Final Independent External Peer Review Report Coastal Texas Protection and Restoration, Integrated Feasibility Report and Environmental Impact Statement

Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Coastal Storm Risk Management National Planning Center of Expertise
Baltimore District

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BATTELLE
It can be done

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Executive Summary

PROJECT BACKGROUND AND PURPOSE

The U.S. Army Corps of Engineers (USACE) is conducting a Mega Study, the Coastal Texas Protection and Restoration, Integrated Feasibility Report and Environmental Impact Statement. This Mega Study addresses Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) along the entire Texas Gulf Coast, from the mouth of the Sabine River to the mouth of the Rio Grande. The study includes the Gulf and tidal waters, barrier islands, estuaries, coastal wetlands, rivers and streams, and adjacent areas that make up the interrelated ecosystem along the coast of Texas. The study area encompasses 18 coastal counties along the Gulf Coast and bayfronts, and has been divided into four regions loosely based on major bay systems and habitats.

The Texas coastal zone contains several large cities at risk during storm events including the nation's fourth largest city, Houston. The coastal region is home to approximately 6.1 million people. Mineral production has a value of nearly $1 billion per year and commercial fisheries generate another $156 million. Agriculture in the less populated counties generates approximately $500 million of product per year. The value of goods exported from Texas ports in 2011 was $251 million, more than that from all other states.

Independent External Peer Review Process

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. USACE is conducting an Independent External Peer Review (IEPR) of the Coastal Texas Protection and Restoration, Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS) (hereinafter: Coastal Texas IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, free from conflicts of interest (COIs), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2018). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate this IEPR. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2018) and OMB (2004). This final report presents the Final Panel Comments of the IEPR Panel (the Panel). Details regarding the IEPR (including the process for selecting panel members, the panel members' biographical information and expertise, and the charge submitted to the Panel to guide its review) are presented in appendices.

Based on the technical content of the decision documents and the overall scope of the project, Battelle identified potential candidates for the Panel in the following key technical areas: Civil Works planning/economics, ecological modeling, environmental law compliance, hydrology and hydraulics

(H&H)/coastal engineering, and geotechnical engineering. Battelle screened the candidates to identify those most closely meeting the selection criteria and evaluated them for COIs and availability. USACE was given the list of all the final candidates to independently confirm that they had no COIs, and Battelle made the final selection of the five-person Panel from this list.

The Panel received electronic versions of the decision documents (2,406 pages in total), along with a charge that solicited comments on specific sections of the documents to be reviewed. Following guidance provided in USACE (2018) and OMB (2004), USACE prepared the charge questions, which were included in the draft and final Work Plans.

The USACE Project Delivery Team (PDT) briefed the Panel and Battelle during a kick-off meeting held via teleconference at the start of the review to provide the Panel an opportunity to ask questions of USACE and clarify uncertainties. Other than Battelle-facilitated teleconferences, there was no direct communication between the Panel and USACE during the peer review process.

IEPR panel members reviewed the decision documents individually and produced individual comments in response to the charge questions. The panel members then met via teleconference with Battelle to review key technical comments and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium/high, medium, medium/low, or low); and (4) recommendations on how to resolve the comment. Overall, 16 Final Panel Comments were identified and documented. Of these, two were identified as having high significance, five had medium/high significance, five had medium significance, two had medium/low significance, and two had low significance.

Results of the Independent External Peer Review

The panel members agreed on their “assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used” (USACE, 2018) in the Coastal Texas review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel’s findings.

Based on the Panel’s review, the project represents an enormous amount of work and demonstrates significant interagency coordination. The structural engineering narratives and conceptual design are well done. The alternatives screening is clear and well described, and the ecological and biological resources coverage is thorough and consistently supported by existing literature. The Panel noted that the work performed to date sets a very good foundation, however, some of the analyses only rise to a reconnaissance level investigation rather than a feasibility level investigation. The Panel finds that additional data collection, assessment, modeling and analysis are warranted for several elements of the project. In addition, given the complexity of this project, the panel is concerned that the current 10-year schedule and cost is unrealistic. These concerns are described below in additional detail.

Plan Formulation/Economics: Considering the magnitude and complexity of this undertaking, the plan formulation effort is nothing short of heroic. However, the project is very large and complex. One of the Panel’s primary concerns is the lack of detail in the economic, engineering, and environmental evaluations for what is supposed to be a feasibility-level study. For example, the alternative analysis does not include evaluating ecosystem restoration measures without the coastal storm risk management

(CSRM) or the beneficial use of dredge material as part of long-term maintenance or a programmatic plan. Additionally, evaluations of ER measures do not include estimates of any incidental recreation economic benefits that might accrue to them. Finally, neither of the CSRM features reach feasibility based on damages reduced and both demonstrate a highly uncertain probability of economic success. The Panel believes these matters can only be addressed with more rigorous evaluation. These are the types of issues that are discovered and addressed when project features are evaluated individually under a programmatic rather that a single multipurpose project.

Another primary concern is that the estimated 10-year project schedule and the cost are unrealistic. Based on the actual construction of other Federal and state funded Mega projects being built throughout the country that are of similar size, complexity, and cost to this project, the Panel notes that none have been completed nor will be completed in 10 years. All took significantly longer time and more money.

Other concerns include the insufficient analysis of the recreational benefits provided by the South Padre CSRM feature and lack of clarity in how sea level rise data are used in the modeling of base storm surge and coastal storm protection to produce economic benefits. The Panel notes that the basis for selecting ER Alternative 1 Scale 2 over ER Alternative 4 Scale 2 is not supported, that it is unclear whether enough measures are in the design to reduce risk to loss of life, and that there is a high risk associated with non-performance. The Panel also notes that the structural inventory does not address why structures already protected were excluded and that no consideration is given to the likelihood that ER measures produce tangible recreational economic benefits.

Engineering: The structural engineering narratives and conceptual design are well done, and it is clear that considerable time was spent laying out potential design and construction scenarios. A primary concern of the Panel, though, is that the engineering appendix appears to lack model calibration and validation information regarding the ADCIRC-STWAVE and adaptive hydraulics (ADH) models. Given the poor goodness-of-fit of the storm surge model, and a lack of calibration and validation information for ADCIRC-STWAVE there is a lack of confidence by the Panel in the modeling results. Additionally, the Panel notes the proposed use of turf alone for levee erosion protection may not be adequate and there is a lack of geotechnical data and geotechnical engineering design in the DIFR-EIS.

Environmental: The project incorporates a wide range of structural, nonstructural, and ecosystem restoration measures, and the strategy of multiple lines of defense inherently target the diverse functions of coastal habitats. Important issues identified by the Panel are that the project does not have consistent biological analyses or modeling tools designed for a comprehensive coast-wide assessment, and that the effects of sea level rise and the interactions between physical and water quality variables, habitat structure, and biological resources are not covered and are assumed to be constant. Also, the Panel notes that the potential environmental impacts in the estuary related to sector gate installation may be understated, and that measures to monitor and reduce potential long-term impacts from changes in freshwater inputs and salinity are not addressed or discussed in the cumulative analysis. No mitigation is discussed regarding potential impacts to listed species from the proposed surge gate, changes in water quality or habitat shifts which may result from the CSRM measures.

Table ES-1. Overview of 16 Final Panel Comments Identified by the Coastal Texas IEPR Panel

No.	Final Panel Comment
Significance – High	
1	The lack of detail in the economic, engineering, and environmental evaluations of the project, as described in the DIFR-EIS, equates to a reconnaissance-level investigation rather than a feasibility-level finding.
2	The DIFR-EIS does not provide sufficient analysis of the recreational benefits provided by the South Padre CSRM feature.
Significance – Medium/High	
3	For the ADCIRC-STWAVE and adaptive hydraulics (ADH) models, the Engineering Appendix does not present or discuss any model calibration and validation goals.
4	It is unclear how the sea level rise data are used in the modeling of base storm surge and coastal storm protection to produce the range of possible economic benefits for both the CSRM and ER components of the project.
5	Given the size and complexity of this project, the estimated 10-year schedule and the cost are unrealistic.
6	The scope of the DIFR-EIS does not have consistent biological analyses or modeling tools designed for a comprehensive coast-wide assessment of CSRMs and ER plans.
7	The effects of sea level rise and the relationships and interactions between physical and water quality variables, habitat structure, and the biological resources are not covered and are assumed to be constant in the HEP for the ER measures.
Significance – Medium	
8	The basis for selecting ER Alternative 1 Scale 2 over ER Alternative 4 Scale 2 is not supported.
9	The proposed use of turf alone for levee erosion protection may not be adequate.
10	The potential environmental impacts in the estuary as a result of sector gate installation may be understated.
11	Measures to monitor and reduce potential long-term impacts from changes in freshwater inputs and salinity are not addressed, nor are regional freshwater and salinity impacts fully discussed in the cumulative analysis.

Table ES-1. Overview of 16 Final Panel Comments Identified by the Coastal Texas IEPR Panel (continued)

No.	Final Panel Comment
Significance – Medium	
12	It is unclear whether enough measures are in the design to reduce risk to loss of life.
Significance – Medium/Low	
13	There is a high risk associated with non-performance given that no alternative scenario has a greater than a 75% chance of economic success in the CSRM for the Upper Texas Coast.
14	There is a lack of geotechnical data and geotechnical engineering design in the DIFR-EIS.
Significance – Low	
15	The Upper Texas Coast structure inventory does not address why structures already protected by projects previously constructed by HCFCD or USACE or proposed by HCFCD/USACE were excluded.
16	No consideration is given to the likelihood that ER measures produce tangible recreational economic benefits.

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LIST OF ACRONYMS

ADH	Adaptive Hydraulics (model)
ADCIRC-STWAVE	Advanced Circulation-Steady State Irregular WAVE numerical model
ADM	Agency Decision Milestone
AAHUs	Average annualized habitat units
BBEST	Basin and Bay Expert Science Team
BCR	Benefit cost ratio
C-CAP	Coastal Change Analysis Program
CAP	Continuing Authorities Program
CERP	Comprehensive Everglades Restoration Plan
COI	Conflict of Interest
CPT	Cone penetration test
CSRM	Coastal Storm Risk Management
DIFR	Draft Integrated Feasibility Report
DrChecks	Design Review and Checking System
DO	Dissolved oxygen
EC	Engineer Circular
EIS	Environmental Impact Statement
ER	Ecosystem Restoration
ERDC	Engineer Research and Development Center
FWOP	Future-without-project
FWP	Future-with-project
GIS	Geographic Information System
HCFCD	Harris County Flood Control District
HEP	Habitat Evaluation Procedure
HSI	Habitat Suitability Index
IEPR	Independent External Peer Review
IWR	Institute for Water Resources
NED	National Economic Development
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration

OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PDT	Project Delivery Team
RSLR	Relative sea level rise
REMI	Regional Economic Models, Inc.
SLR	Sea level rise
SAV	Submerged aquatic vegetation
TSP	Tentatively Selected Plan
UDV	Unit Day Value
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WVA	Wetland Value Assessment

1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE) is conducting a Mega Study, the Coastal Texas Protection and Restoration, Integrated Feasibility Report and Environmental Impact Statement. This Mega Study addresses Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) along the entire Texas Gulf Coast, from the mouth of the Sabine River to the mouth of the Rio Grande. The study includes the Gulf and tidal waters, barrier islands, estuaries, coastal wetlands, rivers and streams, and adjacent areas that make up the interrelated ecosystem along the coast of Texas.

The study area encompasses 18 coastal counties along the Gulf Coast and bayfronts, and has been divided into four regions loosely based on major bay systems and habitats. Region 1 extends from the mouth of Sabine River at the Texas-Louisiana border to west side of Galveston Bay. Region 2 includes the entire Matagorda Bay system from the Brazoria-Matagorda County line to the eastern edge of San Antonio Bay. Region 3 extends from San Antonio Bay to Baffin Bay, and Region 4 extends from the southern edge of Baffin Bay to the Texas-Mexico border.

The Texas coastal zone contains several large cities at risk during storm events including the nation's fourth largest city, Houston. The coastal region is home to approximately 6.1 million people. Mineral production has a value of nearly $1 billion per year and commercial fisheries generate another $156 million. Agriculture in the less populated counties generates approximately $500 million of product per year. The value of goods exported from Texas ports in 2011 was $251 million, more than that from all other states.

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Coastal Texas Protection and Restoration, Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS) (hereinafter: Coastal Texas IEPR) in accordance with procedures described in the Department of the Army, USACE, Engineer Circular (EC) *Review Policy for Civil Works* (EC 1165-2-217) (USACE, 2018) and the Office of Management and Budget (OMB), *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Supplemental guidance on evaluation for conflicts of interest (COIs) was obtained from the *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

This final report presents the Final Panel Comments of the IEPR Panel (the Panel) on the existing engineering, economic, environmental, and plan formulation analyses contained in the Coastal Texas IEPR documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted, including the schedule followed in executing the IEPR. Appendix B provides biographical information on the IEPR panel members and describes the method Battelle followed to select them. Appendix C presents the final charge to the IEPR panel members for their use during the review; the final charge was submitted to USACE in the final Work Plan according to the schedule listed in Table A-1. Appendix D presents the organizational COI form that Battelle completed and submitted to the Institute for Water Resources (IWR) prior to the award of the Coastal Texas IEPR.

2. PURPOSE OF THE IEPR

To ensure that USACE documents are supported by the best scientific and technical information, USACE has implemented a peer review process that uses IEPR to complement the Agency Technical Review, as described in USACE (2018).

In general, the purpose of peer review is to strengthen the quality and credibility of the USACE decision documents in support of its Civil Works program. IEPR provides an independent assessment of the engineering, economic, environmental, and plan formulation analyses of the project study. In particular, the IEPR addresses the technical soundness of the project study's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the Coastal Texas Mega Study was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-217). Battelle, a 501(c)(3) organization under the U.S. Internal Revenue Code, has experience conducting IEPRs for USACE.

3. METHODS FOR CONDUCTING THE IEPR

The methods used to conduct the IEPR are briefly described in this section; a detailed description can be found in Appendix A. The IEPR was completed in accordance with established due dates for milestones and deliverables as part of the final Work Plan; the due dates are based on the award/effective date and the receipt of review documents.

Battelle identified, screened, and selected five panel members to participate in the IEPR based on their expertise in the following disciplines: Civil Works planning/economics, ecological modeling, environmental law compliance, hydrology and hydraulics (H&H)/coastal engineering, and geotechnical engineering. The Panel reviewed the Coastal Texas documents and produced 16 Final Panel Comments in response to 16 charge questions provided by USACE for the review. This charge included two overview questions and one public comment question added by Battelle. Battelle instructed the Panel to develop the Final Panel Comments using a standardized four-part structure:

1. Comment Statement (succinct summary statement of concern)
2. Basis for Comment (details regarding the concern)
3. Significance (high, medium/high, medium, medium/low, or low; in accordance with specific criteria for determining level of significance)
4. Recommendation(s) for Resolution (at least one implementable action that could be taken to address the Final Panel Comment).

Battelle reviewed all Final Panel Comments for accuracy, adherence to USACE guidance (EC 1165-2-217), and completeness prior to determining that they were final and suitable for inclusion in the Final IEPR Report. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Panel's findings are summarized in Section 4.1; the Final Panel Comments are presented in full in Section 4.2.

4. RESULTS OF THE IEPR

This section presents the results of the IEPR. A summary of the Panel's findings and the full text of the Final Panel Comments are provided.

4.1 Summary of Final Panel Comments

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2018) in the Coastal Texas IEPR review documents. The following summarizes the Panel's findings.

Based on the Panel's review, the project represents an enormous amount of work and demonstrates significant interagency coordination. The structural engineering narratives and conceptual design are well done. The alternatives screening is clear and well described, and the ecological and biological resources coverage is thorough and consistently supported by existing literature. The Panel noted that the work performed to date sets a very good foundation, however, some of the analyses only rise to a reconnaissance level investigation rather than a feasibility level investigation. The Panel finds that additional data collection, assessment, modeling and analysis are warranted for several elements of the project. In addition, given the complexity of this project, the panel is concerned that the current 10-year schedule and cost is unrealistic. These concerns are described below in additional detail.

Plan Formulation/Economics: Considering the magnitude and complexity of this undertaking, the plan formulation effort is nothing short of heroic. However, the project is very large and complex. One of the Panel's primary concerns is the lack of detail in the economic, engineering, and environmental evaluations for what is supposed to be a feasibility-level study. For example, the alternative analysis does not include evaluating ecosystem restoration measures without the coastal storm risk management (CSRM) or the beneficial use of dredge material as part of long-term maintenance or a programmatic plan. Additionally, evaluations of ER measures do not include estimates of any incidental recreation economic benefits that might accrue to them. Finally, neither of the CSRM features reach feasibility based on damages reduced and both demonstrate a highly uncertain probability of economic success. The Panel believes these matters can only be addressed with more rigorous evaluation. These are the types of issues that are discovered and addressed when project features are evaluated individually under a programmatic rather that a single multipurpose project.

Another primary concern is that the estimated 10-year project schedule and the cost are unrealistic. Based on the actual construction of other Federal and state funded Mega projects being built throughout the country that are of similar size, complexity, and cost to this project, the Panel notes that none have been completed nor will be completed in 10 years. All took significantly longer time and more money.

Other concerns include the insufficient analysis of the recreational benefits provided by the South Padre CSRM feature and lack of clarity in how sea level rise data are used in the modeling of base storm surge and coastal storm protection to produce economic benefits. The Panel notes that the basis for selecting ER Alternative 1 Scale 2 over ER Alternative 4 Scale 2 is not supported, that it is unclear whether enough measures are in the design to reduce risk to loss of life, and that there is a high risk associated with non-performance. The Panel also notes that the structural inventory does not address why structures already protected were excluded and that no consideration is given to the likelihood that ER measures produce tangible recreational economic benefits.

Engineering: The structural engineering narratives and conceptual design are well done, and it is clear that considerable time was spent laying out potential design and construction scenarios. A primary concern of the Panel, though, is that the engineering appendix appears to lack model calibration and validation information regarding the ADCIRC-STWAVE and adaptive hydraulics (ADH) models. Given the poor goodness-of-fit of the storm surge model, and a lack of calibration and validation information for ADCIRC-STWAVE there is a lack of confidence by the Panel in the modeling results. Additionally, the Panel notes the proposed use of turf alone for levee erosion protection may not be adequate and there is a lack of geotechnical data and geotechnical engineering design in the DIFR-EIS.

Environmental: The project incorporates a wide range of structural, nonstructural, and ecosystem restoration measures, and the strategy of multiple lines of defense inherently target the diverse functions of coastal habitats. Important issues identified by the Panel are that the project does not have consistent biological analyses or modeling tools designed for a comprehensive coast-wide assessment, and that the effects of sea level rise and the interactions between physical and water quality variables, habitat structure, and biological resources are not covered and are assumed to be constant. Also, the Panel notes that the potential environmental impacts in the estuary related to sector gate installation may be understated, and that measures to monitor and reduce potential long-term impacts from changes in freshwater inputs and salinity are not addressed or discussed in the cumulative analysis. No mitigation is discussed regarding potential impacts to listed species from the proposed surge gate, changes in water quality or habitat shifts which may result from the CSRM measures.

4.2 Final Panel Comments

This section presents the full text of the Final Panel Comments prepared by the IEPR panel members.

Final Panel Comment 1

The lack of detail in the economic, engineering, and environmental evaluations of the project, as described in the DIFR-EIS, equates to a reconnaissance-level investigation rather than a feasibility-level finding.

Basis for Comment

The DIFR-EIS is a massive undertaking. The scope of the Tentatively Selected Plan (TSP) covers the entire Texas coast and encompasses just under a quarter of the total U.S. coastline of the Gulf of Mexico. The mid-range of the high and low planning cost estimates is approximately $27 billion in FY2018 dollars and it is planned to be implemented within a 10-year construction schedule.

The TSP includes two large-scale coastal storm risk management (CSRM) features and nine ER features of varying scales. Each feature poses its own set of unique construction challenges. The DIFR-EIS does not explore the linkages with and interactions between these features and challenges except in the broadest detail. This Mega Study calls for a Herculean effort to stage construction activities for large efforts using very scarce equipment.

While the DIFR-EIS is presented as a feasibility-level decision document, the level of detail in the economic, engineering, and environmental evaluations for the CSRM, and particularly the ER features, is that of a reconnaissance investigation. While the DIFR-EIS provides ample evidence that there is a Federal interest in pursuing the proposed measures in conjunction with non-Federal partners, the Panel believes that the sum of the reconnaissance parts does not equal a feasibility-level finding. Each of the proposed measures would still have uncertain and variable probabilities of success if evaluated individually. Consequently, the Panel believes that the measures should be subjected to the more detailed scrutiny that is applied to stand-alone project proposals, in which each feature's feasibility is determined individually, even if included in an overarching coastal Texas protection and restoration program.

For example, the alternative analysis does not include evaluating ecosystem restoration measures without the CSRM or the beneficial use of dredge material as part of long-term maintenance or a programmatic plan. Additionally, evaluations of ER measures do not include estimates of any incidental recreation economic benefits that might accrue to them. Finally, neither of the CSRM features reach feasibility based on damages reduced and both demonstrate a highly uncertain probability of economic success. The Panel believes these matters can only be addressed with more rigorous evaluation. These are the types of issues that are discovered and addressed when project features are evaluated individually under a programmatic rather that a single multipurpose project.

Panel members have extensive, firsthand knowledge of previous mega-style efforts. These include the Comprehensive Everglades Restoration Plan (CERP); the Alabama Coosa Tallapoosa-Apalachicola Chattahoochee Flint Water Management Plans; Olmsted Locks and Dam Replacement; and Louisiana Coastal Wetlands Planning, Protection, and Restoration.

Each of these comprehensive efforts encountered delays and cost overruns caused by funding delays, construction scheduling issues, environmental concerns, non-Federal participation matters, and significant litigation.

Final Panel Comment 1

The costliest and widest-ranging of these efforts to date is CERP. When originally authorized in 2000, CERP was expected to cost approximately $10.5 billion and take 30 years to complete. The most recent estimates are approximately $12 billion and a 50-year schedule to be fully built and operational as planned; several other Everglades projects not foreseen in the original plan are almost certain.

Coastal Texas has more than twice the estimated cost of CERP, a construction schedule plan one-third of CERP's original estimate, and covers a considerably larger geographic, hydrologic, environmental, and economic scale.

The Panel therefore believes that the project-specific Environmental Impact Statement (EIS) framework is not suitable for justifying moving forward with the DIFR-EIS.

Significance – High

The size, complexity, and risk of failing to achieve project objectives within the expected construction schedule call for the DIFR-EIS to be developed in a programmatic rather than a project- specific framework.

Recommendations for Resolution

1. Develop a Draft Programmatic EIS for the DIFR-EIS.
2. Identify features that can be implemented using the USACE Continuing Authorities Program (CAP).
3. Examine CSRM and ER features that would exceed CAP limits in greater detail.

Final Panel Comment 2

The DIFR-EIS does not provide sufficient analysis of the recreational benefits provided by the South Padre CSRM feature.

Basis for Comment

Engineer Regulation 1105-2-100 (USACE, 2000) describes the technical basis and methods for using recreational benefits in the economic analysis of CSRM projects. The DIFR-EIS correctly uses only CSRM damage reduction benefits in plan formulation and only includes recreational benefits after the most efficient CSRM alternative has been identified.

The Panel notes, however, that the South Padre CSRM feature does not reach feasibility for any of the alternatives considered without recreational benefits added. In such a situation, the Panel believes that recreational benefits estimated using a generic Unit Day Value (UDV) method lacks transparency, and that the cap of 750,000 visitor days is not appropriate in this project evaluation.

Practical application of Engineer Regulation 1105-2-100's treatment of recreation in CSRM planning is that a UDV evaluation is appropriate when there is nothing special about the resource in question and/or expected annual visitation does not exceed 750,000. The DIFR-EIS does not explicitly discuss historical, existing, or future-without-project (FWOP) visitation, so the Panel cannot ascertain whether the 750,000 figure approximates actual or expected visitation.

If the FWOP visitation figure is significantly greater than 750,000, then a careful explanation should be presented of why using a UDV approach is appropriate and why a regional or project-specific model is not needed. If the figure is less than 750,000, then the justification of the project is uncertain. Even if 750,000 is a reasonably close approximation of expected visitation, the fact that project justification hinges upon the value of recreation generated by that visitation calls for a more transparent analysis of recreational benefits.

Significance – High

A thorough evaluation of recreational benefits is necessary to support project feasibility.

Recommendations for Resolution

1. Discuss historical, existing, and expected FWOP and future-with-project (FWP) visitation.
2. Determine if there are any existing regional models that are adaptable for use in this study.
3. Provide (via attachment or addendum to Appendix E) the UDV economic analysis and include the UDV used in estimating recreational benefits.

Literature Cited:

USACE (2000). Planning: Planning Guidance Notebook. Engineer Regulation 1105-2-100. Department of the Army, U.S. Corps of Engineers, Washington, DC. April 22.

Final Panel Comment 3

For the ADCIRC-STWAVE and adaptive hydraulics (ADH) models, the Engineering Appendix does not present or discuss any model calibration and validation goals.

Basis for Comment

For each model used, the goals for model calibration and validation are usually presented in terms of various goodness-of-fit statistics, comparing observed versus simulated data, as well as general conformance to conservation of mass or momentum. Some common goodness-of-fit statistics used in water resources modeling include coefficient of determination, cross correlation coefficient, integral square error, root mean square error, and Nash-Sutcliffe efficiency. The calibration or validation goals may vary depending upon the use of the model tool, but the overall goals are presented to demonstrate that the model meets them and therefore is able to simulate the physical processes well enough to make predictions.

For the ADCIRC-STWAVE model, the Engineering Appendix does not present or discuss any model calibration and validation goals. Only cross-correlation statistics are mentioned and some of these appear to be poor (e.g., values less than 0.5). Also, only model validation is discussed. For in water resources modeling, the model developers usually first calibrate the model against one or more real datasets, then separate datasets are used for validation. Model adjustments are made until both calibration and validation goals are met (using goodness-of-fit statistics primarily). The Panel assumes that many of these efforts were made, but just have not been included in the Engineering Appendix.

The Panel cannot say much about the adaptive hydraulics (ADH) modeling since the report and the Engineering Appendix provide neither the model calibration/validation goals nor the actual calibration/validation data. Such information is critical to ensure that the ADH modeling results are valid. Since considerable environmental impacts might occur as a result of the sector gate component of the project and the ADH model is the only tool used to assess these, it is critical that this additional information be provided.

Significance – Medium/High

The poor goodness-of-fit of the storm surge model calibration graph and the lack of calibration and validation information for ADCIRC-STWAVE and ADH results in lack of confidence in the modeling results.

Recommendations for Resolution

1. Include a discussion of model calibration/validation goals in the Engineering Appendix and demonstrate that the ADCIRC-STWAVE model meets the goals.
2. In the Engineering Appendix, explain why only ADCIRC-STWAVE model validation was completed as part of the study rather than a two-step calibration to validation effort.
3. Provide further goodness-of-fit statistics for the calibration/validation effort for the ADCIRC-STWAVE model. Include Nash-Sutcliffe efficiency in the final report.

Final Panel Comment 3

4. In the Engineering Appendix, provide all required ADH model development information in the Engineering Appendix, including a discussion of calibration/validation goals and the degree to which the ADH model met these.

Final Panel Comment 4

It is unclear how the sea level rise data are used in the modeling of base storm surge and coastal storm protection to produce the range of possible economic benefits for both the CSRM and ER components of the project.

Basis for Comment

The overall justification of both the CSRM and ER components of the TSP are highly correlated with relative sea level rise (RSLR) and the use of a regional economic multiplier model. The economic benefits vary widely depending upon which combination of RSLR and cost band (e.g., low cost or high cost) is used.

The need to include regional model and recreational benefits to reach unity in the CSRM benefit-to-cost ratio (BCR) introduces another layer of risk in project performance. While technical guidance allows for including these benefits in project justification, the closer one gets to BCR unity, the greater the effort needed to reduce uncertainty in the key variables that drive risk.

When reviewing the benefits summary table in the main report, all plans that include only standard USACE benefit categories for CSRM studies are much less attractive or not justified at all. For example, the “high cost” band combined with the low RSLR (using standard benefits) results in an unjustified project with a BCR of considerably less than unity. This is not surprising given the fact that, under a low RSLR scenario, the probability of the Bolivar Peninsula being overtopped is 80% or only 5% greater than under current sea level conditions. This means that under the low RSLR scenario the additional damage caused from an extreme storm is a relatively small change.

Although an abbreviated cost risk analysis has been conducted, the level of engineering detail for this study is very low due to its scope and complexity. Similar mega USACE projects have experienced significant cost growth over time (Everglades Restoration or Olmsted Lock and Dam are just two examples). Therefore, it is not unreasonable to expect that this project may also experience some degree of cost growth, rendering the proposed plan even less attractive as a national investment.

The risk of significant cost growth combined with the risk of nonperformance and low BCR of the CSRM measures underscore the need for greater scrutiny of the factors driving risk.

Significance – Medium/High

There is a fundamental issue with the economic justification, which in turn has a strong probability of influencing the technical justification of the recommended plan.

Recommendations for Resolution

1. Provide an expanded discussion of the risk of a project that has a BCR of less than 1.0.
2. Discuss the cost risk analysis in greater detail, particularly those management measures having the greatest influence on project performance.

Final Panel Comment 5

Given the size and complexity of this project, the estimated 10-year schedule and the cost are unrealistic.

Basis for Comment

This is a mega Mega Study. Currently, USACE has assumed that the entire project can be implemented over a 10-year construction period. The Panel is not familiar with any public works project of this size, complexity, and cost that has been completed in this timeframe.

The “Boston Big Dig” took more than 20 years, was six years behind its original schedule, and cost six times the original cost estimate (Pinto, 2010). Olmsted Lock and Dam has been under planning and construction for almost 30 years and is about $3 billion or about four times its original estimated cost (Glass, 2017). The Everglades Restoration (~$16.2 billion at last check and twice the original estimated cost) was scheduled for 30 years; based upon work completed to date, it is behind schedule by at least 7 to 10 years (Staletovich, 2017). Due to the chronic funding shortage from both the Federal government and the State of Florida, the Everglades project may not be completed for 100 years (Staletovich, 2017).

The total USACE new Civil Works budget for 2017 and 2018 was about $1 billion each year with a downward trend (USACE, 2016, 2017). If authorized, the proposed project would require $2 to $3 billion a year in cash flow to be constructed as scheduled. Therefore, both the Federal government and the State of Texas would have to contribute $1 to $1.5 billion per year for 10 years to make the project a reality as currently envisioned. The proposed Federal cost-share alone would be more than the entire annual USACE Civil Works budget. Putting the infeasible funding schedule aside, the sheer complexity of all of the construction features would surely make this much longer than 10 years.

Due to the scope and considerable area covered by the project, conducting the project in stages or phases over an extended period may also substantially reduce project impacts. Strategic construction phases by region and environmental windows would reduce vessel density and may reduce incidental take of Federally listed species from collision impacts. For example, extending the initial construction dredging activities stands to significantly reduce direct impacts on benthic and other marine resources. A longer planned implementation schedule may also allow for further innovations involving the proposed sector gate, which may further reduce potential environmental impacts.

USACE should look at other mega projects at all Districts and revise the construction (and funding) schedule to something that is more realistic.

Significance – Medium/High

The estimated 10-year project implementation schedule and the budget potentially could result in increased project costs and delays.

Final Panel Comment 5

Recommendations for Resolution

1. Develop a revised project implementation schedule more consistent with other USACE mega projects (e.g., Everglades Restoration).
2. Revise the project cost and benefits to reflect the revised, more realistic implementation schedule.

Literature Cited

Glass, Pamela (2017). Almost 30 years later, Olmsted Lock and Dam projected to open in 2018. WorkBoat.com. June 15. Online at: https://www.workboat.com/news/coastal-inland-waterways/olmsted-lock-dam-projected-open-2018/

Staletovich, Jenny (2017). "Is Florida moving too slow to save the Everglades?" Miami Herald, February 3, updated February 6. Online at: https://www.miamiherald.com/news/local/environment/article130702984.html

Pinto, Jeffrey K. (2010). Project Management, Achieving Competitive Advantage, 2nd Edition, Prentice-Hall Publishing, Upper Saddle River, NJ. p. 226.

USACE (2016). President's Fiscal 2017 Budget for the U.S. Army Corps of Engineers Civil Works Program. February 9, 2016. Online at: https://www.usace.army.mil/Media/News-Releases/News-Release-Article-View/Article/652668/presidents-fiscal-2017-budget-for-us-army-corps-of-engineers-civil-works-releas/

USACE (2017). President's Fiscal 2018 Budget for the U.S. Army Corps of Engineers Civil Works Program. May 25, 2017. Online at: https://www.usace.army.mil/Media/News-Releases/News-Release-Article-View/Article/1191687/presidents-fiscal-2018-budget-for-us-army-corps-of-engineers-civil-works-progra/

Final Panel Comment 6

The scope of the DIFR-EIS does not have consistent biological analyses or modeling tools designed for a comprehensive coast-wide assessment of CSRMs and ER plans.

Basis for Comment

Habitat Suitability Index (HSI) models are a widely used and understood tool for evaluating changes in habitat suitability for key fish and shellfish and wildlife species. The HSI selection of the four key aquatic species is well described in Appendix C-8, Section 5 for the Habitat Evaluation Procedure (HEP) and the Wetland Value Assessment (WVA) for ER projects, but key details and assumptions of the HSIs are lacking, and the HSIs are not described or used for the CSRM and ER alternatives analysis.

Incorporating standard biological analyses such as benthic characterization and indices, fish catch rates and size distributions, and species community composition would strengthen this document; these analyses are likely part of already established monitoring programs in coastal Texas. Data collection and analyses designed for adaptive management of the CSRM projects can also be used and/or supplement biological analyses.

There are modeling tools available for linking hydrologic and hydraulic model outputs (e.g., ADH used for coastal barrier alternative with the sector gate project in this document) to demonstrate and evaluate potential environmental impacts on bay water quality, biogeochemical cycling, and/or the nekton community and/or estuarine and coastwide food web. Coastwide modeling and analyses can use a combination of smaller detailed models around projects or specific estuaries, as well as larger, more crudely structured spatial models to represent coastwide dynamics and effects, modeled as different scenarios considering smaller project components.

A large component of the Louisiana Coastal Master Plan (http://coastal.la.gov/our-plan/2017-coastal-master-plan/planning-process/modeling/) is the development and testing and application of hydrodynamic and water quality box models, several HSI models for key fish and wildlife species, vegetation community models, oyster models, and food web models that include the dominant fish and shellfish in the estuaries. These models are updated and improved upon every five years to better represent and understand existing environmental conditions, and to evaluate cumulative environmental impacts and project alternatives for the entire Louisiana coast. The discussion of the economic importance of these commercial fisheries in the study area justifies this analysis (Appendix C-1, p. 3-13).

Data gap analysis for environmental variables in estuaries should be performed for effective project-level and coast-wide biological (including water quality with nutrients and Chlorophyll a, lower trophic level distribution, composition, abundance and/or density, and fish) analysis and modeling. A good example of a comprehensive estuarine monitoring program is the Interagency Ecological Program in conjunction with the U.S. Geological Survey, the U.S. Fish and Wildlife Service, USACE, and the Bureau of Reclamation in California for the San Francisco Estuary. Texas agencies have similar monitoring programs, thus a data inventory and then a data gap analysis for this coast-wide Mega Study would largely benefit the planning and design of biological analyses and modeling.

Final Panel Comment 6

All planned or current water resource projects, including freshwater inflow projects and watershed management projects, that will add inflow to the coastal basins must be included in the comprehensive coast-wide planning and research projects when determining existing conditions and evaluating project alternatives and project impacts.

Significance – Medium/High

The lack of biological analyses and the lack of use of modeling tools will likely result in an underestimate of the impacts on, and the complexities of, ecological and biological resources.

Recommendations for Resolution

1. Plan and design a set of standard modeling tools and/or biological analyses for cumulative or comprehensive evaluation of the planned projects over time.
2. Provide a data inventory that describes existing monitoring programs conducted by the agencies for gulf coastal Texas, including the monitoring objectives, the spatial extent and types of sampling gear types, sampling frequency, the sampling variables, and units monitored. Recommend demonstrating several examples of the data types and references on how they have been used for biological analyses to date.
3. Describe how the monitoring data can be used to define existing conditions and parameterize environmental models.
4. The HEP with HSIs and WVA are a good start in Appendix C-8. Further develop these approaches for coast-wide analyses that include different or additional aquatic fauna species and habitat types by the upper, mid, and lower Texas coastal zones.
5. Recommend reviewing Rose and Sable (2013) for approaches to model selection, documentation, and application for coastal studies, including determining data availability, modeling objectives, defining questions, understanding scale.

Literature Cited

Rose, K. A., and S. Sable (2013). 2017 Coastal Master Plan: Strategy for Selecting Fish Modeling Approaches. Version I. Baton Rouge, Louisiana: Coastal Protection and Restoration Authority. Online at: https://thewaterinstitute.org/assets/docs/publications/10_31_2013_2017-Coastal-Master-Plan-Strategy-for-Selecting-Fish-Modeling-Approaches.pdf

Coastal Protection and Restoration Authority (2017). 2017 Coastal Master Plan: Modeling. http://coastal.la.gov/our-plan/2017-coastal-master-plan/planning-process/modeling/

Final Panel Comment 7

The effects of sea level rise and the relationships and interactions between physical and water quality variables, habitat structure, and biological resources are not covered and are assumed to be constant in the HEP for the ER measures

Basis for Comment

Underlying assumptions for the HEP are not scientifically rigorous and may not accurately represent future-with-project (FWP) and future-without-project (FWOP) conditions. Nor does the current HEP demonstrate the analytical strength of the HSI and WVA tools based on the level of baseline data from the existing condition analysis.

The HEP based solely on the habitat variable as related to cover types is overly simple for evaluating important ER project features at the project footprint scale. This application uses a binary approach where marsh or barrier island habitat built is 100% benefit versus no action assumes 0% benefit.

In analyzing island impacts on erosion and habitats, assumptions for the HEP analysis again use a binary (all or nothing) approach to with- and without-project conditions. For example, it was assumed 0% removal of the target (for example, seagrass habitat) without project and 0% removal of the target with project (Appendix C-8, p. 6-13). In analyzing island impacts, existing conditions were determined by measuring island size using 2016 Google Earth images. FWOP was assumed to be 100% no islands; although the rate of erosion has been clearly demonstrated, assuming a 100% rate of removal has not been clearly justified (Appendix C-8, p. 6-9). Appendix C-8 (p. 6-14) states that the Texas shoreline change data were used to incorporate erosion rates for each barrier island system and applied to FWOP and FWP conditions to illustrate the migration of habitats through the 50-year period. This suggests a much more robust forecasting method than assuming zero or 100% as the end of the 50-year analysis for migration of habitats.

The modeling of temperature or salinity does not incorporate SLR scenarios and freshwater inflow projects stated in the DIFR-EIS sections. Instead, temperature is held constant and salinity assigned a constant number (20% salinity increase) for both FWP and FWOP conditions. These assumptions do not match those written in the DIFR-EIS and do not capture the variability and uncertainty from changes in freshwater input that will directly result from CSRM.

The DIFR-EIS states that the data for temperature and salinity variables were based on water quality data from 2007 to 2016, but it is not clear how the data were used for construction or testing of the HSIs. These data are also not indicative of expected temperature ranges in this region between 2035 and 2085. The worst-case scenario with higher temperatures should be considered for impacts and evaluated under both FWP and FWOP conditions.

For example, statements about SLR and freshwater inflow effects (Appendix C-1, pp. 3-1 to 3-2) summarize the identified expected impacts on coastal Texas from climate change, as "climate change will be greater than those impacts experienced between 1900 and 2000." It further states that existing planning is not adequate to respond to anticipated changes. Expected impacts also include inundation of land areas for longer and covering bigger areas. Potential impacts include a change of habitat due to prolonged soil saturation or salinity changes, for example, freshwater marsh to saltwater marsh.

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The assumptions about oyster reefs are not connected to the spatial extent within the project footprint. As data were not readily available, it was assumed that all oyster habitat and cultch would be eliminated in the FWOP condition. Suitable oyster habitat depends on substrate, existing reef or cultch availability, and seasonal or within-year salinity requirements for oyster growth, survival, and reproduction.

Appendix C-1 (p. 2-23) states that the salinity characteristics of each estuary contribute to the differing biological communities up and down the coast. This suggests that changes in seasonal salinity gradients or isohalines may potentially result in seasonal and inter-annual habitat shifts and species use, which should be incorporated into the HSIs by including varying temperature and salinity conditions.

Appendix C-8 (p. 6-1) states that field sampling was not conducted for this project because it was believed that data were readily available or could be obtained using the Geographic Information System (GIS). However, the National Oceanic and Atmospheric Administration (NOAA) Coastal Change Analysis Program (C-CAP) tool cannot distinguish between freshwater and saltwater marsh. Since this is an important distinction to make, a field visit is necessary to validate this analysis. Further, Appendix C-8 (p. 5-2) states that the palustrine wetland and marsh cover types were merged with the estuarine cover type. With salinity as a driving factor in habitat suitability, merging these habitat types is not realistic across all aquatic species.

Significance –Medium/High

Underlying assumptions for the HEP do not demonstrate the analytical strength of HSIs and WVA tools nor are they based on the baseline data and SLR information presented in the DIFR-EIS and Appendix C-1. The HEP does not likely represent realistic FWOP and FWP conditions, and the assumption of all or nothing based on building specific ER projects is not realistic.

Recommendations for Resolution

1. Include salinity and temperature modifiers on species HSIs, with the changes to salinity and temperature based on SLR and freshwater inflow scenarios as were defined in the DIFR-EIS.
2. Rescale HSIs and WVAs to accurately measure project footprint or estuary-wide effects between FWP and FWOP alternatives and remove all or nothing assumptions of the ER project to redefine habitat types with varying salinity and temperature.
3. Recommend revisiting Swannack et al. (2014) or Beseres-Pollack et al. (2012) for oyster suitability indices that make use of spatially explicit environmental data over existing oyster reefs or else for planned restoration sites to determine suitability.

Literature Cited:

Beseres Pollack, J., A. Cleveland, T.A. Palmer, A.S. Reisinger, P.A. Montagna (2012). A restoration suitability index model for the eastern oyster (Crassostrea virginica) in the Mission-Aransas estuary, Texas, USA. PLOS One 7, e40839. http:// dx.doi.org/10.1371/journal.pone.0040839.

Swannack, T. M., M. Reif, T.M. Soniat (2014). A robust, spatially explicit model for identifying oyster restoration sites: case studies on the Atlantic and Gulf coasts. J. Shellfish Res. 33:395-408.

Final Panel Comment 8

The basis for selecting ER Alternative 1 Scale 2 over ER Alternative 4 Scale 2 is not supported.

Basis for Comment

After reviewing the incremental cost-effectiveness of the scales of ER Alternative 4, a rational consumer could be convinced that the additional cost of ER Alternative 4 Scale 2 (4-2) is worth the additional output over ER Alternative 4-1. This is especially true if the same consumer is also convinced that there are no more scales or increments of ER Alternative 4 beyond Scale 2; that this is as good as Alternative 4 gets.

The same consumer is then asked to consider ER Alternative 1-2, which represents a greater than 100% increase in cost and provides a small increase in output versus ER Alternative 4-2 (Figure 4-17, DIFR-EIS).

The consumer would reject buying ER Alternative 1-2 absent a compelling reason because the incremental cost between ER Alternatives 4-2 and 1-2 has increased substantially. Rational consumer expectations in this scenario are that any additional units of habitat restoration of substantially equal quality will come at ever increasing incremental cost and that no alternatives exist that will increase restoration at the same or lower cost.

In order to convince the consumer to select ER Alternative 1-2, the DIFR-EIS would have to present a clear and compelling argument that the additional 2,211 average annualized habitat units (AAHUs) are worth doubling the total cost. No such case is provided. A hypothetical example of this decision-making process is provided in IWR Report 94-PS-2 (Nine Easy Steps) (USACE, 1994):

> "The value of these analyses is perhaps best illustrated through an example. Suppose that a study has developed three alterative plans for environmental restoration: Plans A, B and C. Plan A will restore 1,000 acres of a habitat at a cost of $1 million; Plan B will restore 950 acres of habitat at a cost of $500,000; and Plan C will also restore 950 acres but at a cost $750,000. While Plans B and C will provide the identical level of environmental output - 950 acres of restored habitat - Plan C is 50% more costly than Plan B. If all other factors are equal, Plan B would be the better choice for restoration. Furthermore, Plan B will provide 95% of Plan A's output at 50% of Plan A's cost. In this case, it would be difficult to argue that the additional 5% of the habitat restored with Plan A would be worth a doubling of the project cost - it is probably far too costly. While this is a simplified and extreme example, it illustrates the type of information revealed through these analyses."

Appendix E-3 (pp. 6-4, 6-5) states that there are unmeasured benefits of ER Alternative 1-2 that will be further explained in an "Is It Worth It?" analysis, but the Panel has not seen that analysis and has only reviewed incremental cost analysis provided.

Significance – Medium

ER Alternative 1-2 has twice the cost and just a small increase in output vs.ER Alternative 4-2, yet its selection is not adequately justified.

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Recommendations for Resolution

1. Describe what sets ER Alternative 1-2 apart from the various scales of ER Alternative 4-2.
2. Answer the question posed in IWR-94-PS-2: “Why is it worth it?”

Literature Cited:

USACE (1994). Cost Effectiveness Analysis for Environmental Planning: Nine Easy Steps. Institute for Water Resources (IWR) Report 94-PS-2. Alexandria, VA.

Final Panel Comment 9

The proposed use of turf alone for levee erosion protection may not be adequate.

Basis for Comment

Many levees and some of the anticipated flood walls included in the TSP appear to be susceptible to erosion. Levees are anticipated to be constructed with earthen material throughout the project area, while T-walls are included along the backside of Galveston Island. There is a risk that during an extreme storm event, with increased wind speeds and large waves, this would cause erosion of the levee or foundation of the flood walls until they collapsed. Modeling efforts should consider what this trigger point might be. Measures such as armoring to minimize soil erosion may reduce this risk, but they are not discussed in the document. Levee failure poses a serious risk to loss of life in these densely populated areas.

Although it is not entirely clear in the report or Engineering Appendix, it appears that only turf protection is assumed for all levee sections. This is likely insufficient in many areas of the project. More likely, some type of armoring of levees will be required to protect them from wave erosion and overwash. During Hurricane Katrina, many levees that were constructed of erodible materials were damaged or destroyed entirely due to lack of erosion protection. And since much of the available borrow material considered for this current study is also erodible, it seems likely that armoring of the levees will be required. This has important implications for the overall cost of the project as well as the implementation of the plan. Armor stone, made of granite or diorite, is likely not available locally and must be imported for the levee construction. Alternatively, concrete mattress or soil-cement can be considered.

Significance – Medium

Without reinforcement, earthen levees covered in turf may not be able to withstand an extreme storm event, risking collapse and serious loss of life.

Recommendations for Resolution

1. Provide a new section in the geotechnical or civil engineering portions of the Engineering Appendix discussing conceptual armor design for the various levee and T-wall sections.
2. Develop a typical section of levee that includes armor protection and use this to aid with the revision of the construction cost estimate.
3. Update the levee and T-wall cost estimate and construction schedule as required.

Final Panel Comment 10

The potential environmental impacts in the estuary as a result of sector gate installation may be understated.

Basis for Comment

The possible environmental impacts of the giant sector gate across the Houston Ship Channel seem understated. A 13% to 16% drop in tidal exchange and 10% to 20% decline in tidal amplitude will likely result in changes in water quality and energy cycling, creating bottom-up effects on the estuarine food web and faunal production in the system.

Reducing tidal exchange, tidal amplitude, and flushing rates within the estuary could cause increased stratification, algal blooms, and low dissolved oxygen (DO) events. Appendix C-1 (p. 5-30) mentions the possibility of increased algal blooms and low DO events. Algal blooms disrupt nutrient/energy cycling within the ecosystem by causing low DO events, shading out benthic microalgae and submerged aquatic vegetation (SAV), and stressing or killing sessile bivalves and nekton trapped within low DO regions during expansive or prolonged blooms or red tides. The Texas Parks and Wildlife Department already monitors coastal Texas for red tides and fish mortality events, thus conceptual and numerical modeling of water quality, algal blooms, and red tides would be beneficial to the CSRM projects that will alter tidal exchange and flushing rates or turnover times in the estuaries. A conceptual model and more detailed discussion of impacts would strengthen this document.

Galveston Bay is largely affected by runoff and wastewater (Galveston Bay Report Card, 2018) and these anthropogenic factors will only increase with the projected increase in Texas coastal populations. These effects again can be represented and evaluated in conceptual and numerical water quality models.

Linked or coupled hydro-water quality-biogeochemical or ecological modeling frameworks are becoming more common for demonstrating existing conditions and evaluating water resource or restoration project alternatives. These studies often use various USACE-accepted or verified modeling tools to evaluate potential environmental impacts on bay water quality, biogeochemical cycling, nutrient and sediment loading, key fish species and oyster production, community and/or food web dynamics. Testa et al. (2017), MacWilliams et al. (2016), and Huang (2010) give some examples for linked modeling approaches, with the first two references providing overviews of multi-dimensional modelling of major U.S. estuaries.

In addition, giant sector gates will likely affect ingress into and up the estuary of key coastal species, and potentially impact species accessibility and use of habitats. Possible impacts on key fish and shellfish species based on changes in water level, salinity, and marsh inundation are discussed briefly, citing Minello et al. (2008, 2012, 2015, 2017) (Appendix C-1, pp. 5-64 to 5-78), but there is no detailed explanation of the potential effects using these references and more.

Reduced tidal exchange can affect ingress and supply or entrance of post-larval shrimps, fish larvae, and crab megalope to the estuaries. These species spawn outside the estuaries and along the shelf; they are carried to the bays by currents and moved into and up the estuaries by tides to critical nursery habitats within estuaries. Table 5-15 in Appendix C-1 summarizes species most vulnerable to flow

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constriction, and text on p. 5-79 briefly states that the coastal barrier CRSM could reduce faunal productivity in the estuary based on the described mechanisms. Added explanation and details for the most vulnerable species in relation to gate operation and changing conditions would support the impacts assessment and project justification.

Potential expanded impacts resulting from the risk of oil spills and other hazardous waste spills inside the sector gate area are not discussed.

Significance – Medium

The limited explanation of the estuarine model describing potential environmental impacts from the sector gate does not provide a complete understanding and may underestimate impacts from the reduction in tidal exchange, amplitude, and flushing rates.

Recommendations for Resolution

1. Expand textual explanation and details given by the Minello et al. references and those summarized in Table 5-15 to discuss the suite of environmental impacts in the Galveston Estuary due to reduced tidal exchange, amplitude, and flushing rates.
2. Consider water quality and/or biogeochemical modeling components to use or link with ADH models for better understanding of existing conditions and evaluation of project impacts.
3. Define effects of reduced tidal exchange and amplitude and reduced flushing on salinity, water levels, turnover time, algal blooms, and low DO events in the estuary in expanded detail.
4. Consider including a conceptual model of Galveston Estuary that includes all environmental and ecological components of the estuary that could be affected by the project to better understand and mitigate cumulative impacts and reference the model while discussing impacts.
5. Discuss impacts associated with the increased risk of hazardous waste spills within the sector gate area.

Literature Cited:

Galveston Bay Report Card (2018). Water Quality Summary. https://www.galvbaygrade.org/water-quality/

Huang, W. (2010). Hydrodynamic modeling and ecohydrological analysis of river inflow effects on Apalachicola Bay, Florida, USA. Estuarine, Coastal and Shelf Science 86(3):526-534. Online at: https://www.sciencedirect.com/science/article/pii/S0272771409003655

MacWilliams, M. L., E. S. Ateljevich, S. G. Monismith, C. Enright (2016). An overview of multi-dimensional models of the Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science 14(4):1-36. Online at: https://escholarship.org/uc/item/31r7x1js

Testa, J. M., et al. (2018). Ecological forecasting and the science of hypoxia in Chesapeake Bay. BioScience 67(7): 614-626. Online at: https://academic.oup.com/bioscience/article/67/7/614/3858868

Final Panel Comment 11

Measures to monitor and reduce potential long-term impacts from changes in freshwater inputs and salinity are not addressed, nor are regional freshwater and salinity impacts fully discussed in the cumulative analysis.

Basis for Comment

Implementation of the TSP will have impacts on physical processes, but these have not been fully evaluated and mitigated. Cumulative effects of climate change and RSLR, combined with the CSRM measures, will alter hydrologic parameters within this sensitive ecosystem. It is the broad range of salinities that allows the region to support a wide spectrum of habitats, and salinity characteristics of each estuary contribute to the differing biological communities (Appendix C-1, p. 2-23). The sensitive balance of freshwater inflows and seawater maintains the salinity of the marsh and influences plant community composition (NOAA 2017d, as referenced in Appendix C-1, p. 2-71). Significant changes in freshwater inflow regimes can affect the ecological health of these estuaries (Appendix C-1, p. 2-38). The document presents the uniqueness of this ecosystem, but does not adequately discuss the complex interactions between cumulative effects of freshwater changes on salinity concentrations, considering the long-term cumulative impacts of this large-scale project, previous projects, and climate change.

Changes in freshwater inputs and salinity concentrations can substantially impact both Federally listed species and critical habitat; for example, less tidal inundation could potentially convert wetland areas to ephemeral wetlands or uplands (Appendix C-1, p. 5-64). Cumulative impacts argue that hydrologic changes from other previous flood risk management features are generally greater than the salinity changes expected from the TSP. However, it does not integrate these impacts within the cumulative impact from all of those projects, combined with the large-scale cumulative impact of this project, while also integrating climate change scenarios. This includes the potential for extended drought periods and their effect on freshwater inputs and forecasting how this project will contribute to the overall regional cumulative flux.

Analyses conducted for this project do not adequately consider project impacts on salinity. For example, in evaluating commercial brown shrimp, temperature and salinity variables were not included in the analysis, and these variables may have a greater impact on fisheries than habitat area increases caused by sea level rise (Appendix C-1, p. 3-13). In the HEP analysis, salinity is increased 20% in both FWP and FWOP conditions, without consideration of project impacts on salinity and freshwater drainage or varying the scenarios in a linear progression.

Analysis of the Coastal Barrier impacts estimated a decrease of bay salinities on average of 2 ppt, based on the estuarine modeling conducted by USACE (McAlpin et al., 2018). While the effort to simulate water level velocity and salinity are critical, obtaining an accurate forecast for these variables based on existing data, and considering the uncertainty of climate change forecasts, it is unclear how meaningful the results of modeling efforts are (Appendix C-1, pp. 5-6, 5-7). Yet this number provides the basis for dismissing project biological impacts as insignificant.

During normal flow conditions, average salinities range from 10 to 30 ppt, stating that most organisms occupying these environments are ubiquitous along the Texas coast and can tolerate a wide range of

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salinities (Appendix C-1, p. 5-75). Therefore, this analysis concludes that no adverse effects on fauna are expected due to changes in salinity. However, earlier in the document it states that salinity characteristics play a fundamental role in defining each estuary, which contributes to the differing biological communities both seasonally and regionally (Appendix C-1, p. 2-23). This suggests that changes in salinity may potentially affect specific life stages of listed species and may result in habitat shifts.

The State of Texas conducted studies to recommend freshwater inflows to the Sabine-Neches Estuary necessary to provide the salinity regime and maintain the character of the ecosystem (Appendix C-1, p. 2-23). The Nueces BBEST (2011) used indicator organisms to develop an ecologically sound salinity regime, concluding 18 ppt is the defined target to maintain ecological health (Appendix C-1, p. 2-25). A similar effort is needed to offset project impacts. Defining appropriate salinity levels should be tied to monitoring efforts and adaptive management triggers. There is no discussion about mitigating project impacts, outside of the marsh mitigation plan. Monitoring and adaptive management plans have not been developed, so the Panel cannot assess its adequacy.

The Coastal Barrier could produce a range of salinity impacts (Appendix C-1, p. 5-17). The construction of the levee/floodwall will disconnect the tidal exchange on a portion of wetlands (Appendix C-1, p. 5-68) and inundate other areas. The degree of biological impact will be determined by the salinity during construction (Appendix C-1, p. 5-72). Direct impacts from the proposed levee system will change watershed drainage patterns (Appendix C-1, p. 5-89). The project argues that long-term benefits will justify short-term impacts, however, as the extent of impacts is uncertain, this conclusion is dependent upon the sensitivity of species and habitats in this unique environment. Clear measures are not presented to monitor and reduce these defined hydrologic project impacts. The combination of hydrologic impacts in this sensitive environment has not been adequately discussed in the cumulative impacts section. Contingency plan options for increasing freshwater flow should be defined, with adaptive management triggers presented. Management actions to increase freshwater inflow have been implemented in the past (Appendix C-1 refers to the Colorado River, 1991 [p. 2-22] and Galveston Bay, 2001 [p.2-23]) and provide examples of opportunities to increase freshwater inputs if needed.

Significance – Medium

Construction of the TSP will have long-term impacts on watershed drainage patterns, freshwater inputs, and salinity dynamics that, cumulatively, may have biological impacts not currently mitigated.

Recommendations for Resolution

1. Analyze the role of salinity in several analysis, for example, the HEP.
2. Conduct conceptual and numerical modeling of water quality, considering cumulative impacts of past projects, this project, and climate change scenarios.
3. Define a salinity monitoring program to be incorporated into the monitoring and adaptive management program. Specific thresholds should be defined, and management actions should be

Final Panel Comment 11

triggered based on these thresholds. This plan should include contingencies of potential sources and actions to increase freshwater inputs, if needed.

4. Conduct an analysis like Nueces BBEST (2011), selecting appropriate indicator organisms to develop an ecologically sound salinity regime for each project area.
5. Establish an appropriate salinity concentration and ranges for normal flows as a target to maintain ecological health.
6. Define adaptive management triggers, such as increasing freshwater inputs or modifying the surge gates.
7. Add discussion in the cumulative impacts section regarding the cumulative effect on freshwater and salinity concentrations of both construction and long-term impacts of this project, previous projects, and climate change scenarios.

Literature Cited:

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Nueces (BBEST) (2011). Environmental Flows Recommendation Report. Final Submission by the Nueces River and Corpus Christi and Baffin Bays Basin and Bay Expert Science Team (BBEST) to the Environmental Flows Advisory Group, Nueces River and Corpus Christi and Baffin Bays Basin and Bay Area Stakeholders Committee, and Texas Commission on Environmental Quality. 285 pp.

Final Panel Comment 12

It is unclear whether enough measures are in the design to reduce risk to loss of life.

Basis for Comment

Results show the greatest threat to life and property occurs from storm surge and tides during a hurricane landfall (Appendix C-1, p. 2-27). According to predictions made at the Lynchburg pump station, if the system were to fail, the flood depths could be over 22 feet for some areas (Appendix C-1, p. 3-25). This presents significant risk to life loss because there is insufficient response time in this scenario. While nonstructural measures such as emergency management plans are intended as part of this project, specific measures to minimize the increased life safety hazards from CSRM measures have not been adequately addressed.

There is a potential for induced flooding in the communities of Baytown and Santa Fe resulting from the construction of the barriers. Overtopping of the levee by storm surge during extreme events would immediately inundate vulnerable populated areas and key emergency service routes. This risk is a key concern for communities that are socially vulnerable, low income, elderly, or minority populations (Appendix C-1, p. 5-123).

Although there is significant opportunity to improve existing flood risk management systems and storm reduction measures, it is unclear whether enough measures are in the design to reduce risk to loss of life, given that increased flooding risk will occur from the CSRM measures. In addition, emergency transportation systems were excluded from the design.

Continued sea level rise and hurricane storm surges would increase degradation of natural and man-made seawalls levees and barrier islands, eroding foundations until they collapsed. This risks leaving industrial facilities more susceptible to damage and increasing the potential for the release of waste materials into the environment (Appendix C-1, p. 3-7). However, these risks to life safety were not addressed due to the low probability of occurrence. With the potential increased intensity of both storm surge and wind, this risk driver may increase. Measures such as armoring levees to minimize soil erosion may reduce this risk, but they were not discussed in the document.

The uncertainty of climate change impacts on future storm surge peaks, in combination with impacts from CSRM measures, may include reduced watershed drainage and longer periods of inundation, in addition to sea level rise. Given the cumulative effects, a failure in levees or floodwall overtopping may result in significant loss of life (Appendix C-1, p. 3-4). Given that a primary objective of the project is to protect life, additional measures to reduce loss of life that may result from the project itself should be defined.

Significance – Medium

Residual risk to loss of life remains and some components of the CSRM measures may increase some risks, yet no actions are defined to reduce these impacts.

Recommendations for Resolution

Final Panel Comment 12
1. Add detailed discussion of specific nonstructural emergency management measures to reduce risks to life safety. 2. Define specific measures to minimize the increased life safety hazards resulting from CSRM measures. 3. Design measures that target protection of vulnerable populations. 4. Consider armoring levees to minimize soil erosion and further reduce this risk to life.

Final Panel Comment 13

There is a high risk associated with non-performance given that no alternative scenario has a greater than a 75% chance of economic success in the CSRM for the Upper Texas Coast.

Basis for Comment

At best, there is a one in four chance that the Upper Texas Coast CSRM feature will not produce economic benefits equal to or greater than its cost (Appendix E-1, Section 5.0, pp 5-14 – 5-17). Further increasing uncertainty and risk is that the feature's feasibility relies on including benefits from the outputs of REMI (Regional Economic Models, Inc.), a model used to estimate indirect impacts of the project on the national economy.

The closer a project comes to infeasibility, the higher the risk of non-performance and the greater the scrutiny of the factors contributing the most uncertainty. The DIFR-EIS incorporates risk and uncertainty by the book in terms of identifying the important risk factors and integrating them as best as possible under schedule and budget constraints.

While the DIFR-EIS identifies uncertainty in the important variables in risk-based flood damage reduction, the schedule and budget for this study appear to have precluded the type of in-depth analysis that could significantly reduce that uncertainty. Reducing uncertainty in critical variables such as structure and content values, the stage-frequency relationship, and construction costs is likely to lead to changes in the number and types of management measures considered. This in turn is likely to improve both economic feasibility and probability of economic performance.

Documenting the REMI model assumptions, inputs, methodology, and outputs would further improve confidence, primarily through increased transparency. The DIFR-EIS includes no detailed discussion of what REMI used, what analyses it performed, or how it produced reliable results. The reader is simply told that REMI was run, and its outputs were used, with no explanation given for why the results were reasonable or how they were meaningful.

Significance – Medium/Low

High risk of non-performance, lack of detailed risk analysis, and lack of transparency prevent confidence in the economic justification for the Upper Texas Coast CSRM feature.

Recommendations for Resolution

1. Explicitly acknowledge the risk of non-performance and explain why uncertainty in key variables cannot be further reduced.
2. Document the REMI model thoroughly, listing all its assumptions, explaining its methodology, and analyzing its results.

Final Panel Comment 14

There is a lack of geotechnical data and geotechnical engineering design in the DIFR-EIS.

Basis for Comment

The DIFR-EIS provides no geotechnical soil cross-sections and no core boring logs or cone penetration test (CPT) logs. Although core borings and CPT tests are mentioned, and some locations of these data are provided, none of the relevant field data is included in the Engineering Appendix. A few key (representative) boring logs or CPT sheets would add to the understanding of the geotechnical assumptions.

The report includes limited, very brief narrative discussions of the various foundation conditions, but they generally have a limited basis and vary considerably in the level of detail. There are references to some external geotechnical engineering reports, but in most cases, there are no comprehensive summaries of these reports. Given that the literature data are the primary basis for conceptual design, it would be helpful to have some of that information summarized, assessed (including the basis for each design parameter), and presented in the report to make it a stand-alone document. Tables of proposed geotechnical design parameters (e.g., phi angles, undrained shear strength) are provided, but it is not clear how these parameters were estimated or if they were just assumed.

In addition, there is no geotechnical engineering analysis in the Engineering Appendix: no stability analysis for T-walls or levees, seepage analysis, bearing capacity assessments, and order-of-magnitude settlement estimates. This information is important to support the assumed feature geometries, including T-wall widths and height; levee side slopes, height, and top width; environmental restoration beach/wetland areas; and breakwater/rubble-mound structures.

Also, there are only a few figures or drawings that show “typical” sections for various features. Some of these are shown in the Structural Engineering section of the Engineering Appendix (e.g., T-walls, seawall raise), but none is provided for all the various levees included in the TSP.

Lastly, in the main report and Engineering Appendix, there are very brief references to subsidence and how it is tied to estimates of sea level rise. This seems to be an important geotechnical consideration in the study area, but no relevant data or discussion are provided.

Significance – Medium/Low

The limited geotechnical data and geotechnical engineering analysis prevent assessments of geotechnical factors such as stability, seepage, bearing capacities, and settlement rates.

Recommendations for Resolution

1. Provide a more complete summary of external geotechnical literature, including all assumptions and bases for selecting various geotechnical design parameters.
2. Provide a few typical soil cross-sections for key features of the TSP including the sector gate.

Final Panel Comment 14

3. Include key or “typical” core boring or CPT logs in the Engineering Appendix in order to link conceptual design to field data.

4. Develop “typical” levee sections for all key project areas and include them as figures in the Engineering Appendix. Ensure that side-slopes, top width, height, and degree of armoring are shown on figures.

5. Complete preliminary stability evaluations, seepage analysis, bearing capacity evaluations, and order-of-magnitude settlement estimates for representative levee sections, T-wall sections, rubble mound structures, and the sector gate.

6. Provide further narrative discussion regarding subsidence in the study area. Tie in existing geotechnical data to the extent practical.

Final Panel Comment 15

The Upper Texas Coast structure inventory does not address why structures already protected by projects previously constructed by HCFCD or USACE or proposed by HCFCD/USACE were excluded.

Basis for Comment

The Harris County Flood Control District (HCFCD) has a very robust flood risk management program affecting every significant watershed within Harris County. The Upper Texas Coast structure inventory includes significant portions of Harris County.

However, the DIFR-EIS does not discuss whether or how to identify structures and infrastructure already protected by risk management projects that are actively operated and maintained by HCFCD or that are likely to be included in and protected by proposed projects.

Significance – Low

Care must be taken to ensure that the structure inventory for the Upper Texas Coast CSRM feature does not count assets already protected by existing projects, or assets likely to be protected by proposed projects.

Recommendations for Resolution

1. Discuss the projects under HCFCD operation and management responsibility.
2. Describe how the structure inventories of these projects are kept separate from the Upper Texas Coast inventory.

Final Panel Comment 16

No consideration is given to the likelihood that ER measures produce tangible recreational economic benefits.

Basis for Comment

If successful in their primary purpose, the ER measures proposed in the DIFR-EIS will result in greater habitat quantity and quality along the entire Texas coast. This improvement in the natural environment has a very high probability of attracting more wildlife and game species, which will in turn attract greater numbers of visitors to the coast wishing to see and enjoy the improved recreational experience.

This has the capacity to increase both the number of expected future visitors and the value those visitors are likely to place on the recreational experience. However, the DIFR-EIS does not address this potential benefit stream.

Significance – Low

While recreational benefits are incidental to ER projects and features, they can be used to further demonstrate the desirability of the project.

Recommendations for Resolution

1. Include a qualitative discussion of improved recreation as a result of implementing the ER measures.
2. Recommend further analyses to quantify economic benefits of environmental restoration in the region as a result of the project.

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APPENDIX A

IEPR Process for the Coastal Texas Project

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A.1 Planning and Conduct of the Independent External Peer Review (IEPR)

Table A-1 presents the major milestones and deliverables of the Coastal Texas IEPR. Due dates for milestones and deliverables are based on the award/effective date listed in Table A-1. The review documents were provided by U.S. Army Corps of Engineers (USACE) on October 24, 2018. Note that the actions listed under Task 6 as well as the public comment review occur after the submission of this report. The actual date for submitting the pdf printout of the USACE's Design Review and Checking System (DrChecks) project file (the final deliverable) and contract end will depend on the date that all activities for this IEPR are conducted and subsequently completed.

Table A-1. Major Milestones and Deliverables of the Coastal Texas IEPR

Task	Action	Due Date
1	Award/Effective Date	5/18/2018
	Review documents available	10/24/2018
	Battelle submits draft Work Plan[a]	5/30/2018
	USACE provides comments on draft Work Plan	6/25/2018
	Battelle submits final Work Plan[a]	6/27/2018
2	Battelle submits list of selected panel members[a]	6/6/2018
	USACE confirms the panel members have no COI	6/19/2018
3	Battelle convenes kick-off meeting with USACE	6/5/2018
	Battelle convenes kick-off meeting with panel members	11/6/2018
	Battelle convenes kick-off meeting with USACE and panel members	11/8/2018
4	Panel members complete their individual reviews	12/10/2018
	Panel members provide draft Final Panel Comments to Battelle	12/20/2018
	Panel finalizes Final Panel Comments	1/9/2019
5	Battelle submits Final IEPR Report to USACE[a]	1/28/2019
6[b]	Battelle convenes Comment Response Teleconference with panel members and USACE	3/4/2019
	Battelle submits pdf printout of DrChecks project file[a]	3/19/2019
	Agency Decision Milestone (ADM) meeting[c]	TBD
	Post-ADM Senior Leader Meeting (SLM)[c]	
	Contract End/Delivery Date	8/31/2019

[a] *Deliverable.*
[b] *Task 6 and public comments activities occur after the submission of this report.*
[c] *The ADM and SLM meetings were listed in the Performance Work Statement under Task 3, but were relocated in this schedule to reflect the chronological order of activities.*

At the beginning of the Period of Performance for the Coastal Texas IEPR, Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., terminology to use, access to DrChecks, etc.). Any revisions to the schedule were submitted as part of the final Work Plan. The final charge consisted of 16 charge questions provided by USACE, two overview questions, and one public comment question added by Battelle (all questions were included in the draft and final Work Plans), and general guidance for the Panel on the conduct of the peer review (provided in Appendix C of this final report).

Prior to beginning their review and after their subcontracts were finalized, all the members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge, as well as the review documents and reference/supplemental materials listed in Table A-2.

Table A-2. Documents to Be Reviewed and Provided as Reference/Supplemental Information

Review Documents	No. of Review Pages
Main DIFR-EIS	444
Appendix A: Plan Formulation Supporting Information	66
Appendix B: Agency and Tribal Coordination	146
Appendix C-1: Environmental Supporting Documentation	470
Appendix C-2: Draft CWA Section 404(b)(1) Evaluation	30
Appendix C-3: ESA – Biological Assessment	94
Appendix C-4: Draft EFH Assessment	100
Appendix C-5: USFWS PAL	34
Appendix C-6: Draft CZMA Consistency Determination	30
Appendix C-7: Draft HTRW Assessment	108
Appendix C-8: Draft HEP and WVA Modeling Report	76
Appendix C-9: Draft Mitigation Plan	34
Appendix D: Engineering Design, Cost Estimate, and Cost Risk Analysis	300
Appendix E-1 – Coastal Storm Surge Reduction, Upper Texas Coast	124
Appendix E-2: South Padre Island CSRM Economics	90
Appendix E-3: Economic CE-ICA	38
Appendix G: Public Coordination	246
Public Comments[ab]	100
Total Number of Review Pages	**2,406**

[a] *Supporting documentation only. These documents are not for Panel review and should be used as information sources only. They are not included in the total page count.*

[b] *USACE will submit public comments to Battelle upon their availability. Battelle will in turn submit the comments to the IEPR Panel for review. A separate Addendum to the Final Report will be submitted if additional Final Panel Comments are necessary.*

In addition to the materials provided in Table A-2, the panel members were provided the following USACE guidance documents.

- USACE guidance, *Review Policy for Civil Works* (EC 1165-2-217), February 20, 2018
- Office of Management and Budget, *Final Information Quality Bulletin for Peer Review,* December 16, 2004.

The Panel gave Battelle seven clarifying questions for USACE during the course of their review. Battelle sent the questions to USACE and USACE provided the answers to Battelle via email about mid-way through the review. Because of this written exchange, Battelle determined and USACE confirmed that a mid-review teleconference with USACE was not necessary

A.2 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response form provided by Battelle. At the end of the review period, the Panel produced individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. At the end of the review, Battelle summarized the individual comments into a preliminary list of overall comments and discussion points. Each panel member's individual comments were shared with the full Panel.

A.3 IEPR Panel Teleconference

Battelle facilitated a teleconference with the Panel so that the panel members could exchange technical information. The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments in the Final IEPR Report and decide which panel member should serve as the lead author for the development of each Final Panel Comment. This information exchange ensured that the Final IEPR Report would accurately represent the Panel's assessment of the project, including any conflicting opinions. The Panel engaged in a thorough discussion of the overall positive and negative comments, added any missing issues of significant importance to the findings, and merged any related individual comments. At the conclusion of the teleconference, Battelle reviewed each Final Panel Comment with the Panel, including the associated level of significance, and confirmed the lead author for each comment.

A.4 Preparation of Final Panel Comments

Following the teleconference, Battelle distributed a summary memorandum for the Panel documenting each Final Panel Comment (organized by level of significance). The memorandum provided the following detailed guidance on the approach and format to be used to develop the Final Panel Comments for the Coastal Texas IEPR:

- Lead Responsibility: For each Final Panel Comment, one panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. Battelle modified lead assignments at the direction of the Panel. To assist each lead in the development of the Final Panel Comments, Battelle distributed a summary email detailing each draft final comment statement, an example Final Panel Comment following the four-part structure described below, and templates for the preparation of each Final Panel Comment.

- Directive to the Lead: Each lead was encouraged to communicate directly with the other panel members as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.

- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:

  1. Comment Statement (succinct summary statement of concern)
  2. Basis for Comment (details regarding the concern)
  3. Significance (high, medium/high, medium, medium/low, and low; see description below)
  4. Recommendation(s) for Resolution (see description below).

- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:

  1. **High:** There is a fundamental issue within study documents or data that will influence the technical or scientific basis for selection of, justification of, or ability to implement the recommended plan.

  2. **Medium/High:** There is a fundamental issue within study documents or data that has a strong probability of influencing the technical or scientific basis for selection of, justification of, or ability to implement the recommended plan.

  3. **Medium:** There is a fundamental issue within study documents or data that has a low probability of influencing the technical or scientific basis for selection of, justification of, or ability to implement the recommended plan.

  4. **Medium/Low:** There is missing, incomplete, or inconsistent technical or scientific information that affects the clarity, understanding, or completeness of the study documents, and there is uncertainty whether the missing information will affect the selection of, justification of, or ability to implement the recommended plan.

  5. **Low:** There is a minor technical or scientific discrepancy or inconsistency that affects the clarity, understanding, or completeness of the study documents but does not influence the selection of, justification of, or ability to implement the recommended plan.

- Guidelines for Developing Recommendations: The recommendation section was to include specific actions that USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. At the end of this process, 16 Final Panel Comments were prepared and assembled. There was no direct

communication between the Panel and USACE during the preparation of the Final Panel Comments. The full text of the Final Panel Comments is presented in Section 4.2 of the main report.

A.5 Conduct of the Public Comment Review

The public comment review will be completed at the end of the public comment period. The public comment review for the IEPR panel members will take place after the Final IEPR Report (this document) has been submitted to USACE and will be summarized in an addendum to the final report.

A.6 Final IEPR Report

After concluding the review and preparation of the Final Panel Comments, Battelle prepared a final IEPR report (this document) on the overall IEPR process and the IEPR panel members' findings. Each panel member and Battelle technical and editorial reviewers reviewed the IEPR report prior to submission to USACE for acceptance.

A.7 Comment Response Process

As part of Task 6, Battelle will enter the 16 Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle. Battelle will provide USACE and the Panel a pdf printout of all DrChecks entries, through comment closeout, as a final deliverable and record of the IEPR results.

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APPENDIX B

Identification and Selection of IEPR Panel Members for the Coastal Texas Project

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B.1 Panel Identification

The candidates for the Coastal Texas IEPR Panel were evaluated based on their technical expertise in the following key areas: Civil Works Planning/Economics, Ecological Modeling, Environmental Law Compliance, Hydrology and Hydraulics (H&H)/Coastal Engineering, and Geotechnical Engineering. These areas correspond to the technical content of the review documents and overall scope of the Coastal Texas project.

To identify candidate panel members, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle evaluated these candidate panel members in terms of their technical expertise and potential conflicts of interest (COIs). Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected five experts for the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed COIs, or lack of the precise technical expertise required.

Candidates were screened for the following potential exclusion criteria or conflicts of interest (COIs). These COI questions were intended to serve as a means of disclosure in order to better characterize a candidate's employment history and background. Battelle evaluated whether scientists in universities and consulting firms that are receiving USACE-funding have sufficient independence from USACE to be appropriate peer reviewers. Guidance in OMB (2004, p. 18) states,

> "…when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

Panel Conflict of Interest (COI) Screening Questionnaire for the Coastal Texas IEPR
1. Previous and/or current involvement by you or your firm in the Coastal Texas Protection and Restoration, Integrated Feasibility Report and Environmental Impact Statement (FR/EIS) and related projects.
2. Previous and/or current involvement by you or your firm in any work related to coastal storm risk management and ecosystem restoration along the Texas coast.
3. Previous and/or current involvement by you or your firm in the design, construction, or operation and maintenance (O&M) of any projects in the Coastal Texas Protection and Restoration, Integrated FR/EIS project area.
4. Current employment by the U.S. Army Corps of Engineers (USACE).

Panel Conflict of Interest (COI) Screening Questionnaire for the Coastal Texas IEPR

5. Previous and/or current involvement with paid or unpaid expert testimony related to Coastal Texas Protection and Restoration, Integrated FR/EIS.

6. Previous and/or current employment or affiliation with the non-Federal sponsor or any of the following cooperating Federal, State, County, local and regional agencies, environmental organizations, and interested groups *(for pay or pro bono):*
   - Texas General Land Office
   - Gulf Coast Community Protection & Recovery District
   - SSPEED Center
   - Texas A&M University at Galveston
   - Orange County
   - Velasco Drainage District
   - ERDC
   - RMC
   - ASCE
   - U.S. Geological Survey.

7. Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to the Texas coast.

8. Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Galveston and New Orleans Districts.

9. Previous or current involvement with the development or testing of models (i.e., Beach-fx) that will be used for, or in support of, the Coastal Texas Protection and Restoration, Integrated FR/EIS project.

10. Current firm involvement with other USACE projects, specifically those projects/contracts that are with the Galveston and New Orleans Districts. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please also clearly delineate the percentage of work you personally are currently conducting for the Galveston and New Orleans Districts. Please explain.

11. Any previous employment by USACE as a direct employee, notably if employment was with the Galveston and New Orleans Districts. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.

12. Any previous employment by USACE as a contractor (either as an individual or through your firm) within the last 10 years, notably if those projects/contracts are with the Galveston and New Orleans Districts. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.

Panel Conflict of Interest (COI) Screening Questionnaire for the Coastal Texas IEPR
13. Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning coastal storm risk management, ecosystem restoration review, or flood management, and include the client/agency and duration of review (approximate dates).
14. Pending, current, or future financial interests in Coastal Texas Protection and Restoration, Integrated FR/EIS related contracts/awards from USACE.
15. Significant portion of your personal or office's revenues within the last three years came from USACE contracts.
16. Significant portion of your personal or office's revenues within the last three years came from Texas General Land Office contracts.
17. Any publicly documented statement (including, for example, advocating for or discouraging against) related to Coastal Texas Protection and Restoration, Integrated FR/EIS.
18. Participation in relevant prior and/or current Federal studies relevant to this project and/or Coastal Texas Protection and Restoration, Integrated FR/EIS.
19. Previous and/or current participation in prior non-Federal studies relevant to this project and/or Coastal Texas Protection and Restoration, Integrated FR/EIS.
20. Has your research or analysis been evaluated as part of the Coastal Texas Protection and Restoration, Integrated FR/EIS?
21. Is there any past, present, or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe.

Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit. The term "firm" in a screening question referred to any joint venture in which a firm was involved. It applied to whether that firm serves as a prime or as a subcontractor to a prime. Candidates were asked to clarify the relationship in the screening questions.

B.2 Panel Selection

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. Table B-1 provides information on each panel member's affiliation, location, education, and overall years of experience. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. USACE was given the list of candidate panel members, but Battelle selected the final Panel.

Table B-1. Coastal Texas IEPR Panel: Summary of Panel Members

Name	Affiliation	Location	Education	P.E.	Exp. (yrs)
Civil Works Planning/Economics (Dual Role)					
David Luckie	Independent consultant	Mobile, AL	B.A., Economics and Finance	N/A	30
Ecological Modeling					
Shaye Sable	Dynamic Solutions, LLC	Baton Rouge, LA	Ph.D., Oceanography and Coastal Sciences	No	17
Environmental Law Compliance Expert					
Felicia Rein Orah	Florida Atlantic University	Encino, CA	Ph.D., Ecosystem Science and Water Resource Management	No	29
H&H/Coastal Engineering					
Alan Hall	Independent consultant	Point Saint Lucie, FL	B.S. Engineering Management; Graduate Studies in Professional Engineering Management	Yes	40+
Geotechnical Engineering					
Chris Brown	University of North Florida	Jacksonville, FL	Ph.D., Civil Engineering/Hydrology	Yes	29

Table B-2 presents an overview of the credentials of the final five members of the Panel and their qualifications in relation to the technical evaluation criteria. More detailed biographical information on the panel members and their areas of technical expertise is given in Section B.3.

Table B-2. Coastal Texas IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Luckie	Sable	Rein Orah	Hall	Brown
Civil Works Planner/Economics (Dual Role)					
Minimum of 15 years demonstrated experience in economics	X				
M.A./M.S. degree or higher in economics (waived by USACE due to years of experience)	X				
Experience in water resource economic evaluation or review, working directly for or with USACE, and experience with coastal storm risk management	X				
Familiarity with USACE Civil Works planning policies, methodologies, and procedures	X				
Experience reviewing Federal water resource economic documents justifying construction efforts, understanding of social well-being and regional economic development, and traditional natural economic development benefits	X				
Familiarity with USACE plan formulation processes, procedures, and standards as it relates to coastal storm risk management Civil Works projects	X				
Minimum of five years of directly dealing with the USACE six-step planning process and policies governed by Engineer Regulation 1105-2-100, Planning Guidance Notebook	X				
Ecological Modeling					
At least 10 years of experience in describing and evaluating the complex relationships and dynamics of coastal ecosystems and demonstrated experience assessing the consequences of altering environmental conditions		X			
Familiarity with the application of the Wetland Value Assessment (WVA), the Habitat Evaluation Procedure (HEP) model, and ecosystem restoration planning in a similar coastal area		X			
Environmental Law Compliance Expert					
Minimum of 15 years of experience directly related to water resources environmental evaluation or review			X		
M.A./M.S. degree or higher in a related field			X		
At least 10 years of experience in evaluating and conducting National Environmental Policy Act (NEPA) impact assessments, including cumulative effects analyses for complex, multi-objective public works projects with competing trade-offs			X		

Table B-2. Coastal Texas IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Luckie	Sable	Rein Orah	Hall	Brown
Familiarity and experience with Endangered Species Act (ESA), Clean Water Act and essential fish habitat (EFH), and Fish and Wildlife Coordination Act (FWCA)			X		
H&H/Coastal Engineer					
Minimum of 10 years' experience in public works planning				X	
M.S. degree or higher in engineering (waived by USACE due to years of experience)				X	
Minimum of 10 years of experience in coastal engineering or as a professor from academia with an extensive background in coastal theory and practice				X	
Extensive experience in estuarine systems and familiarity with USACE applications of standard USACE Hydrologic Engineering Center's (HEC) modeling computer software, including HEC Flood Damage Analysis (FDA), HEC River Analysis (RAS), and HEC Hydrologic Modeling System (HMS)				X	
Registered professional engineer				X	
Safety Assurance Review (SAR)				X	
Geotechnical Engineer					
Registered professional engineer					X
Minimum of 15 years of experience in geotechnical engineering					X
M.S. degree or higher in engineering					X
Familiarity with estuarine and coastal engineering, specifically design of flood control works including channel modifications, an understanding of traditional natural economic development benefits					X
Familiarity with geotechnical practices used in site investigation planning and implementation including modification of channels, minimizing environmental impacts, coastal process, and geomorphology					X
Safety Assurance Review (SAR)					X

B.3 Panel Member Qualifications

Detailed biographical information on each panel members' credentials and qualifications and areas of technical expertise are summarized in the following paragraphs.

Name	David Luckie
Role	Civil Works Planning/Economics (Dual Role)
Affiliation	Independent consultant

Mr. Luckie is an independent consultant with 30 years of professional experience in water resource economics, planning, plan formulation, benefit-cost analysis, and risk-based analysis. His public works experience encompasses decades of work with Federal and non-Federal agencies, as well as local and state organizations. He earned his B.S. in economics and finance from the University of South Alabama in 1986. His professional experience includes working with multidisciplinary teams to provide or review complex planning studies for coastal storm risk management (CSRM), dam safety, flood risk management (FRM), ecosystem restoration, and water supply and water quality studies. He is intimately familiar with Engineer Regulation 1105-2-100 and the 6-Step Planning Process and has prepared, supervised, or reviewed numerous planning studies in his career.

Mr. Luckie is familiar with the evaluation of alternative plans for both CSRM and FRM studies and has conducted, supervised, or reviewed several water resource studies featuring numerous alternative plans constructed from an array of different management measures. Over the last three decades, Mr. Luckie has been involved in numerous CSRM studies. Two examples are the Panama City Beach, Florida, study, a multipurpose project that included structural, non-structural, and recreation outputs, and the Mississippi Coastal Improvements Program following Hurricanes Katrina and Rita. He has also served as a panel member on the IEPRs of the Hereford Inlet CSRM Study in New Jersey and the Encinitas-Solana Beach CSRM Study in California. He applied his knowledge of Engineer Regulation-1105-2-100 and the 6-Step Planning Process in each of these high-profile efforts.

Least cost analysis, also known as cost-effectiveness analysis, has been a very important aspect of Mr. Luckie's decades of work. He is familiar with the evaluation of alternative plans. As a Regional Economist with the USACE Mobile District (1988-2006), Mr. Luckie conducted, supervised, or reviewed benefit-cost analyses for a variety of water resource projects, both single-purpose and multi-purpose projects covering the full range of USACE missions. Relevant studies include the Apalachicola-Chattahoochee-Flint River and the Alabama-Coosa-Tallapoosa Comprehensive Studies; the draft Programmatic Environmental Impact Statements covering the states of Alabama, Florida, and Georgia; and the Hunting Bayou General Reevaluation Report in Houston, Texas.

Mr. Luckie is very familiar with USACE standards and procedures. He has extensive experience in performing National Economic Development (NED) analyses, specifically as they relate to flood and coastal risk management. For more than 25 years, he has performed, supervised, or reviewed NED procedures for technical accuracy and for compliance with policy, guidance and accepted planning principles. Such studies as Panama City Beaches and Mississippi Coastal Improvements reflect this expertise.

Mr. Luckie has been using the Hydrologic Engineering Center Flood Damage Reduction Analysis (HEC-FDA) software since its inception in the 1990s. He has also performed, reviewed, or trouble-shot scores of HEC-FDA analyses for Federal, non-Federal, and private sector clients. In addition, he has mentored interns and junior economists in USACE methodologies for CSRM, requiring them to calculate without- and with-project condition damages, either by hand or with a Microsoft Excel spreadsheet, before allowing them to use HEC-FDA. He is also very familiar with the USACE Regional Economic System

(RECONS) model and the estimation of Regional Economic Development benefits, and has used the model for both Federal and non-Federal project proponents since its inception.

Name	**Shaye Sable, Ph.D.**
Role	**Ecological Modeling**
Affiliation	**Dynamic Solutions, LLC**

Dr. Sable, an aquatic/fisheries ecologist and modeler with Dynamic Solutions, LLC, has 17 years of experience developing sampling and modeling frameworks and analyses for water resource planning and design projects and resource management. She received a Ph.D. in oceanography and costal sciences with a minor in experimental statistics from the Louisiana State University in 2007, and a B.S. in biology from the Ohio State University in 1997.

Dr. Sable has previously performed development and testing of Habitat Suitability Indices (HSI), Habitat Evaluation Procedures (HEP), Wetland Value Assessments (WVA), benthic indices, diversity indices, univariate and multivariate statistical models, and numerical simulation models of fish populations and food webs for the USACE Mississippi Valley and South Atlantic Districts. In 2009, she led the multivariate and spatial statistical analyses of the fisheries-independent monitoring data to evaluate habitat associations, temporal and spatial changes and trends in relative abundance of key fish and shellfish species for the region as part of the USACE Mississippi River-Gulf Outlet Draft Environmental Impact Statement project.

She has analyzed large hydrologic, environmental, and biological data sets using many univariate and multivariate statistical methods and numerical modeling methods for various ecosystem and coastal restoration projects. For example, she is working on the Mid-Barataria Sediment Diversion Project Environmental Impact Statement, Barataria, Louisiana, where she is reviewing the water quality, phytoplankton, vegetation, and ecological modeling analyses used by the State of Louisiana to evaluate impacts from the diversion on the estuary. She has linked her numerical models to time series data of environmental conditions, and hydrodynamic models such as DELFT, EFDC, RMA, and ADH to explore how river diversions, nutrient enrichment and removal, and habitat degradation and restoration affect species production and food web interactions in coastal ecosystems.

Dr. Sable has extensive experience in applying fish population and community, food web, and ecosystem models to evaluate species responses to changing environmental conditions, habitat restoration, climate change, and stressors such as invasive species and exposure to toxicants. Dr. Sable assisted with the planning evaluation for the Twin Marsh Wetland Reserve Hydrologic Restoration Plan of Operation in Indian River County, Florida. She supported field efforts to map the existing wetlands, hydrology, surface and ground water sources and supply, and fish and wildlife to determine the ecological impacts. The planning evaluation of the wetland hydrologic restoration alternatives included a surface water modeling analysis to determine which operation plan led to recovery of native wetlands and prevention of invasive species.

Prior to joining Dynamic Solutions, Dr. Sable was a research biologist with the Louisiana Department of Wildlife and Fisheries (LDWF), where she primarily conducted analyses of the fisheries-independent and dependent monitoring data to support the state's fisheries management measures and stock assessments; assessed and re-designed LDWF field monitoring protocol; provided technical advice,

numerical modeling, and analyses to Louisiana Coastal Area (LCA) habitat restoration projects; and developed grant and research proposals for the Grand Isle Fisheries Research Laboratory.

Dr. Sable has experience developing and applying aquatic community and food web models and linking them to hydrodynamic and water quality data and models in order to simulate lower trophic level dynamics in the San Francisco Estuary and upper trophic level (fish) dynamics in Louisiana estuaries. She has experience developing HSIs, bioenergetics models, fish population and community models using matrix projection models and individual-based models, and food web models using the Comprehensive Aquatic System Model (CASM) approach (San Francisco Estuary and Barataria Basin, Louisiana). She also has experience coupling ecological and fish models with hydrodynamic and water quality models. She has extensive experience in developing numerical models in FORTRAN and in the analysis of large data sets with SAS. Dr. Sable has provided technical support, analyses, and review for the Environmental Impact Statements (EISs) written for the Caernarvon and the Davis Pond Diversion Projects in Louisiana. In addition, she has reviewed and provided strategies for improving Wetland Value Assessment, HSI, and statistical analyses for determining ecological benefits and impacts for Louisianan estuarine systems.

Name	**Felicia Rein Orah, Ph.D.**
Role	**Environmental Law Compliance Expert**
Affiliation	**Florida Atlantic University**

Dr. Rein has 29 years of professional environmental management experience implementing large-scale multidisciplinary research and evaluation projects. Currently a researcher and Affiliate Professor of geosciences for Florida Atlantic University, she earned a Ph.D. in ecosystem science and water resource management from the University of California, Santa Cruz, in 2000 and a B.S. in biology, environmental science, and English from Tufts University in 1988. Dr. Rein's areas of expertise include water quality, river science, watershed management, ecological monitoring, impact assessment, and ecological restoration, with a focus on ecological and biological sciences and National Environmental Policy Act (NEPA) assessment.

Dr. Rein's experience is focused on water resource management and environmental evaluation. Her primary expertise is in ecosystem science, but her interdisciplinary doctoral program included environmental policy and economics. She has prepared and reviewed NEPA documents for two environmental planning firms and has served on past IEPR panels as biology and environmental compliance analyst. She has experience with coastal storm risk management (Encinitas-Solana Beach Coastal Storm Damage Reduction Project) and ecosystem restoration (Delta Islands and Levees Feasibility Study, Sacramento, California; and Jamaica Bay Feasibility Report IEPR).

Dr. Rein is familiar with ecological studies and potential impacts on habitat, fish and wildlife species, as well as tribal cultures and archeology that may be affected by project alternatives. In more than 25 years of experience managing projects, many along the Pacific coast, she has gained experience with coastal ecology, including beach erosion, wetlands and riparian habitats, and ecologic restoration, specializing in the land-water interface. Her doctoral research was conducted in Elkhorn Slough, which drains into the Monterey Bay, where she investigated grass buffer strips as a best management practice (BMP) to reduce agricultural non-point-source pollution and improve water quality from conventional agricultural activities.

Working as a senior project manager for Denise Duffy & Associates, Dr. Rein was based in Monterey, California, and worked in environmental impact assessment, analyzing impacts of dozens of projects on the Pacific Coast. These projects involved analyzing environmental trade-offs for threatened species, water resources, and other land uses; developing mitigation plans; conducting wetland delineations; and monitoring construction sites for erosion control compliance.

Dr. Rein has worked for the Port Authority of New York and New Jersey, assessing impacts on both habitat and specific species potentially resulting from dredging activities. This project required environmental analysis to mitigate cumulative effects of a 5-year dredging program to deepen the NY-NJ harbor and ensure the economic viability of the port through blasting operations to deepen the channels and harbor while protecting threatened habitats. Solutions included defining cost-effective mapping of limited dredging operation windows in specific locations during nesting season. She has also managed a project on the Carmel River in California at the California State Water Resource Control Board dealing with a complex multi-objective environmental study. Cumulative impacts of an existing on-stream lake in Carmel Valley, central Pacific Coast, was analyzed to balance water right claims, wetland habitats and competing endangered species habitat trade-offs, focused on the California steelhead salmon and the California red legged frog.

Dr. Rein is experienced with the IEPR process and has participated in project reviews that included technical models estimating fluvial delivery into the system and optimizing hydrodynamics to rehabilitate jetties and reduce storm erosion. Dr. Rein has extensive experience preparing planning documents such as environmental impact reports and environmental impact statements (EISs) and has experience with all National Environmental Policy Act (NEPA) EIS requirements. She also has experience with the Endangered Species Act, essential fish habitat, and the Marine Mammals Protection Act.

During her career, Dr. Rein has written or reviewed NEPA documents that have analyzed existing archeology and potential impacts and also has specific experience with tribal culture. At the Site One Impoundment project in Florida, human remains potentially from a tribe member were found, and a protocol to communicate with the tribe regarding the remains was initiated. Under the terms of the protocol, the area was protected and kept dewatered to ensure that no impacts occurred. In addition, as project manager of a mine reclamation study mentioned above for the Pala band of Mission Indians on tribal lands in northern San Diego County, she developed a familiarity with the area's tribal culture.

Dr. Rein's expertise includes compliance with environmental laws, policies, and regulations. As a consultant, she has been awarded many projects dealing with environmental compliance monitoring. Her firm is responsible for all aspects of conducting required monitoring and maintaining compliance with permits, regulations, and laws. As a reviewer, she has extensive experience evaluating documents for NEPA compliance. Dr. Rein has had specific experience with the U.S. Fish and Wildlife Service (USFWS) on interagency coordination for several projects in compliance with the Fish and Wildlife Coordination Act. She also has managed projects that required expert knowledge of the Clean Water Act; these projects focused on wetland restoration or protection, wastewater discharge, and water quality protection. In addition, she has managed projects involving compliance with the Endangered Species Act, both in field monitoring and report preparation and review. For example, the project in Carmel, California, required an assessment of two species with conflicting habitat needs (the threatened red-legged frog and the endangered steelhead salmon) for compliance with the Endangered Species Act. Dr. Rein is also familiar with the USFWS Habitat Evaluation Procedure (HEP). Dr. Rein is familiar with the Standardized Assessment Methodology (SAM) and the Combined Habitat Assessment Protocols (CHAP) habitat evaluation model.

Name	**Alan Hall, D.WRE, P.E.**
Role	**H&H / Coastal Engineering**
Affiliation	**Independent Consultant**

Mr. Hall is an independent consultant with more than 40 years of experience in the fields of water resources, environmental, and civil engineering in government service and private practice. He currently provides watershed-scale water resources consulting services to public and private client groups. He earned his B.S. in engineering management from NOVA Southeastern University in 1986, is a registered professional engineer in Florida, and a Diplomate of the American Academy of Water Resource Engineers. He completed numerous graduate studies in Professional Engineering Management from the University of South Florida.

Mr. Hall is a well-known expert in hydrology and hydraulics and has developed hydrologic methods that were adopted by the USDA-NRCS (aka SCS) for their National Field Engineers Handbook. For the State of Florida, he developed a hydraulic model for rapid planning analysis of capacities of alternative conveyance components. As an independent consultant, Mr. Hall led the hydrologic and hydraulic modeling of a large coastal urbanizing watershed in Florida using the full suite of HEC models (HEC-HMS, HEC-RAS, and HEC-FDA) to identify the “with- and without- project” conditions for the Federal flood control project that identified future development plans and damage reduction options. He also led the modeling efforts for damage reduction analysis of coastal flood protection plans on the southwest coast of Florida, which subsequently produced the appropriate Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for the communities in Lee and Collier Counties.

Mr. Hall is familiar with large, complex water resources projects with high public and interagency interests and has managed over $2 billion in water resources programs. For example, while serving as the Deputy Director of Planning for the South Florida Water Management District (SFWMD) (1983-1988), he led the agency efforts for the development of Regional Water Supply Plans to identify and plan for the water needs of over 6 million municipal customers, over 1 million agricultural acres, electric power suppliers, and recreational customers. As the Deputy Director of Operations & Maintenance (1988-1994), he oversaw a $15 billion water control system. He also served as the SFWMD Director of Ecosystems Restoration (1994-1999), managing more than a billion dollars in ecosystems restoration planning, design and construction projects. Mr. Hall’s specific accomplishments with SFWMD included the design and implementation of the Everglades Construction Project and Florida Bay Restoration, and the Emergency Interim Project.

Several projects in New Orleans, Louisiana required his expertise in civil engineering, water resources engineering, and operations and maintenance. Mr. Hall served in multiple professional capacities as an IEPR panel member to oversee the design and construction of the Gulf Intracoastal Waterway Closure Complex (GIWCC) project. Included within the study were flood control pumping stations, a waterway closure gate, extensive levees and hurricane protection walls, and an environmentally sensitive water control structure.

Mr. Hall is experienced in the USACE water supply storage reallocation process for Federal water projects and has worked on multiple USACE water supply and flood control projects in Ohio, West Virginia, Louisiana, and Florida. Relevant studies include the Supply-Side Management Plan for South Florida. He was the sole author of this management and operations plan to meet the needs of over 6 million urban customers, over one million acres of agricultural production, power supplies and the

recreational and environmental needs for two million acres. This manual has been in use for the past 25 years and established the rule curves for the use of a four-million-acre-foot Federally constructed reservoir during both flood and drought conditions. The water control system controlled by this manual is valued at approximately $15 billion. On another project, Mr. Hall served as an operations expert on the design, construction, and operation IEPR for a dam system, with a design capacity of more than 1,000,000 cfs that served the flood control and water supply needs in southern West Virginia.

Mr. Hall is familiar with the development and evaluation of alternative plans for water supply for municipal and industrial uses, to include both surface and groundwater sources, and he has led regional water supply planning efforts that included surface and groundwater sources and their interconnections. Studies include the Central & South Florida Flood Control Project, where he developed the models, rule curves, and operation manuals for storage and distribution of water supplies for a system that included a 700 square mile reservoir with multiple water storage units upstream. He also wrote and implemented the manuals for flood control and water supply management for a system that delivered water to over six million residents from Orlando to Key West, Florida and for over 1.5 million acres of agricultural areas. Mr. Hall has experience working in states under both Eastern and Western systems of water rights in numerous studies throughout the United States. He served as an advisor to the General Manager of the Metropolitan Water District of Southern California during an initiative to drought-proof supplies for the future. He also served on a project team as an expert in hydraulic design and management to develop new water supplies for the environment, urban, agricultural, and power utilities for southern Florida in support of the Central Everglades Planning Project (CEPP). He served as the Deputy Planning Director of the SFWMD to manage the development of regional water supply plans to provide for all of the regional water supply needs in the future.

Mr. Hall is also experienced in water resources studies at Federal multipurpose reservoir projects as defined in USACE Engineer Regulation 1105-2-100. Engineer Regulation 1105-2-100 was the basic set of regulations for the processes, procedures, and criteria that were used for the CEPP (that was completed in 2014) and has been the guidance on almost all project feasibility studies in which he has participated. Mr. Hall's understanding of the application of Engineer Regulation 1105-2-100 is also demonstrated through his participation on several USACE IEPR projects as a civil and operations and maintenance expert for such studies as the WBV 14C.2 - New Westwego Pump Station to Orleans Village - 3RD Enlargement - Phase 1 and the Gulf Intracoastal Waterway (GIWW) West Closure Complex (WCC).

Name	**Christopher Brown, Ph.D., P.E.**
Role	**Geotechnical Engineering**
Affiliation	**University of North Florida**

Dr. Brown is an associate professor at the University of North Florida (UNF), teaching courses in civil engineering, fluid mechanics, hydraulics, senior design, foundation engineering, and engineering geology. He earned his Ph.D. in civil engineering in 2005 from the University of Florida, M.A. in civil engineering (geo-environmental concentration) in 1997 from Villanova University, and a B.S. in civil engineering from Temple University in 1991. Dr. Brown is a licensed, practicing professional engineer in Florida and Pennsylvania focusing on water resources and geotechnical engineering. Dr. Brown has 29 years of civil engineering experience, which includes planning, design, construction, inspection, and teaching, working

with and for USACE (Philadelphia District, 1991-1999, and Jacksonville District, 1999-2006), as well as municipal governments and private engineering firms.

Dr. Brown has worked on a wide variety of large public works projects including dams, levees, shore protection, coastal structures, navigation (e.g., dredging and lock/dam projects), and environmental restoration (e.g., Everglades Restoration work). Dr. Brown has worked on several large channel modification projects as both a design engineer and peer reviewer. For the Molly Ann's Brook project in Haledon/Patterson, New Jersey, he worked on excavation plans, retaining wall design, and helped with the underpinning of existing buildings near the modified channel. As a peer reviewer, he has reviewed channel modification projects in North Carolina, Arizona, Illinois, Washington, and Texas. Dr. Brown has helped project economists derive traditional economic benefits from transportation savings, reduced emergency response costs, and reduced inundation costs. He has used all manner of site investigations on flood control, shore protection, and navigation projects, including standard penetration test borings, cone penetration test borings, downhole geophysical investigations, vibracores, and test pits. Dr. Brown has used this information to determine channel modification depths, rock excavation requirements, and disposal estimates. For the Little Mill Creek project in Delaware, he determined the required depths of channel modification based upon the site investigation data. Dr. Brown was the primary design engineer for the modification of the Canaveral Harbor South Jetty, where he considered environmental impacts, natural geomorphology, and coastal processes to optimize the final modification design. Dr. Brown was also the lead geotechnical engineer evaluating both shore protection needs and dredging requirements in the Tampa Harbor complex. For this project, disposal of dredged material in open ocean environments, as beneficial beach fill material, and in upland confined disposal sites were all investigated.

Dr. Brown has also worked as an expert witness, testifying in multiple trials involving differing site condition claims, foundation failures, and deficient designs. He has also testified in arbitration proceedings and in the International Court of Settlements. Dr. Brown has planning and design experience in Florida, Georgia, Delaware, Virginia, West Virginia, New Jersey, Delaware, Pennsylvania, and Puerto Rico. Dr. Brown teaches the water resources series of courses at UNF as well as the senior civil engineering capstone course. In the past, he has also taught engineering geology and foundation engineering. Dr. Brown has participated on several previous IEPR panels for multiple USACE districts.

Dr. Brown is also fully capable of addressing relevant SAR issues and has fulfilled this requirement for at least four other IEPR projects, including the Olmsted Locks and Dam 52 and 53 Replacement Project Post Authorization Change Report and the Dallas Floodway Feasibility Report and Environmental Impact Statement (EIS), Dallas, Texas.

Dr. Brown is active in the Society of American Military Engineers (SAME) and the American Water Resources Association; he is the faculty advisor to the University of North Florida SAME student chapter. He is also a former active member of the American Society of Civil Engineers.

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APPENDIX C

Final Charge for the Coastal Texas IEPR

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Charge Questions and Guidance to the Panel Members for the Independent External Peer Review (IEPR) of the Coastal Texas Protection and Restoration, Integrated Feasibility Report and Environmental Impact Statement

This is the final Charge to the Panel for the Coastal Texas IEPR. This final Charge was submitted to USACE as part of the final Work Plan, originally submitted on June 27. 2018. The dates and page counts in this document have not been updated to match actual changes made throughout the project.

BACKGROUND

Coastal Texas is a Mega Study addressing Coastal Storm Risk Management (CSRM) and Ecosystem Restoration (ER) along the Texas Coast. The study area consists of the entire Texas Gulf Coast from the mouth of the Sabine River to the mouth of the Rio Grande, and includes the Gulf and tidal waters, barrier islands, estuaries, coastal wetlands, rivers and streams and adjacent areas that make up the interrelated ecosystem along the coast of Texas. The study area encompasses 18 coastal counties along the Gulf Coast and bayfronts. The study area has been divided into four regions loosely based on major bay systems and habitats.

The Texas coastal zone contains several large cities at risk during storm events including the nation's fourth largest city (Houston). The coastal region is home to approximately 6.1 million people. Mineral production has a value of nearly $1 billion per year and commercial fisheries generate another $156 million. Agriculture in the less populated counties generates approximately $500 million of product per year. The value of goods exported from Texas ports in 2011 was $251 million, more than that from all other states.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Coastal Texas Protection and Restoration, Integrated Feasibility Report and Environmental Impact Statement (FR/EIS) (hereinafter: Coastal Texas IEPR) in accordance with the Department of the Army, U.S. Army Corps of Engineers (USACE), Water Resources Policies and Authorities' *Review Policy for Civil Works* (Engineer Circular [EC] 1165-2-217, dated February 20, 2018), and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004). Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. Peer review typically evaluates the clarity of hypotheses, validity of the research design, quality of data collection procedures, robustness of the methods employed, appropriateness of the methods for the hypotheses being tested, extent to which the conclusions follow from the analysis, and strengths and limitations of the overall product.

The purpose of the IEPR is to "assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, models used in evaluation of economic or environmental impacts, and any biological opinions" (EC 1165-2-217; p. 39) for the decision documents. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) who meet the technical criteria and areas of expertise required for and relevant to the project.

The Panel will be "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-217 (p.41), review panels should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The panel members may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The following is a list of documents, supporting information, and reference materials that will be provided for the review. The review assignments per panel member may vary slightly according to discipline.

	Subject Experts					
Review Documents	No. of Review Pages	Civil Works Planner/ Economist	Ecological Modeler	Environ-mental Law Compliance	H&H / Coastal Engineer	Geotech-nical Engineer
Main DIFR-EIS	444	444	444	444	444	444
Appendix A: Plan Formulation Supporting Information	66	66				
Appendix B: Agency and Tribal Coordination	146	146		146		
Appendix C-1: Environmental Supporting Documentation	470		470	470		
Appendix C-2: Draft CWA Section 404(b)(1) Evaluation	30			30		
Appendix C-3: ESA – Biological Assessment	94			94		
Appendix C-4: Draft EFH Assessment	100			100		
Appendix C-5: USFWS PAL	34			34		
Appendix C-6: Draft CZMA Consistency Determination	30			30		
Appendix C-7: Draft HTRW Assessment	108			108		
Appendix C-8: Draft HEP and WVA Modeling Report	76		76	76		
Appendix C-9: Draft Mitigation Plan	34			34		
Appendix D: Engineering Design, Cost Estimate, and Cost Risk Analysis	300	300			300	300
Appendix E-1 – Coastal Storm Surge Reduction, Upper Texas Coast	124	124				
Appendix E-2: South Padre Island CSRM Economics	90	90				
Appendix E-3: Economic CE-ICA	38	38				
Appendix G: Public Coordination	246			246		

	Subject Experts					
Review Documents	**No. of Review Pages**	**Civil Works Planner/ Economist**	**Ecological Modeler**	**Environ-mental Law Compliance**	**H&H / Coastal Engineer**	**Geotech-nical Engineer**
Public Comments[ab]	100	100	100	100	100	100
Total Number of Review Pages	**2,406**	**1308**	**1090**	**1912**	**744**	**744**

[a] Supporting documentation only. These documents are not for Panel review and should be used as information sources only. They are not included in the total page count.
[b] Page count for public comments is approximate. USACE will submit public comments to Battelle, who will in turn submit the comments to the IEPR Panel.

Documents for Reference

- USACE guidance *Review Policy for Civil Works,* (EC 1165-2-217, February 20, 2018)
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004)
- Foundations of SMART Planning
- SMART Planning Bulletin (PB 2013-03)
- SMART – Planning Overview
- Planning Modernization Fact Sheet.

SCHEDULE & DELIVERABLES

This schedule is based on the receipt date of the final review documents and may be revised if review document availability changes. This schedule may also change due to circumstances out of Battelle's control such as changes to USACE's project schedule and unforeseen changes to panel member and USACE availability. As part of each task, the panel member will prepare deliverables by the dates indicated in the table (or as directed by Battelle). All deliverables will be submitted in an electronic format compatible with MS Word (Office 2003).

Task	Scope Summary - Milestones and Deliverables	Due Date Working Days
1	Review documents available	10/24/2018
2	Subcontractors complete mandatory Operations Security (OPSEC) training	11/30/2018
3	Battelle convenes kick-off meeting with USACE	6/5/2018
	Battelle sends review documents to panel members	11/1/2018
	Battelle convenes kick-off meeting with panel members	11/5/2018
	Battelle convenes kick-off meeting with USACE and panel members	11/5/2018
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	11/20/2018
	Battelle participates in the ADM Meeting	2/14/2019
	Battelle participates in the SLM	TBD
4	Panel members complete their review of the documents	12/7/2018
	Battelle provides talking points to panel members for Panel Review Teleconference	12/11/2018
	Battelle convenes Panel Review Teleconference	12/12/2018
	Battelle provides Final Panel Comment templates and instructions to panel members	12/13/2018
	Panel members provide draft Final Panel Comments to Battelle	12/19/2018
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	12/20/2018 - 12/30/2018
	Panel finalizes Final Panel Comments	12/31/2018
4	Battelle receives public comments from USACE	1/8/2019
	Battelle sends public comments to Panel	1/10/2019
	Panel members complete their review of the public comments	1/16/2019
	Battelle and Panel review the Panel's responses to the charge question regarding the public comments	1/17/2019
	Panel drafts Final Panel Comment on public comments, if necessary	1/22/2019
	Panel finalizes Final Panel Comment regarding public comments, if necessary	1/24/2019
5	Battelle provides Final IEPR Report to panel members for review	1/28/2019
	Panel members provide comments on Final IEPR Report	1/30/2019
	Battelle submits Final IEPR Report to USACE*	2/1/2019
	USACE Planning Center of Expertise (PCX) provides decision on Final IEPR Report acceptance	2/8/2019
6	Battelle inputs Final Panel Comments to Design Review and Checking System (DrChecks) and provides Final Panel Comment response template to USACE	2/12/2019
	Battelle convenes teleconference with USACE to review Comment Response process	2/12/2019
	Battelle convenes teleconference with Panel to review Comment Response process	2/12/2019
	USACE Project Delivery Team (PDT) provides draft Evaluator Responses to USACE PCX for review	2/27/2019

Task	Scope Summary - Milestones and Deliverables	Due Date Working Days
6	USACE PCX reviews draft Evaluator Responses and works with USACE PDT regarding clarifications to responses, if needed	3/5/2019
	USACE PCX provides draft PDT Evaluator Responses to Battelle	3/6/2019
	Battelle provides draft PDT Evaluator Responses to panel members	3/8/2019
	Panel members provide draft BackCheck Responses to Battelle	3/13/2019
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	3/14/2019
	Battelle convenes Comment Response Teleconference with panel members and USACE	3/15/2019
	USACE inputs final PDT Evaluator Responses to DrChecks	3/22/2019
	Battelle provides final PDT Evaluator Responses to panel members	3/25/2019
	Panel members provide final BackCheck Responses to Battelle	3/28/2019
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	3/29/2019
	Battelle submits pdf printout of DrChecks project file*	4/1/2019
	Contract End/Delivery Date	8/31/2019

***** Deliverables

****** Battelle will provide public comments to the Panel after they have completed their individual reviews of the project documents to ensure that the public comment review does not bias the Panel's review of the project documents.

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the decision documents are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, and properly documented; satisfies established quality requirements; and yields scientifically credible conclusions. The Panel is being asked to provide feedback on the economic, engineering, environmental resources, and plan formulation. The panel members are not being asked whether they would have conducted the work in a similar manner.

Specific questions for the Panel (by report section or appendix) are included in the general charge guidance, which is provided below.

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the decision documents. Please focus your review on the review materials assigned to your discipline/area of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note that the Panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-217).

1. Your response to the charge questions should not be limited to a "yes" or "no." Please provide complete answers to fully explain your response.

2. Assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, and any biological opinions of the project study.

3. Assess the adequacy and acceptability of the economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, and models used in evaluating economic or environmental impacts of the proposed project.

4. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation.

5. Identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods.

6. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable.

7. Please focus the review on assumptions, data, methods, and models.

Please **do not** make recommendations on whether a particular alternative should be implemented, or whether you would have conducted the work in a similar manner. Also, please **do not** comment on or make recommendations on policy issues and decision making. Comments should be provided based on your professional judgment, **not** the legality of the document.

1. If desired, panel members can contact one another. However, panel members **should not** contact anyone who is or was involved in the project, prepared the subject documents, or was part of the USACE Agency Technical Review (ATR).

2. Please contact the Battelle Project Manager (Lynn McLeod; mcleod@battelle.org) for requests or additional information.

3. In case of media contact, notify the Battelle Program Manager, Lynn McLeod (mcleod@battelle.org) immediately.

4. Your name will appear as one of the panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to the Project Manager, no later than 10 pm ET by the date listed in the schedule above.

Independent External Peer Review of the Coastal Texas Protection and Restoration, Integrated Feasibility Report and Environmental Impact Statement

Charge Questions and Relevant Sections as Supplied by USACE

The following Charge to Reviewers outlines the objective of the Independent External Peer Review (IEPR) for the subject study and the specific advice sought from the IEPR panel.

The objective of the IEPR is to obtain an independent evaluation of whether the interpretations of analysis and conclusions based on analysis are reasonable for the subject study. The IEPR panel is requested to offer a broad evaluation of the overall study decision document in addition to addressing the specific technical and scientific questions included in the charge. The panel has the flexibility to bring important issues to the attention of decision makers, including positive feedback or issues outside those specific areas outlined in the charge.

The panel review is to focus on scientific and technical matters, leaving policy determinations for USACE and the Army. The panel should not make recommendations on whether a particular alternative should be implemented or present findings that become "directives" in that they call for modifications or additional studies or suggest new conclusions and recommendations. In such circumstances the panel may have assumed the role of advisors as well as reviewers, thus introducing bias and potential conflict in their ability to provide objective review.

Panel review comments are to be structured to fully communicate the panel's intent by including the comment, why it is important, any potential consequences of failure to address, and suggestions on how to address the comment.

Broad Evaluation Charge Questions

1. Is the need for and intent of the decision document clearly stated?
2. Does the decision document adequately address the stated need and intent relative to scientific and technical information?
3. Given the need for and intent of the decision document, assess the adequacy and acceptability of the project evaluation data used in the study analyses.
4. Given the need for and intent of the decision document, assess the adequacy and acceptability of the economic, environmental, and engineering assumptions that underlie the study analyses.
5. Given the need for and intent of the decision document, assess the adequacy and acceptability of the economic, environmental, and engineering methodologies, analyses, and projections.
6. Given the need for and intent of the decision document, assess the adequacy and acceptability of the models used in the evaluation of existing and future without-project conditions and of economic or environmental impacts of alternatives.
7. Given the need for and intent of the decision document, assess the adequacy and acceptability of the methods for integrating risk and uncertainty.

8. Given the need for and intent of the decision document, assess the adequacy and acceptability of the formulation of alternative plans and the range of alternative plans considered.

9. Given the need for and intent of the decision document, assess the adequacy and acceptability of the quality and quantity of the surveys, investigations, and engineering sufficient for conceptual design of alternative plans.

10. Given the need for and intent of the decision document, assess the adequacy and acceptability of the overall assessment of significant environmental impacts and any biological analyses.

11. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable.

12. Assess the considered and tentatively selected alternatives from the perspective of systems, including systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

13. For the tentatively selected plan, assess whether the models used to assess life safety hazards are appropriate,

14. For the tentatively selected plan, assess whether the assumptions made for the life safety hazards are appropriate,

15. For the tentatively selected plan, assess whether the quality and quantity of the surveys, investigations, and engineering are sufficient for a concept design considering the life safety hazards and to support the models and assumptions made for determining the hazards, and

16. For the tentatively selected plan, assess whether the analysis adequately address the uncertainty and residual risk given the consequences associated with the potential for loss of life for this type of project.

Battelle Summary Charge Questions to the Panel Members

The following questions will be included in the list of questions sent to the Panel for completion during their review. These questions are provided for Battelle's use in identifying the Panel's key technical issues.

Summary Questions

17. Please identify the most critical concerns (up to five) you have with the project and/or review documents. These concerns can be (but do not need to be) new ideas or issues that have not been raised previously.

18. Please provide positive feedback on the project and/or review documents.

Public Comment Questions

19. Do the public comments raise any additional discipline-specific technical concerns with regard to the overall report?

APPENDIX D

Conflict of Interest Form

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David Kaplan
USACE, Institute for Water Resources
May 10, 2018
C-2

Conflicts of Interest Questionnaire

Independent External Peer Review

COASTAL TEXAS PROTECTION AND RESTORATION
INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

The purpose of this document is to help the U.S. Army Corps of Engineers identify potential organizational conflicts of interest on a task order basis as early in the acquisition process as possible. Complete the questionnaire with background information and fully disclose relevant potential conflicts of interest. Substantial details are not necessary; USACE will examine additional information if appropriate. Affirmative answers will not disqualify your firm from this or future procurements.

NAME OF FIRM: **Battelle Memorial Institute Corporate Operations**
REPRESENTATIVE'S NAME: **Jason Jenkins**
TELEPHONE: **614-424-4873**
ADDRESS: **505 King Avenue, Columbus, Ohio 43201**
EMAIL ADDRESS: **jenkins@battelle.org**

I. INDEPENDENCE FROM WORK PRODUCT. Has your firm been involved in any aspect of the preparation of the subject study report and associated analyses (field studies, report writing, supporting research etc.) **No** Yes (if yes, briefly describe):

II. INTEREST IN STUDY AREA OR OUTCOME. Does your firm have any interests or holdings in the study area, or any stake in the outcome or recommendations of the study, or any affiliation with the local sponsor? **No** Yes (if yes, briefly describe):

III. REVIEWERS. Do you anticipate that all expert reviewers on this task order will be selected from outside your firm? No **Yes** (if no, briefly describe the difficulty in identifying outside reviewers):

IV. AFFILIATION WITH PARTIES THAT MAY BE INVOLVED WITH PROJECT IMPLEMENTATION. Do you anticipate that your firm will have any association with parties that may be involved with or benefit from future activities associated with this study, such as project construction? **No** Yes (if yes, briefly describe):

V. ADDITIONAL INFORMATION. Report relevant aspects of your firm's background or present circumstances not addressed above that might reasonably be construed by others as affecting your firm's judgment. Please include any information that may reasonably: impair your firm's objectivity; skew the competition in favor of your firm; or allow your firm unequal access to nonpublic information.

No additional information to report.

Courtney M. Brooks

Courtney Brooks

May 9, 2018

Date

Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal

BATTELLE

It can be done