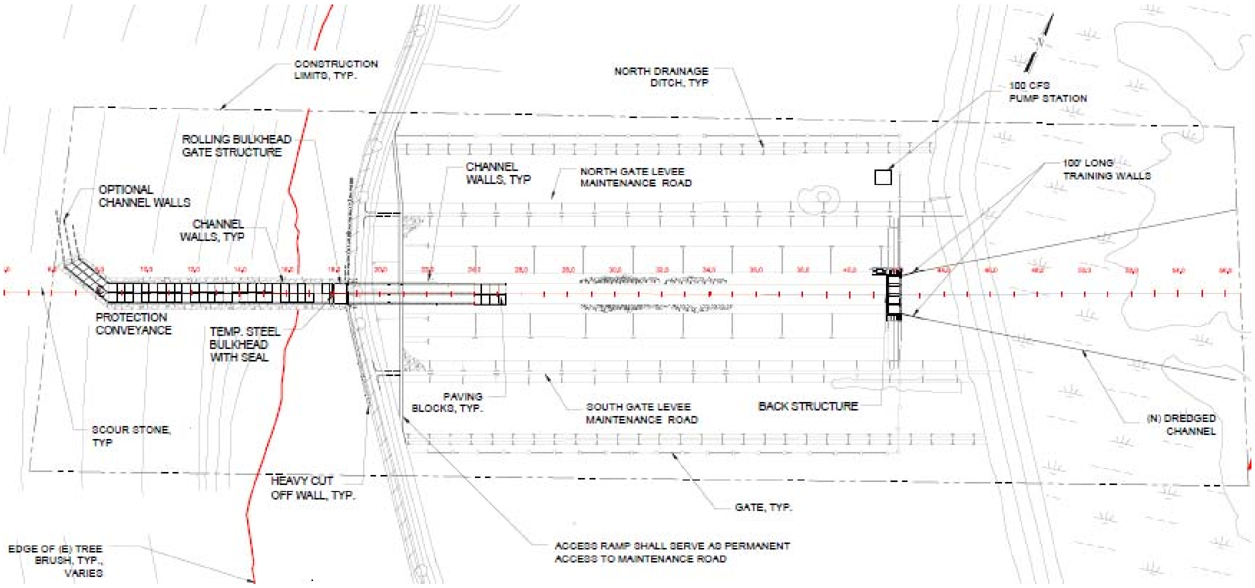

Figure C.8 Alt. B – Plan View for the Inlet/Approach Channel, Control Structure, Submerged Box Culverts & Transition to the Conveyance Channel, Conveyance Channel, Back Structure and Outlet/Discharge Channel

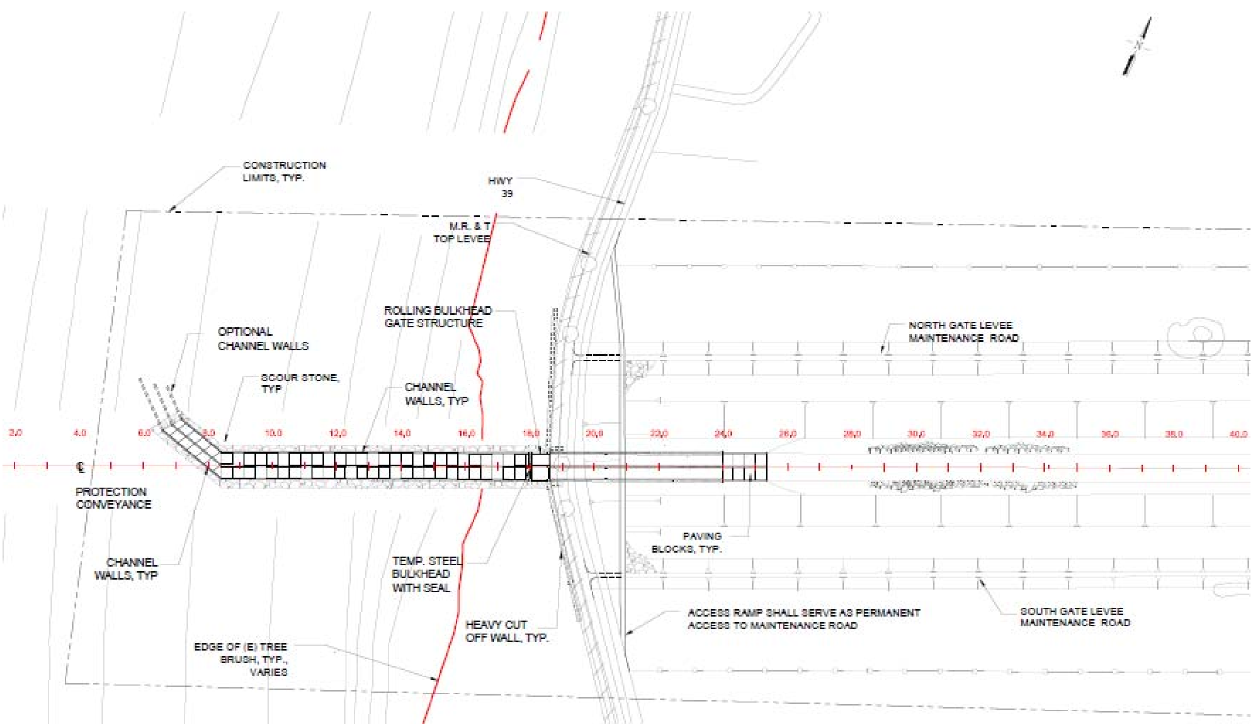

Figure C.9 Alt. B – Plan View of the Inlet/Approach Channel, Control Structure, Submerged Box Culverts & Transition to the Conveyance Channel

Figure C.10 shows a profile view of the inlet/approach channel, lift-in roller gate control structure, open-channel-flow box culvert & transition to the conveyance channel.
Figure C.11 shows a cross-sectional view of the submerged orifice at the control structure. 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 optional eductor jets (sand pumps) can be positioned to prevent the submerged orifice from plugging with sediment). Figure C.12 shows an alternate cross-sectional view of the open-channel flow box culverts. Figure C.12a shows a cross-sectional view of the conveyance channel; and Figure C.12b shows a plan view of the back structure and outlet/discharge channel.

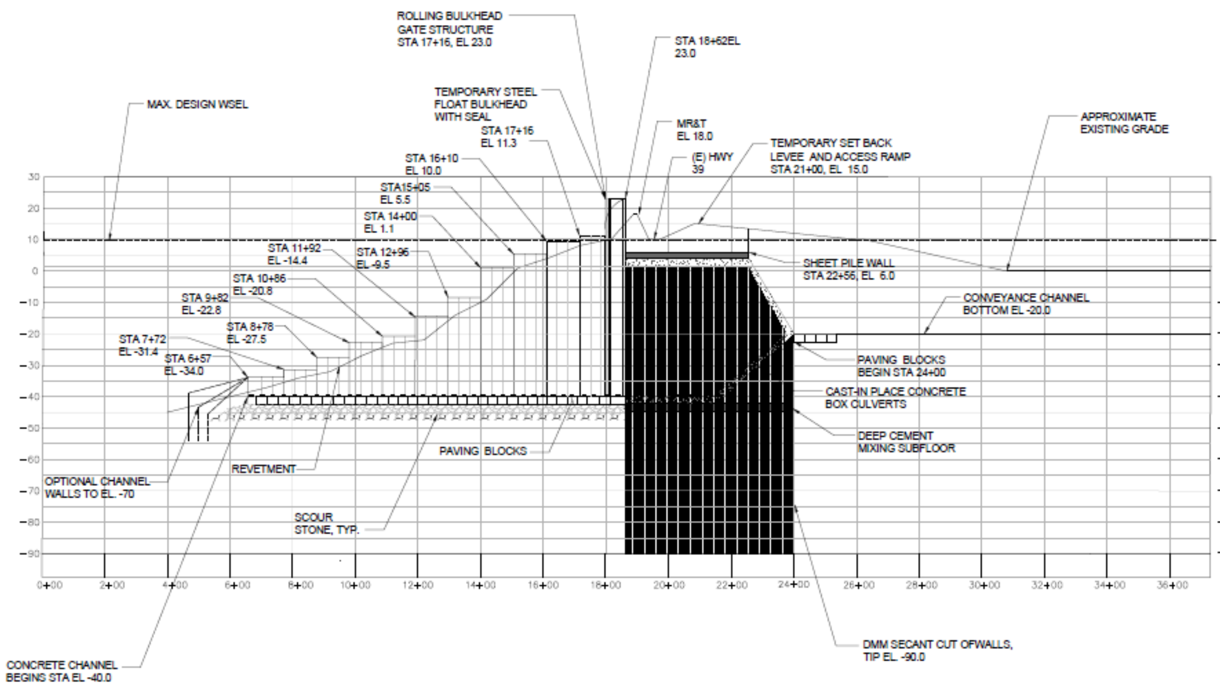

Figure C.10 Alt. B – Profile View of the Inlet/Approach Channel, Control Structure, Open-Channel-Flow Box Culverts & Transition to the Conveyance Channel (This Image shows how the DMM Panels can engage the Pleistocene layer to prevent the possible formation of a deep seated failure surface through the soil near the MR&T Levee)

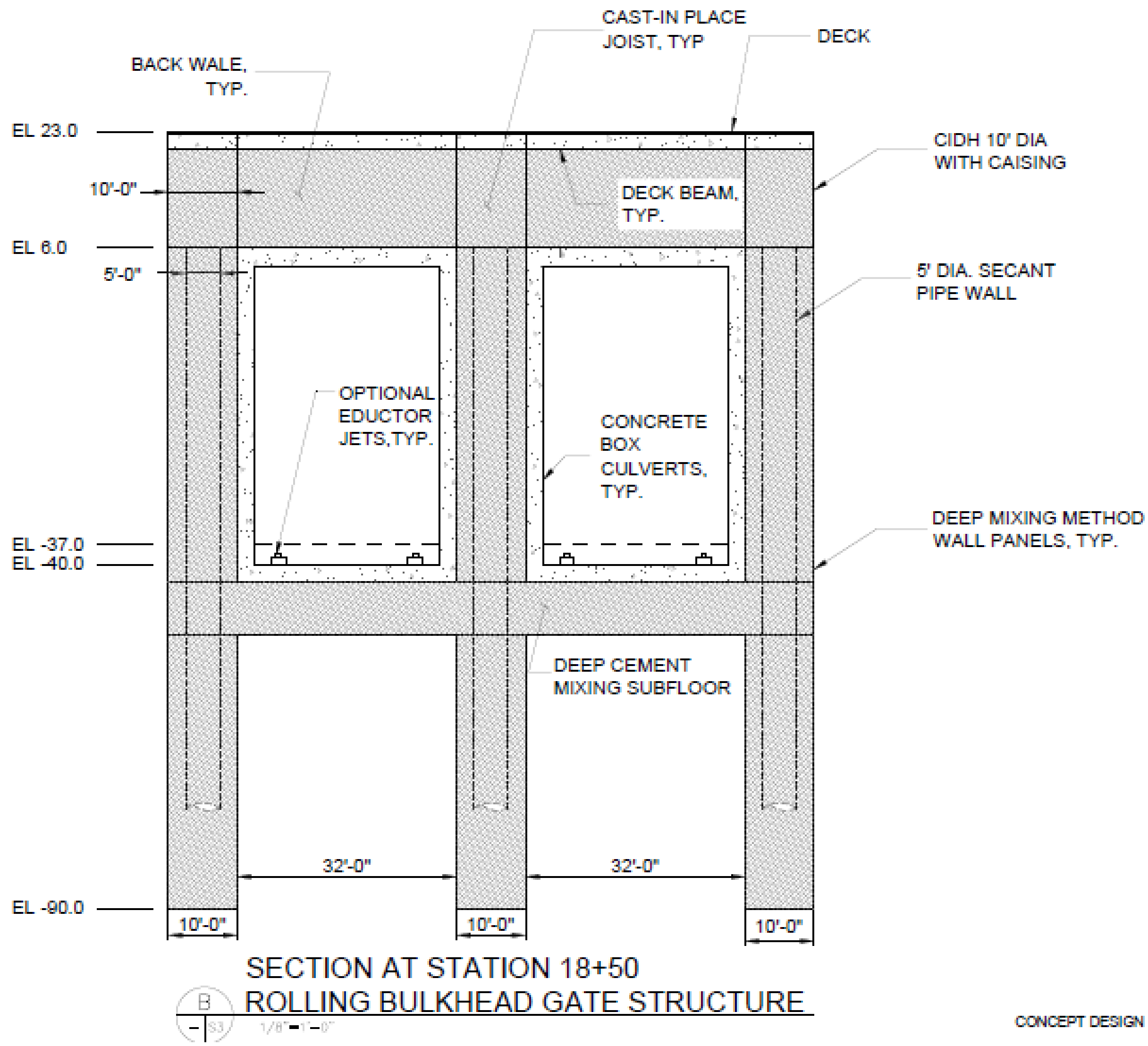

Figure C.11a Alt. B – Cross-Sectional View of the Submerged Orifices at the Control Structure at Sta 18+50 with a Cast-In-Place Concrete Liner (This Image Shows How Optional Eductor Jets (Sand Pumps) Can Prevent the Submerged Box Culverts from Plugging with Sediment)

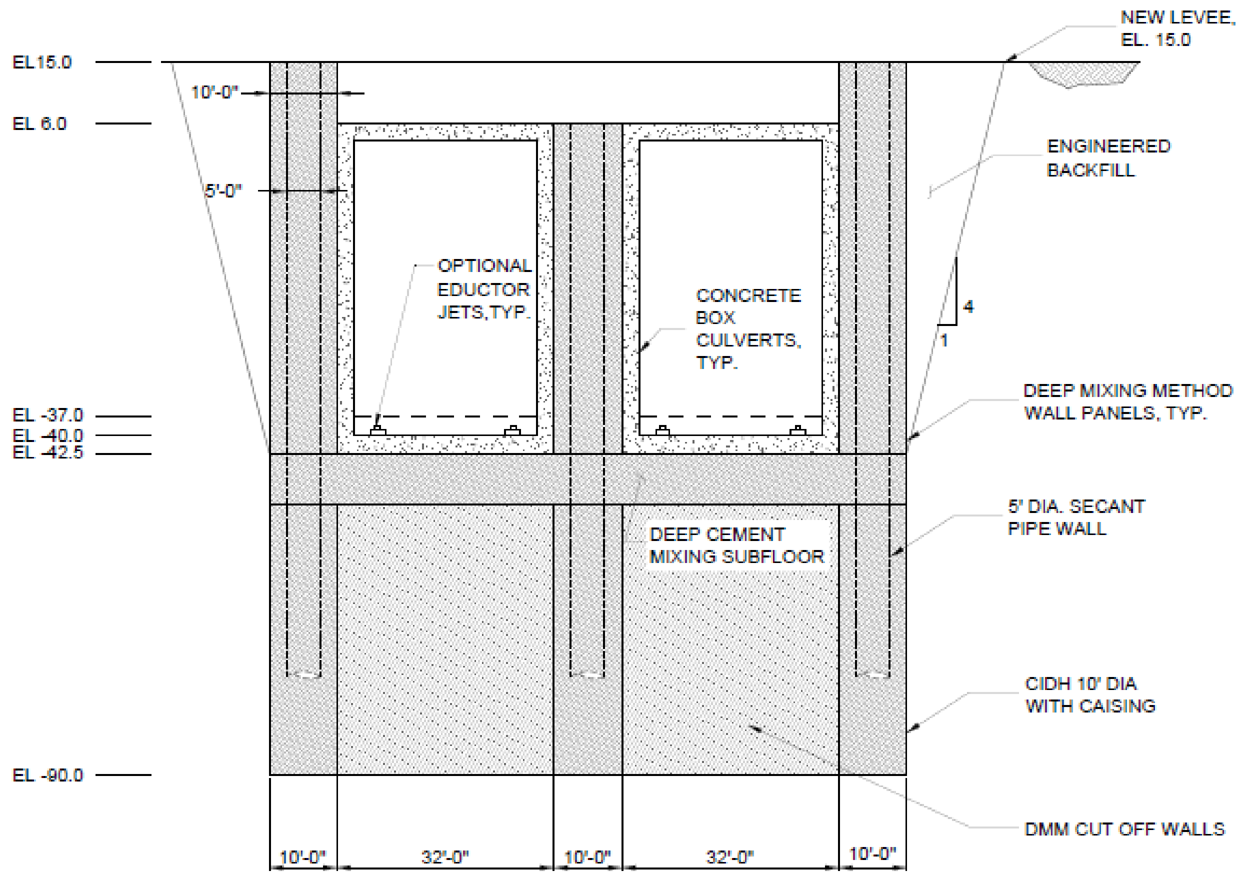

Figure C.11b Alt. B – Cross-Sectional View of the Submerged Orifices at the Downstream of Control Structure at Sta 19+00 with a Cast-In-Place Concrete Liner (This Image Shows How Optional Eductor Jets (Sand Pumps) Can Prevent the Submerged Box Culverts from Plugging with Sediment)

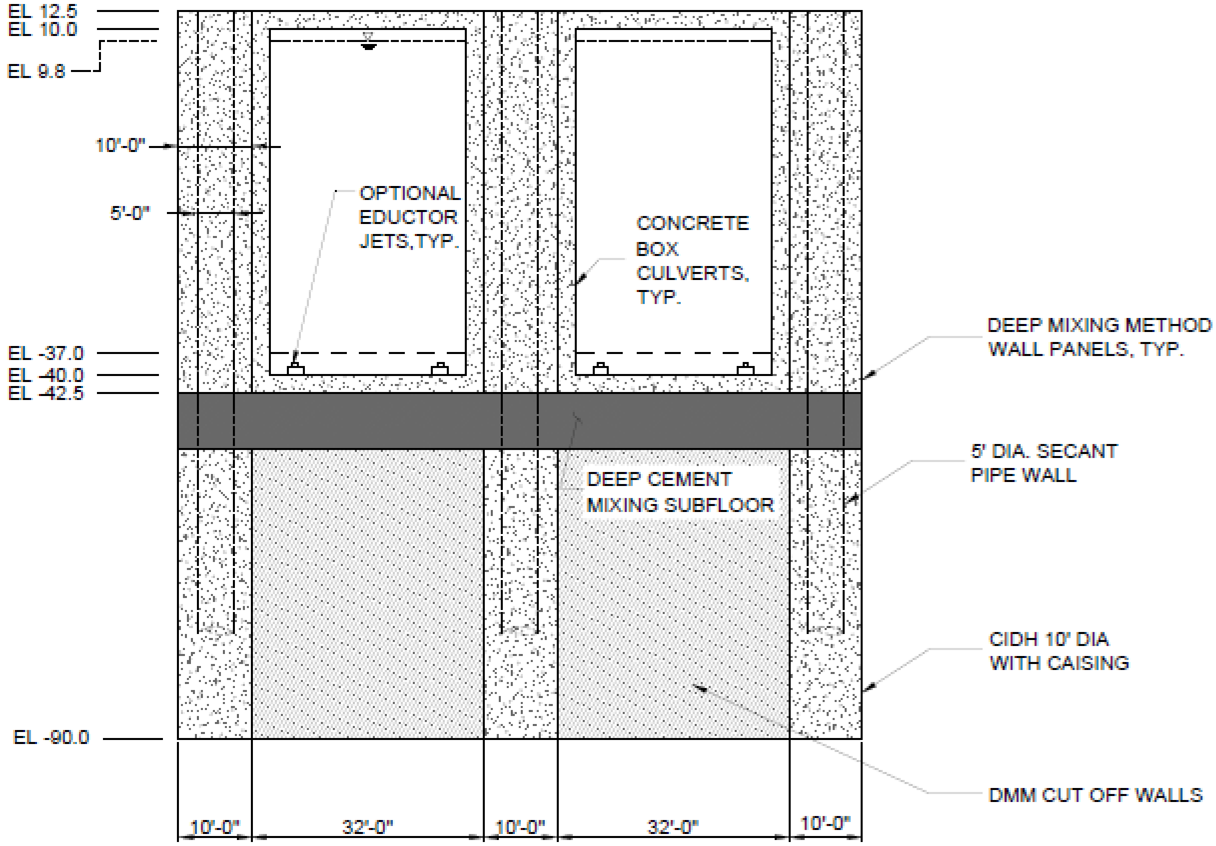

Figure C.12 Alt. B – Alternate Cross-Sectional View of the Open-Channel-Flow Box Culverts at Hwy 39, Sta 19+75, with Cast-in-Place Roof.

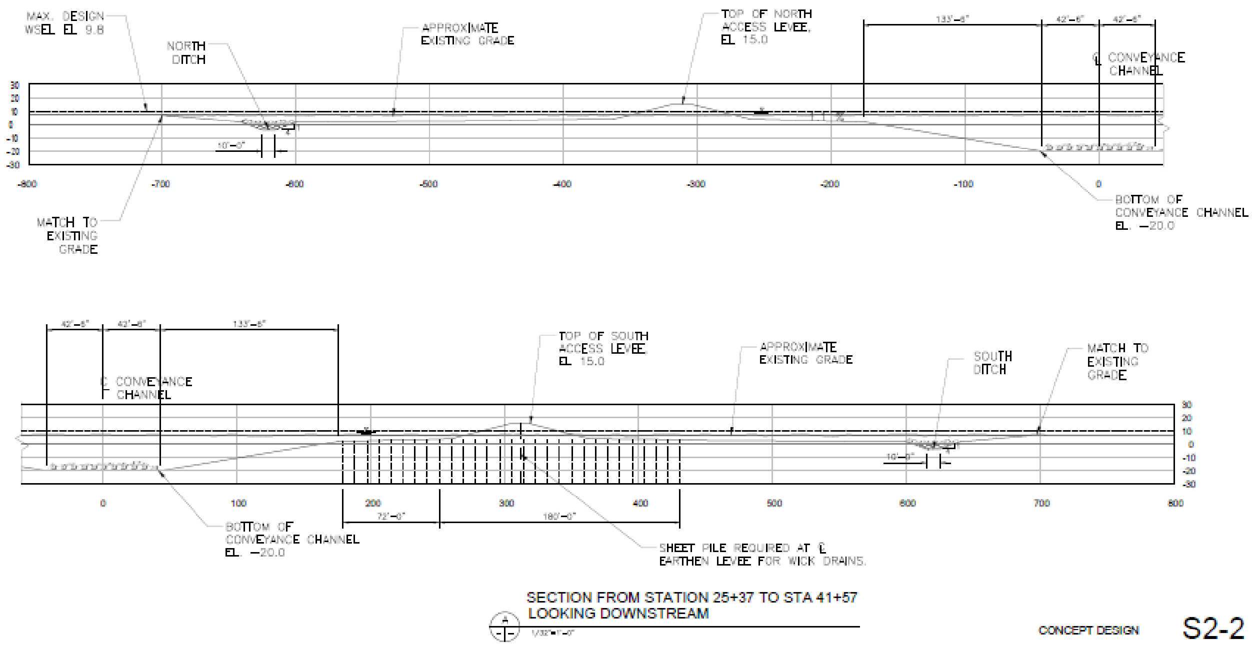

Figure C.12a Alt. B – Typical Cross-Sectional View of the Conveyance Channel

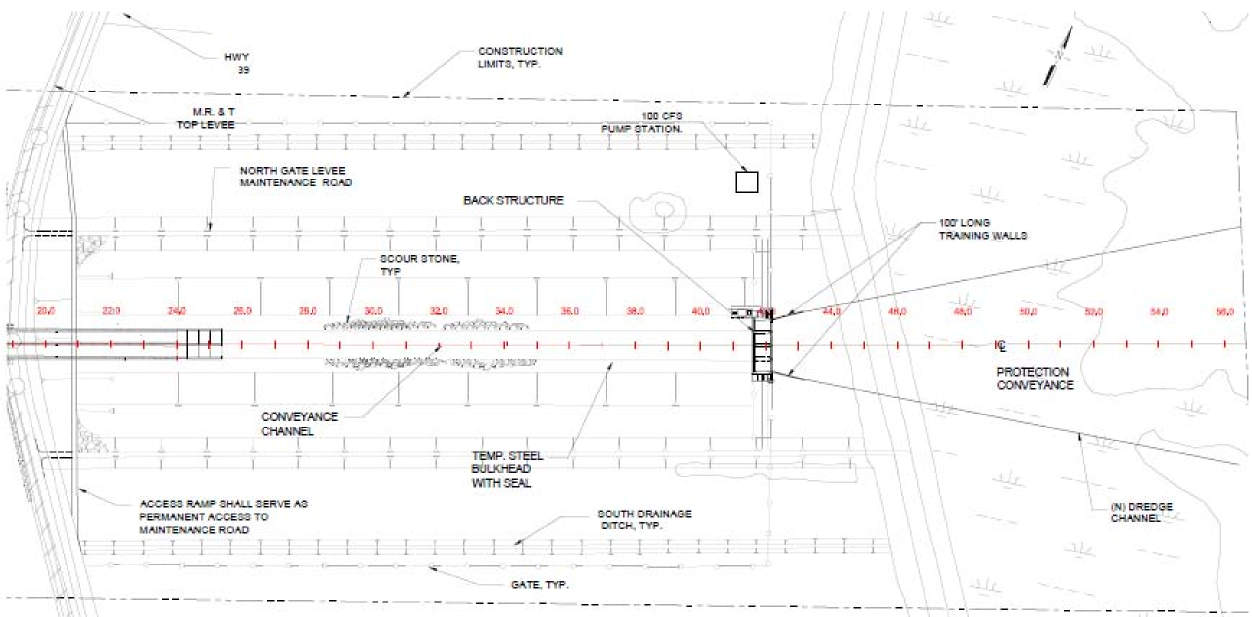

Figure C.12b Alt. B – Plan View of the Back Structure and Outlet/Discharge Channel

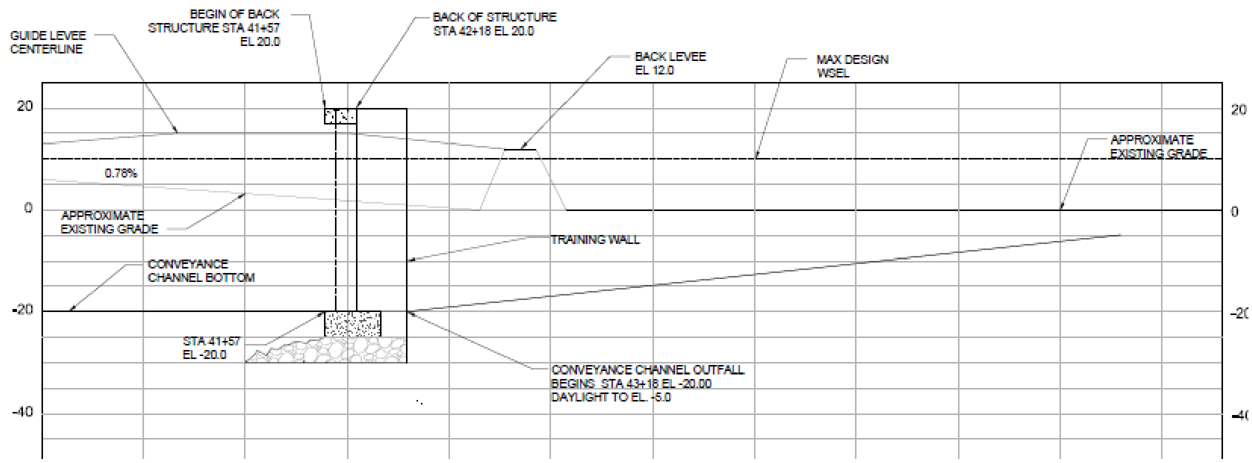

Figure C.12c Alt. B – Profile View of the Back Structure and Outlet/Discharge Channel

Alternate C: "In the Wet" Roller Gate Control Structure and submerged box culvert intake & out channels (with eductors) with inverts at -60-ft

The following discussion applies to Alternate C. Figure C.13 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.14, shows a plan view of how this open topped Approach Channel connects to an operating roller 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 Hwy 39, and beneath an end levee of the Conveyance Channel where the tube daylights with paving blocks in the transition area to the Conveyance Canals.

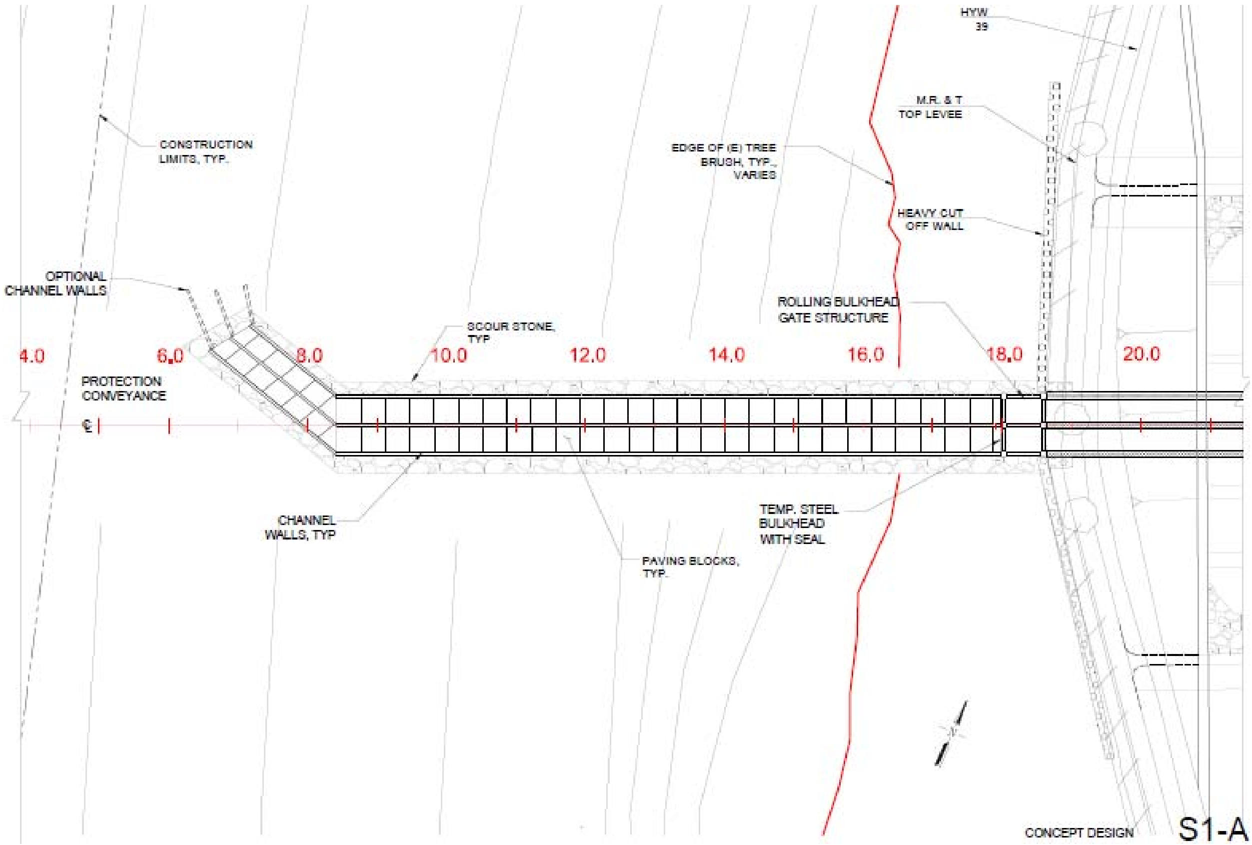

Figure C.13 Alt. C - Plan View of a Detail of the Inlet/Approach Channel

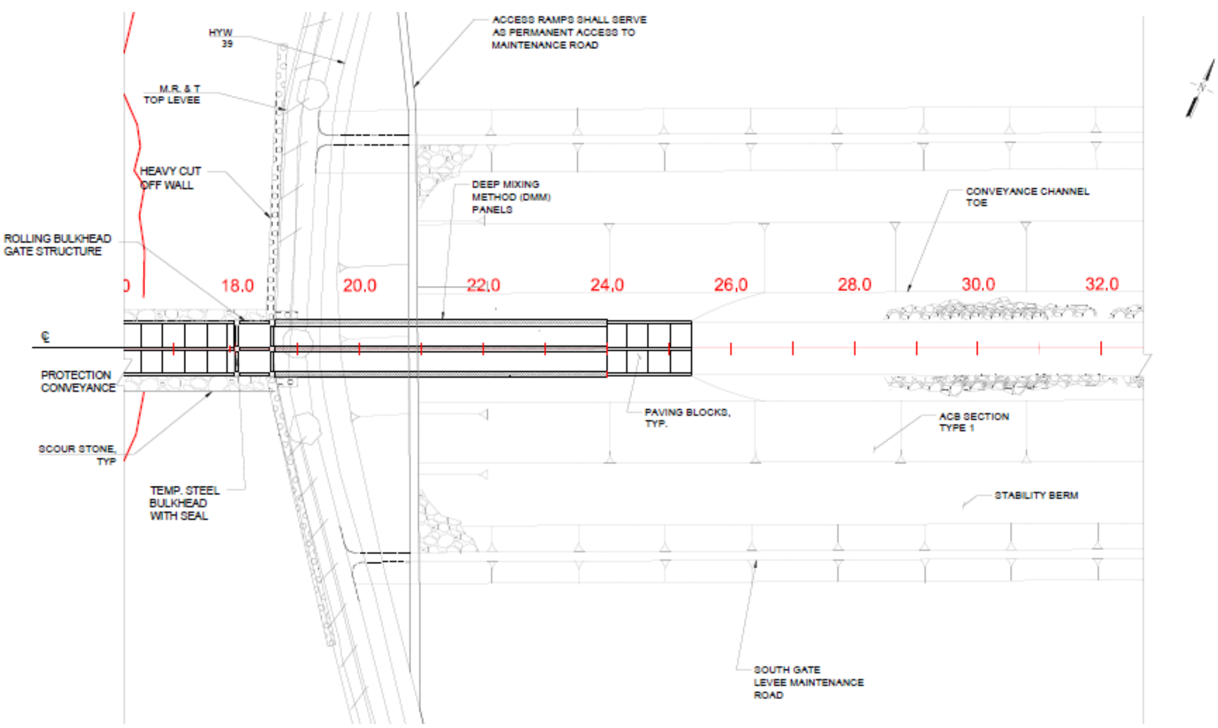

Figure C.14 Alt. C – Plan View of the Inlet/Approach Channel, Control Structure, Submerged Box Culverts & Transition to the Conveyance Channel

Figure C.15 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.16 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.17 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.18 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.

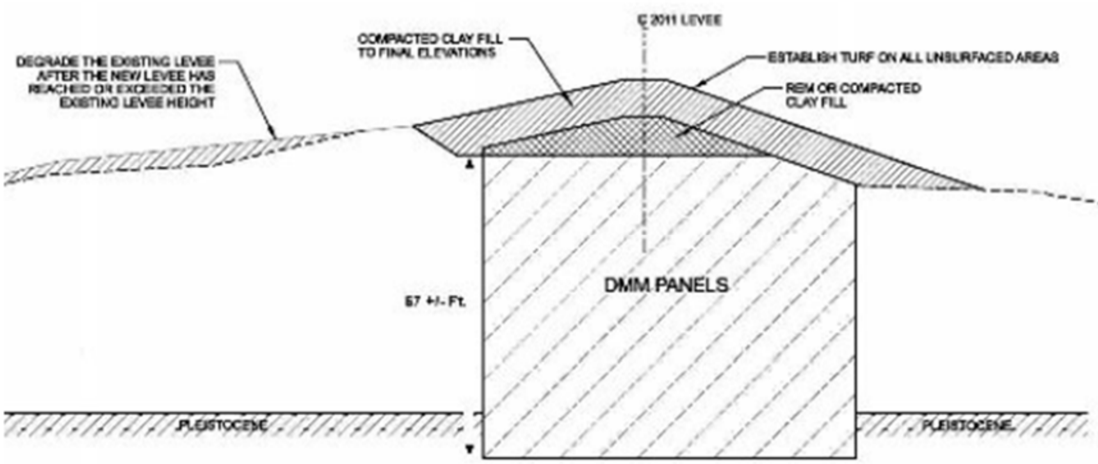

Figure C.15 Alt. C – Profile View of the Deep Mixing Method, DMM, Panels Which Illustrates How the DMM Side Walls of the Submerged Box Culverts Can Engage the Pleistocene Layer to Prevent the Possible Formation of a Deep Seated Failure Surface Through the Soil Near the MR&T Levee

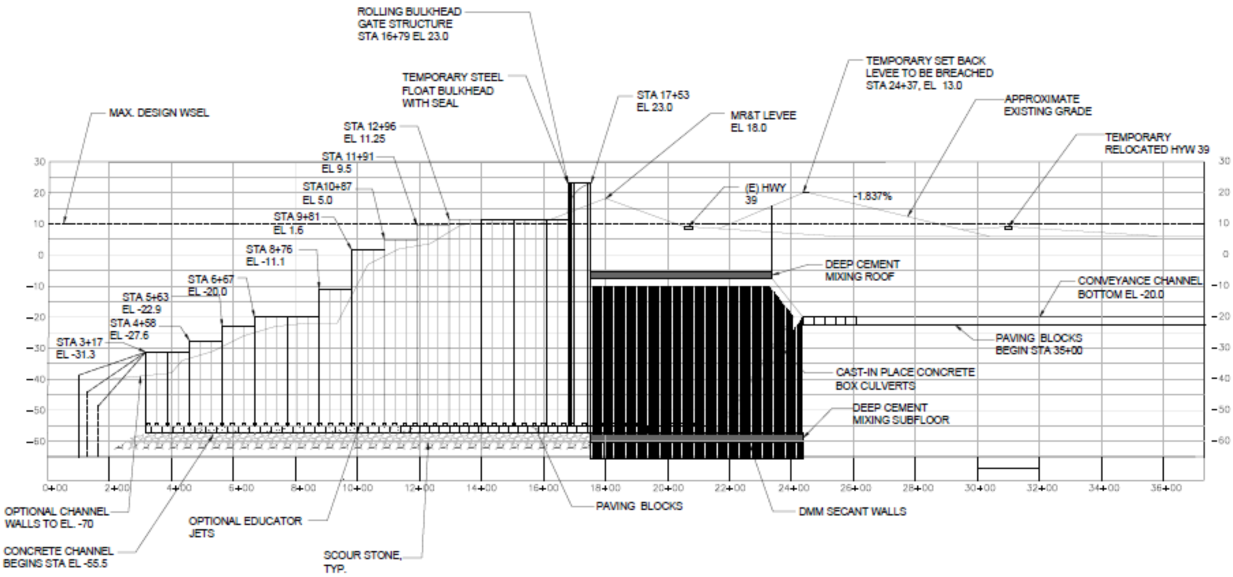

Figure C.16 Alt. C – Profile View of the Inlet/Approach Channel, Control Structure, Submerged Box Culvert & Transition to the Conveyance Channel (This Image Shows both: (1) How the DMM Panels Can Engage the Pleistocene Layer to Prevent the Possible Formation of a Deep Seated Failure Surface Through the Soil Near the MR&T Levee; and (2) How Eductor Jets Can Prevent the Approach Channel and Submerged Box Culverts from Plugging with Sediment)

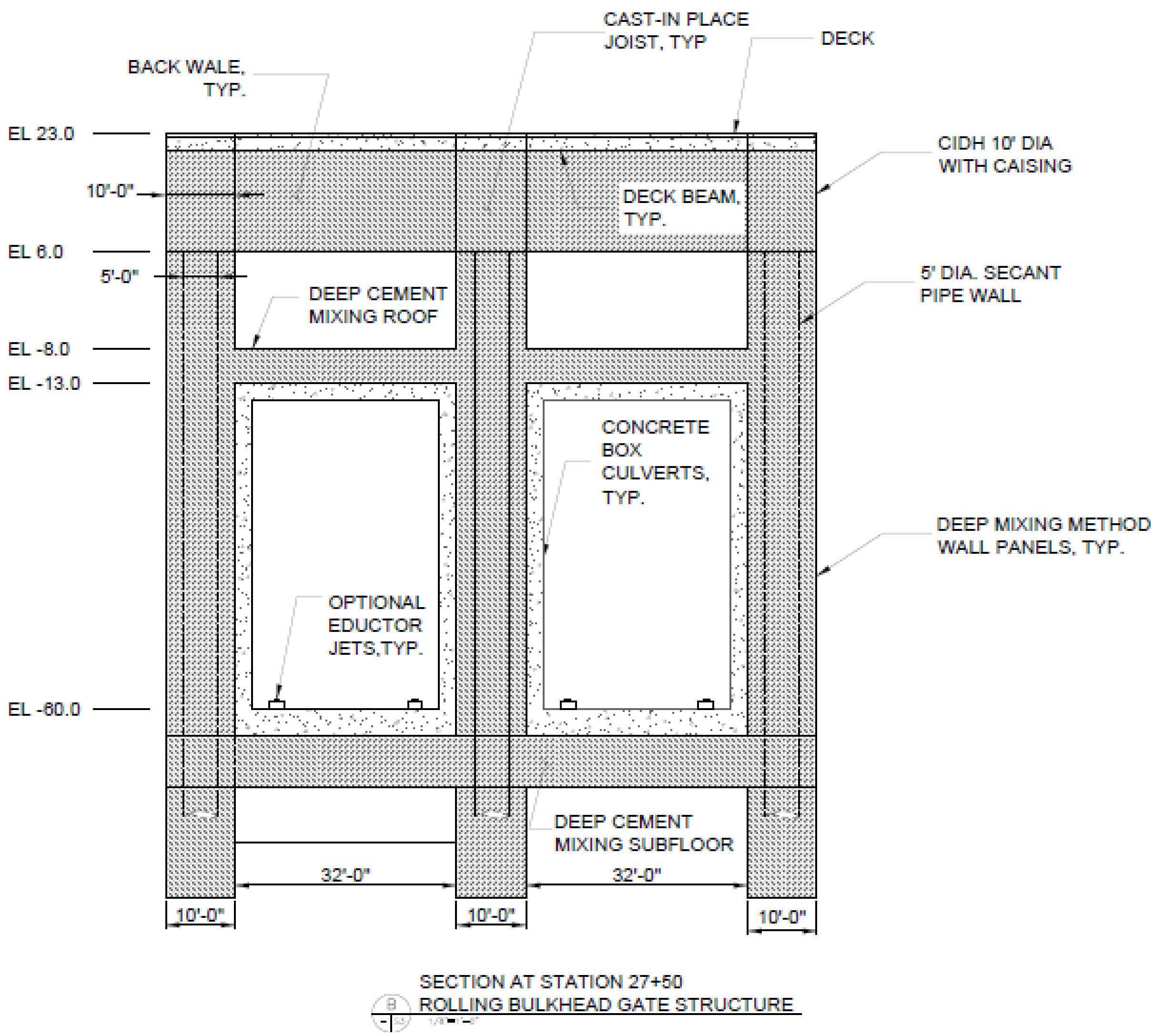

Figure C.17 Alt. C – Cross-Sectional View of the Submerged Box Culverts, with a Cast-In-Place Concrete Liner (This Image Shows How Eductor Jets (Sand Pumps) Can Prevent the Submerged Box Culverts from Plugging with Sediment)

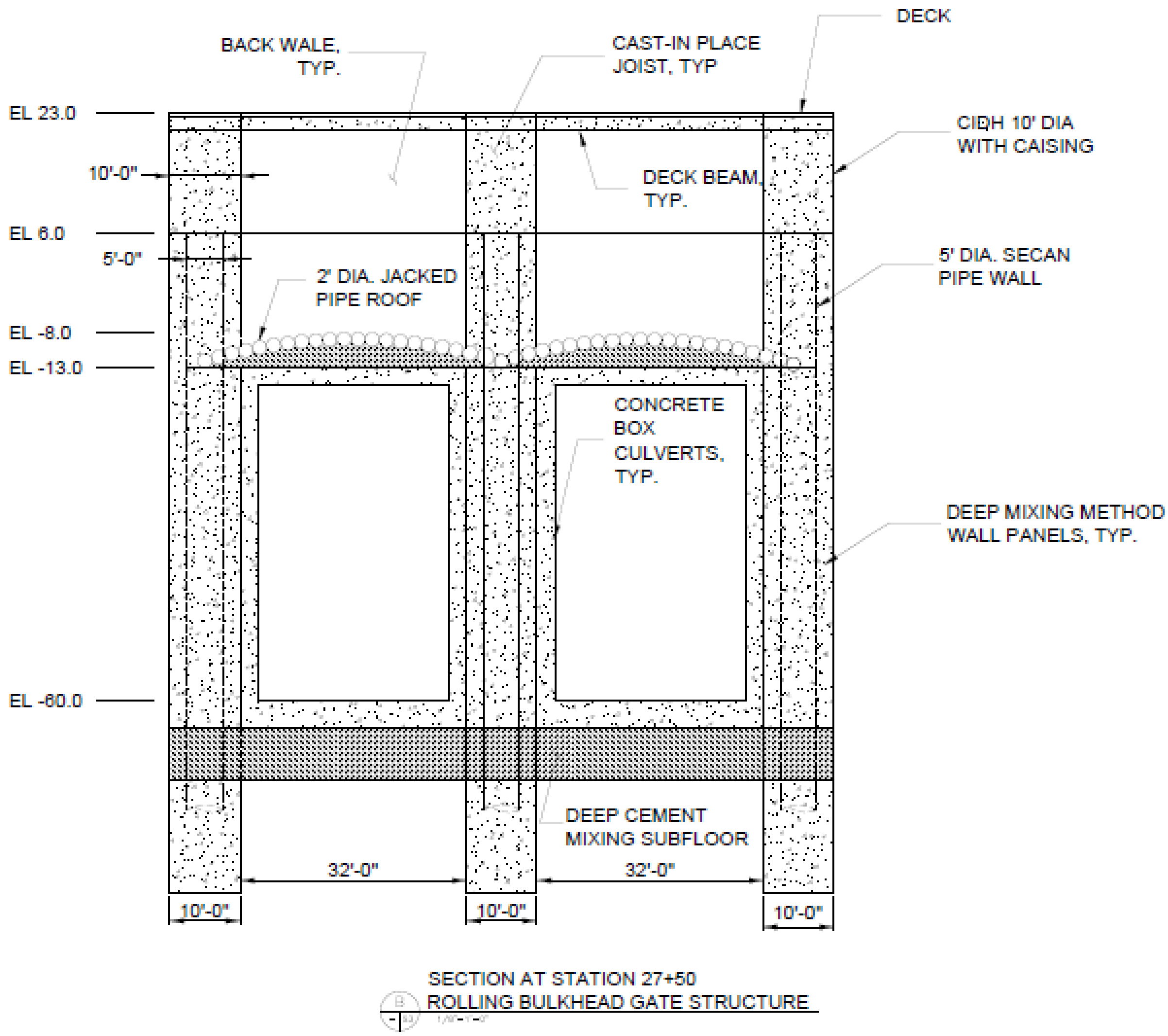

Figure C.18 Alt. C – Alternate Cross-Sectional View of the Submerged Box Culverts, Illustrating How Jacked Pipes Could be Used to Form the Roof if Preferred (note eductors are not shown)

Figure C.19 shows a plan view of the back structure, submerged box culverts & transition to the Barataria Basin. Similarly, Figure C.20 shows a profile view of the Back Structure, Submerged Box Culverts & Transition to the Breton Sound 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.21 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.22 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).

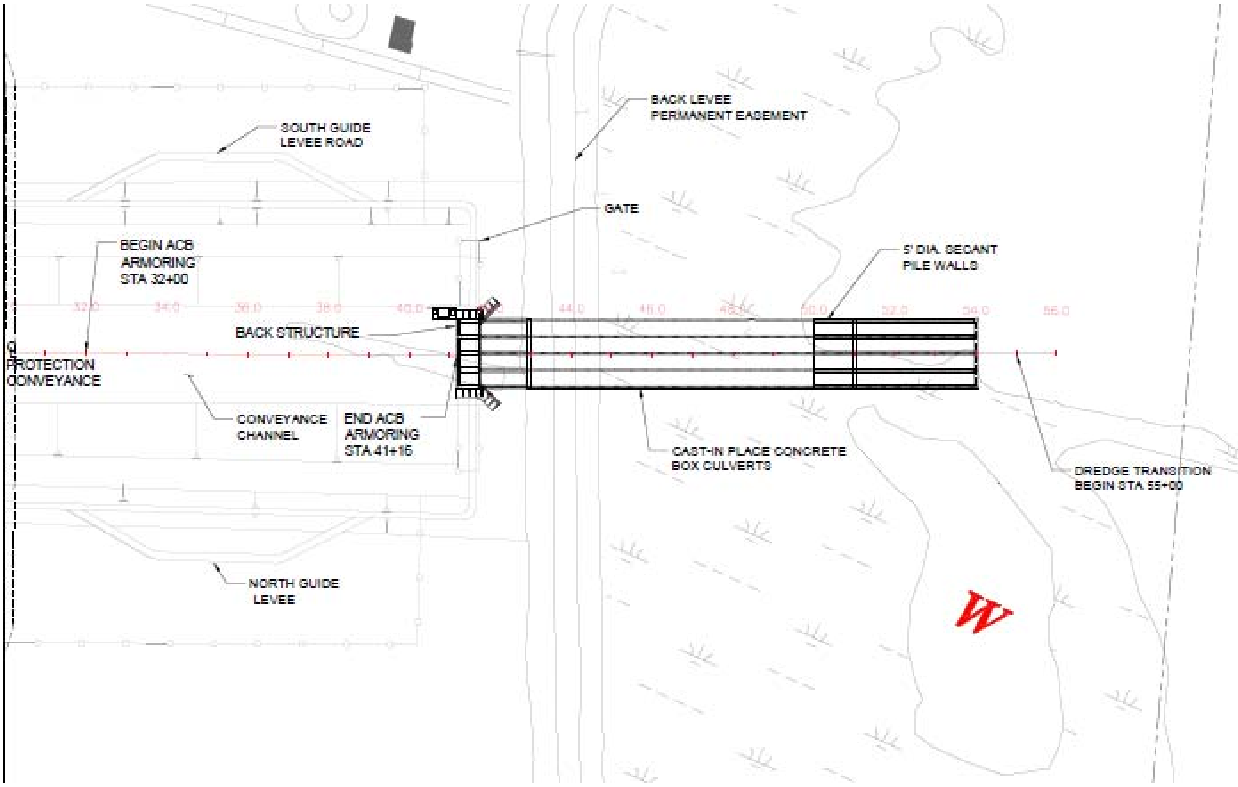

Figure C.19 Alt. C – Plan View of the Back Structure, Submerged Box Culverts & Transition to the Breton Sound Basin

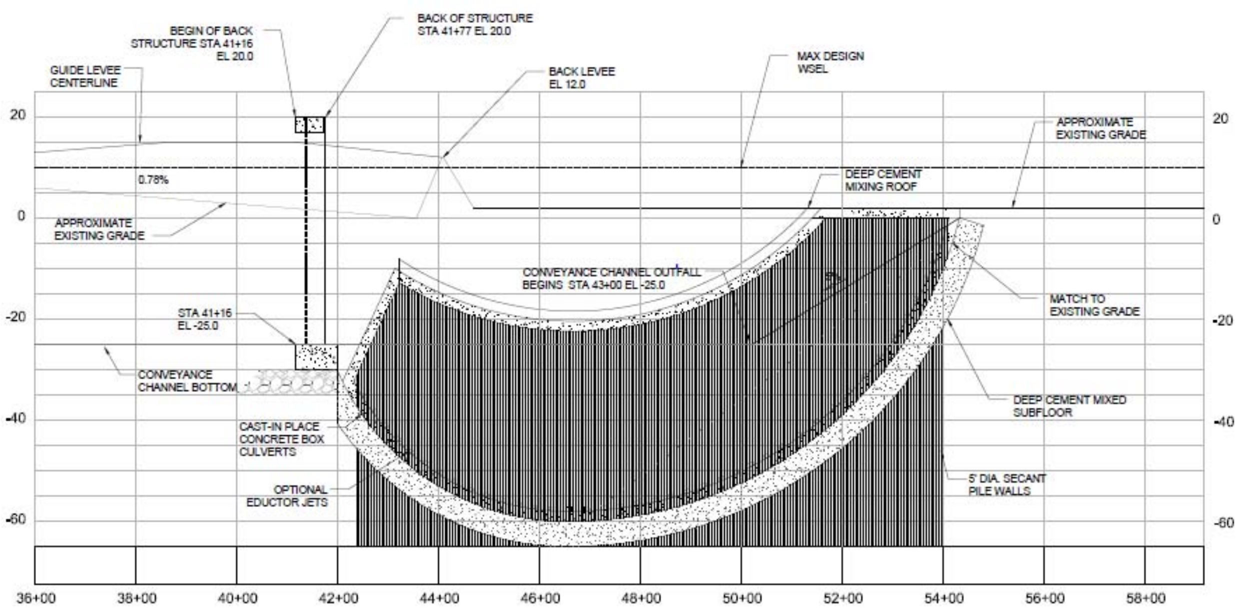

Figure C.20 Alt. C – Profile View of the Back Structure, Submerged Box Culverts & Transition to the Breton Sound Basin

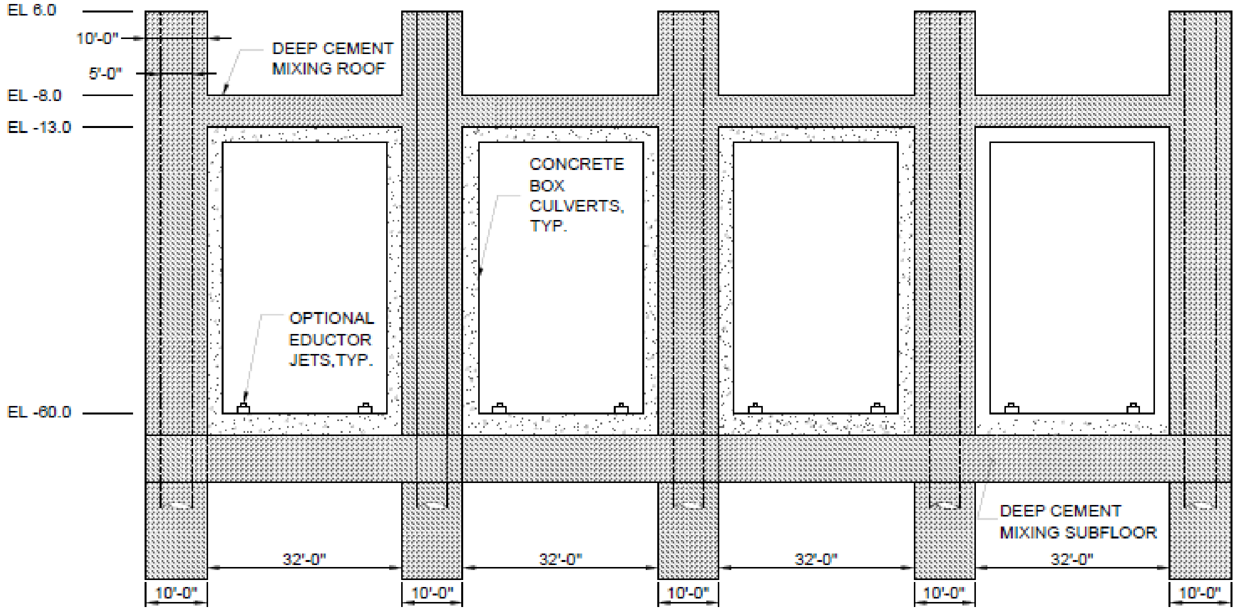

Figure C.21 Alt. C – Cross-Sectional View of the Outlet Submerged Box Culverts, with a Cast-In-Place Concrete Liner (This Image Shows How Eductor Jets (which could be either embedded in, or on top of, the floor slab) Can Prevent the Submerged Box Culverts from Plugging with Sediment)

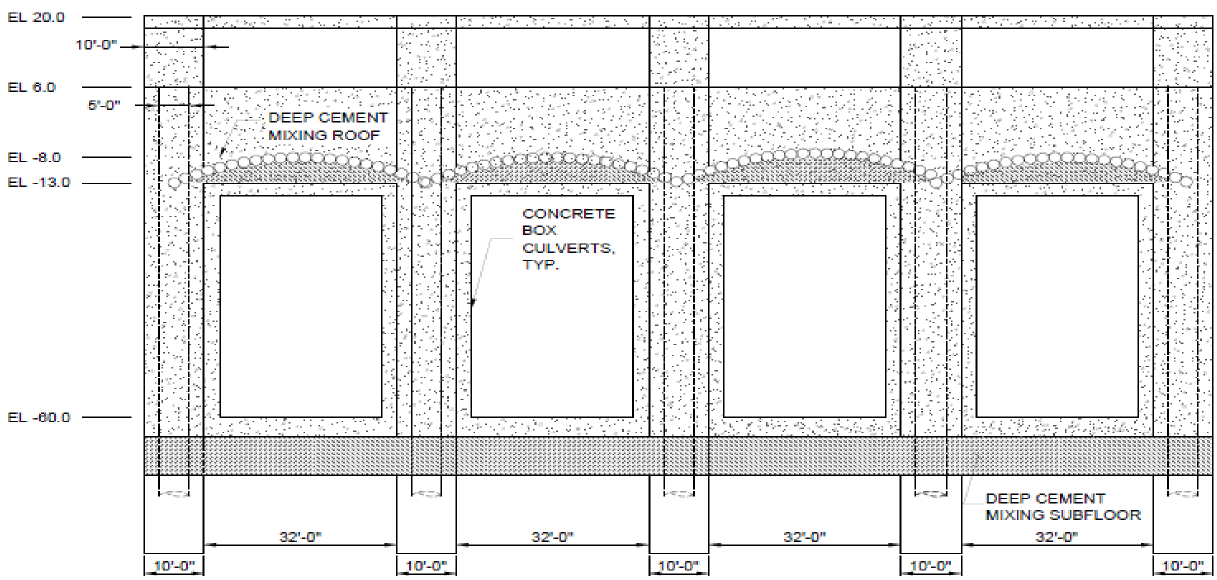

Figure C.22 Alt. C – Alternate Cross-Sectional View of the Outlet Submerged Box Culverts, with a Temporary Horizontally Directionally Drilled Pipe Roof, and with a Cast-In-Place Concrete Liner (eductor jets are not shown)

Luke E. LeBas, P.E. **Atkins** 445 North Boulevard, Suite 805 Baton Rouge, LA 70802 Luke.Lebas@atkinsglobal.com 225.663.7951	**Keith Boeneke** **Atkins** 445 North Boulevard, Suite 805 Baton Rouge, LA 70802 Keith.Boeneke@atkinsglobal.com 225.663.7960	**Dale Berner, Ph.D., P.E.** **COWI** 1300 Clay Street, 7th Floor Oakland, CA 94612 deb@cowi.com 510.267.7132	**Dennis Lambert, P.E.** **COWI** 400 Poydras Street, Suite 1160 New Orleans, LA 70130 delm@cowi.com 504.528.2004 Ext. 115

www.atkinsglobal.com