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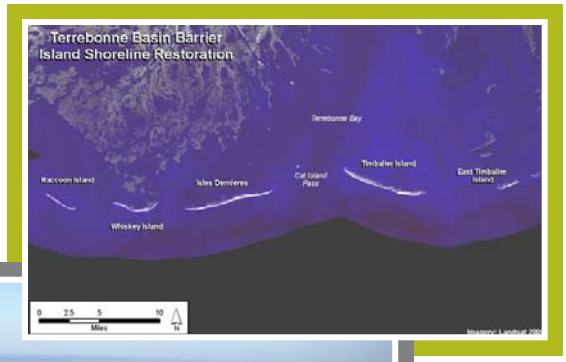
Final Independent External Peer Review Report for the Integrated Feasibility Study and Environmental Impact Statement for the Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration Terrebonne Parish, Louisiana

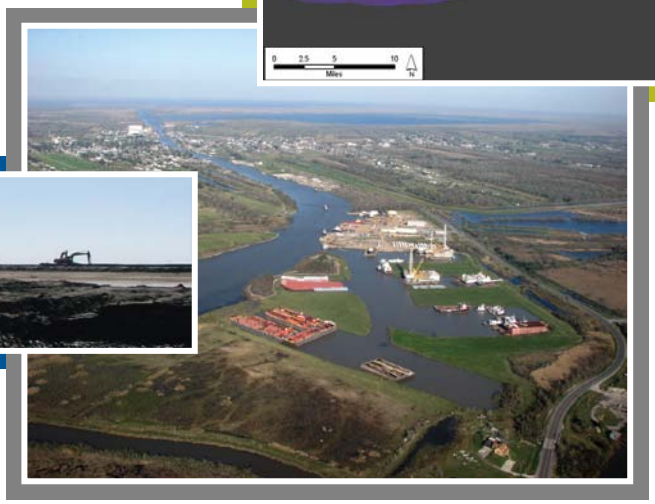
Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Ecosystem Restoration Planning Center of Expertise
Rock Island District

Contract No. W911NF-07-D-0001
Task Control Number: 10096
Delivery Order: 0896

June 25, 2010





SHORT-TERM ANALYSIS SERVICE (STAS)

on

Final Independent External Peer Review Report for the Integrated Feasibility Study and Environmental Impact Statement for the Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration Terrebonne Parish, Louisiana

by

Battelle
505 King Avenue
Columbus, OH 43201

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Scientific Services Program

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FINAL INDEPENDENT EXTERNAL PEER REVIEW REPORT
for the
Integrated Feasibility Study and Environmental Impact Statement for the Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration Terrebonne Parish, Louisiana

EXECUTIVE SUMMARY

The Terrebonne Basin Barrier Shoreline (TBBS) Restoration project (hereinafter referred to as the Terrebonne project) is located in Louisiana Coastal Area (LCA) Subprovince 3 and provides for the restoration of the Timbalier and Isles Dernieres barrier island chains located in Terrebonne Parish and Lafourche Parish, Louisiana. A Feasibility Study (FS) for the project was conducted to meet the goal of the 2004 LCA Plan and to address the critical near-term needs for shoreline restoration in Terrebonne Basin through simulation of historical conditions. The desired restoration can be achieved by enlarging the existing barrier islands (width and dune crest) and reducing the number of breaches. Additional objectives of the FS include analyzing the current conditions of the barrier islands, assessing impacts from the hurricanes of 2005 and 2008, and reaffirming the validity of the findings of the Final Programmatic Environmental Impact Statement (EIS). The Integrated Feasibility Study and Environmental Impact Statement for the Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration Terrebonne Parish, Louisiana (hereinafter referred to as the Terrebonne report) is based on a review of existing scientific and engineering reports, as well as geospatial, survey, and geotechnical data.

The U.S. Army Corps of Engineers (USACE) is simultaneously conducting five[1] individual Independent External Peer Reviews (IEPRs) under one project (LCA 6 project) to review six elements of the LCA Ecosystem Restoration Project. As part of the LCA 6 project, an IEPR was conducted for the Terrebonne project. Battelle, as a 501(c)(3) non-profit science and technology organization with experience in establishing and administering peer review panels for USACE, was engaged to coordinate the IEPR of the Terrebonne report. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2010), USACE (2007), and OMB (2004). This final report describes the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

Five panel members were selected for the IEPR from more than 90 identified candidates for the five LCA 6 project IEPR panels. Based on the technical content of the Terrebonne report and the overall scope of the project, the final panel members were selected for their technical expertise in the following key areas: civil design/construction cost engineering, Civil Works planning, wetland ecology, hydrology and hydraulics engineering, and economics.

The Panel received electronic versions of the Terrebonne report, along with a charge that solicited comments on specific sections of the documents to be reviewed. The USACE Project

[1] Two of the six elements were reviewed under one independent external peer review.

Delivery Team (PDT) briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review. Other than this teleconference, there was no direct communication between the Panel and USACE during the peer review process. The Panel produced nearly 400 individual comments in response to the more than 116 charge questions .

IEPR panel members reviewed the Terrebonne report individually. The panel members then met via teleconference with Battelle to review key technical comments, discuss charge questions for which there were conflicting responses, 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, or low); and (4) recommendations on how to resolve the comment. Overall, 16 Final Panel Comments were identified and documented. Of these, 4 were identified as having high significance, 9 had medium significance, and 3 had low significance.

Table ES-1 summarizes the Final Panel Comments by level of significance. Detailed information on each comment is contained in Appendix A of this report.

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

Significance – High	
1	The evaluation of structural measures (i.e., offshore breakwaters and terminal groins) needs to include additional information and analysis to support their inclusion in the National Ecosystem Restoration (NER) plan, while revetments are excluded.
2	Physical processes should be analyzed for the Terrebonne Basin barrier island system as a whole.
3	More information from critically important studies regarding physical processes (including modeling, analysis, and prior project performance) needs to be provided in the Terrebonne report.
4	The initial short-term impacts to habitat due to project construction need to be quantified in more detail, and revisions to designs and construction should be considered to reduce potential impacts.
Significance – Medium	
5	The accuracy of the predicted effects of storm events and sediment transport is uncertain.
6	The economic criteria and approach used for overall project justification and plan formulation need to be clarified.
7	Some of the assumptions used in the evaluation of alternatives need to be explained and supported in more detail.
8	The role of barrier islands in enhancing and protecting mainland socioeconomic and business benefits is understated.
9	The Terrebonne report should explain that, although the objectives of the Terrebonne project will be met by the Tentatively Selected Plan (TSP) on a local scale, the project will not fully meet the LCA objective of restoring the geomorphologic form and function of the Terrebonne Basin barrier islands.

10	The justification for parameter selection and model calculations, as well as information on validation and application of the Wetland Value Assessment (WVA) models, should be provided.
11	The construction design and expected performance of the TSP should be described in greater detail.
12	The description of the scope and cost-sharing for the Adaptive Management and Monitoring Plan requires additional detail, and the projected costs for its administration may be underestimated.
13	The Abstract and Executive Summary (ES) should be expanded to include more specific descriptions of the TSP and NER plan, and the Terrebonne main report should include graphic illustrations of these plans.
Significance – Low	
14	The approach used to calculate habitat acres created at Year 1 and subsequent years should be explained in more detail, including whether the number of acres calculated includes existing habitat.
15	Information from the risk and uncertainty (R&U) analysis in Appendix L-5 should be brought forward into the main body of the Terrebonne report.
16	Minor editorial and technical revisions to the Terrebonne report should be made to improve the quality of the report.

The Panel agreed on the "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2010; p. D-4) in the Terrebonne report. Overall, the Panel agreed that the Terrebonne project is a good project with the potential to provide benefits to the island habitats proposed to be restored by the Tentatively Selected Plan (TSP) and, to some degree, the estuary and wetlands on the leeward side of the islands within Terrebonne Bay. Furthermore, the Panel agrees that monitoring after the implementation of this project could capture valuable data, approaches, and lessons that would enhance the capacity to perform similar efforts on other islands in the LCA and beyond. The following statements summarize the Panel's findings, which are described in more detail in the Final Panel Comments (see Appendix A).

Plan Formulation Rationale: The Terrebonne report follows conventional protocol and presents the sequence used to determine the TSP (i.e., Alternative 11), including identifying project objectives, alternatives considered, cost-effectiveness/incremental cost analysis (CE/ICA), and eventually the project budget. Plan formulation was accurate and well done, although there are concerns about plan formulation being overly simplified by considering island acreage rather than island system benefits. However, the initial plan screening was not constrained by budget requirements. Additionally, the inclusion of some structural alternatives (breakwaters and terminal groins) and the exclusion of other structural alternatives (revetments) in the alternatives evaluation was not well justified by analyses or descriptions of prior project performance. The plan formulation identified the alternative which was estimated to yield the greatest gross benefit and best met NER objectives (Alternative 5); however, this alternative was not chosen because it exceeded the project budget. A different alternative (Alternative 11) is chosen as the TSP based on the project budget. The Panel noted that the Terrebonne report

should explain that, although the objectives of the Terrebonne project will be met by the TSP on a local scale, the project will not fully meet the LCA objective of restoring the geomorphologic form and function of the Terrebonne Basin Barrier Islands.

Economics: The CE/ICA is correctly applied and determined a relatively cost-effective plan in terms of island area created but not in terms of island system benefits. However, the TSP is based on the alternative that the project could afford given the budget allowed rather than the NER plan. The Panel noted that, in order to better inform readers, the Terrebonne report needs additional explanation of the economic criteria and approach used to justify the recommended project(s). In addition, the Panel noted that the Terrebonne report would benefit from documenting the role of barrier islands in enhancing and protecting mainland socioeconomic and business benefits to emphasize the system-wide importance of the restoration project.

Engineering: The Panel noted that it was difficult to determine the accuracy of the engineering analyses conducted on this project given the documentation supplied in the Terrebonne report on the assumptions and models (STWAVE, SBEACH and GENESIS) used to predict the effects of storm events and sediment transport. In some instances, the Panel noted that USACE has access to stronger models (i.e., ADCIRC) to model some of the parameters. In addition, the analysis of physical processes was limited to individual islands rather than looking at the barrier island system as a whole. A system-wide analysis is necessary to formulate a preferred project that enhances the barrier island system. Some of the assumptions used to evaluate alternatives need to be explained and supported in more detail, and lessons learned from other projects should be used to justify and support the alternatives analysis.

Environmental: From an ecological standpoint, the project will be beneficial. However, the selection of project alternatives relies heavily on the output of the models that is not well explained and may not be accurate. The design, environmental, and construction considerations outlined for the TSP should be more detailed to better support the alternatives analysis and the selected plan, particularly with regard to physical and ecological processes that will be restored and adaptation to specific conditions and the existing environment. Furthermore, the initial short-term impacts to habitat due to project construction need to be better quantified, and revisions to designs and construction should be considered to reduce the extent of short-term impacts. The restoration project will provide an ideal opportunity to learn more about physical processes that are critical to the success of the project; however, the scope and cost-sharing of the Adaptive Management and Monitoring Plan requires additional detail to understand better how the restoration project will be measured and evaluated. The projected costs for its administration may be underestimated.

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LIST OF ACRONYMS

AAHA	Average Annual Habitat Acre
AAHU	Average Annual Habitat Unit
ATR	Agency Technical Review
BCA	Benefit-Cost Analysis
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
CPRA	Coastal Protection and Restoration Authority
DrChecks	Design Review and Checking System
EIS	Environmental Impact Statement
ERDC	Engineer Research and Development Center
ES	Executive Summary
FS	Feasibility Study
ft	Foot
HEC	Hydrologic Engineering Center
HSI	Habitat Suitability Index
IEPR	Independent External Peer Review
IWR	Institute for Water Resources
LACPR	Louisiana Coastal Protection and Restoration
LCA	Louisiana Coastal Area
LTER	Long-term Ecological Research
MHW	Mean High Water
NED	National Economic Development
NER	National Ecosystem Restoration
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NTP	Notice to Proceed
O&M	Operations and Maintenance
OCPR	Office of Coastal Protection and Restoration
OMB	Office of Management and Budget
PDT	Project Delivery Team
PED	Preliminary Engineering Design
R&U	Risk and Uncertainty
RSLR	Relative Sea Level Rise
SI	Suitability Index
SLR	Sea Level Rise
STAS	Short-term Analysis Service
TSP	Tentatively Selected Plan
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WRDA	Water Resources Development Act
WVA	Wetland Value Assessment

1. INTRODUCTION

The Water Resources Development Act (WRDA) of 2007 authorized the Louisiana Coastal Area (LCA) program to restore wetland ecosystems along the coast of Lousiana. Specifically, Section 7006(e)(3) requires the Secretary of the Army to submit one feasibility report to Congress on six elements of the project (hereinafter referred to as the LCA 6 project):

1) Terrebonne Basin Barrier Shoreline Restoration,
2) Small Diversion at Convent/Blind River,
3) Amite River Diversion Canal Modification,
4) Medium Diversion at White Ditch,
5) Convey Atchafalaya River Water to Northern Terrebonne Marshes, and
6) Multipurpose Operation of Houma Navigation Lock.

The Congressional language further authorizes construction of these six elements contingent upon submittal of a favorable report from the Chief of Engineers no later than December 31, 2010. The U.S. Army Corps of Engineers (USACE) is the Federal sponsor for the projects, and the non-Federal sponsor is Louisiana's Coastal Protection and Restoration Authority (CPRA).

Five[2] individual Independent External Peer Reviews (IEPRs) are being conducted simultaneously under one project (LCA 6 project) to review the six elements of the LCA Ecosystem Restoration Project. As part of the LCA 6 project, an IEPR was conducted for the the Terrebonne Basin Barrier Shoreline Restoration project (hereinafter referred to as the Terrebonne project). The project is located in LCA Subprovince 3 and provides for the restoration of the Timbalier and Isles Dernieres barrier island chains located in Terrebonne Parish and Lafourche Parish, Louisiana. A Feasibility Study (FS) for the project was conducted to meet the goal of the 2004 LCA Plan and to address the critical near-term needs for shoreline restoration in Terrebonne Basin through simulation of historical conditions. The desired restoration can be achieved by enlarging the existing barrier islands (width and dune crest) and reducing the number of breaches. Additional objectives of the FS include analyzing the current conditions of the barrier islands, assessing impacts from the hurricanes of 2005 and 2008, and reaffirming the validity of the findings of the Final Programmatic Environmental Impact Statement (EIS). The Integrated Feasibility Study and Environmental Impact Statement for the Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration Terrebonne Parish, Louisiana (hereinafter referred to as the Terrebonne report) is based on a review of existing scientific and engineering reports, as well as geospatial, survey, and geotechnical data.

The objective of the work described here was to conduct an IEPR of the Terrebonne report in accordance with procedures described in the Department of the Army, USACE Engineer Circular *Civil Works Review Policy* (EC No. 1165-2-209) (USACE, 2010), USACE CECW-CP memorandum *Peer Review Process* (USACE, 2007), and Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Battelle, as a 501(c)(3) non-profit science and technology organization with experience in establishing and

[2] Two of the six elements were reviewed under one independent external peer review.

administering peer review panels, was engaged to coordinate the IEPR of the Terrebonne report. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses.

This final report details the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel on the existing environmental, economic, and engineering analyses contained in the Terrebonne report. Detailed information on the Final Panel Comments is provided in Appendix A.

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 (ATR), as described in USACE (2010) and USACE (2007).

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 economic, engineering, and environmental analysis 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 Terrebonne report was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization under Section 501(c)(3) of the U.S. Internal Revenue Code with experience conducting IEPRs for USACE.

3. METHODS

This section describes the method followed in selecting the members for the IEPR Panel (the Panel) and in planning and conducting the IEPR. The IEPR was conducted following procedures described by USACE (2010) and in accordance with USACE (2007) and OMB (2004) guidance. Supplemental guidance on evaluation for conflicts of interest 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).

3.1 Planning and Schedule

After receiving the notice to proceed (NTP), Battelle held a kick-off meeting on the entire LCA 6 project with USACE to review the preliminary/suggested schedule for each of the five reviews, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan.

Table 1 outlines the tasks conducted under this project and defines the schedule followed in executing the Terrebonne report IEPR. Tasks 1 thorugh 4 were conducted concurrently for all five IEPRs being conducted under the LCA 6 project. For instance, one work plan applicable to

all five reviews was prepared and submitted. Table 1 is based on receipt of approval from the USACE Contracting Officer to begin initial work on the project (i.e., Pre-award funding approval) on March 12, 2010. The actual meeting dates and receipt for the Terrebonne report are specific for this review. Note that the work items listed in Task 7 occur after the submission of this report. 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.

Table 1. Terrebonne IEPR Schedule

TASK	ACTION	DUE DATE
1	Pre-award funding approval[a]	March 12, 2010
	NTP/review documents available	March 24, 2010
	Battelle prepares draft Work Plan[b]	April 9, 2010
	USACE provides comments on draft Work Plan	April 14, 2010
2	Battelle recruits and screens up to 30 potential panel members; prepares summary information[a]	April 7, 2010
3	Battelle submits draft charge[b]	April 9, 2010
	USACE provides comments on draft charge	April 14, 2010
	Battelle submits final Work Plan, including final charge[b]	April 19, 2010
	USACE approves final Work Plan, including final charge	April 20, 2010
4	Battelle selects no more than 25 panel members	April 7, 2010
	Battelle submits list of selected panel members	April 7, 2010
	USACE provides comments on list of panel members	April 9, 2010
	Battelle completes subcontracts for panel members	April 27, 2010
5	Kick-off meeting convened with USACE and Battelle	March 26, 2010
	Kick-off meeting convened with Battelle and IEPR Panel	April 26, 2010
	Kick-off meeting convened with USACE, Battelle, and IEPR Panel	April 27, 2010
6	Battelle sends review documents and charge to IEPR Panel	April 26, 2010
	IEPR Panel completes review and provides comments to Battelle	May 13, 2010
	Battelle consolidates comments from IEPR Panel	May 24, 2010
	Consensus teleconference convened with IEPR Panel and Battelle	May 28 2010
7	IEPR Panel provides draft Final Panel Comments to Battelle	June 2, 2010
	Battelle submits final IEPR Report to USACE[b]	June 25, 2010
8[c]	Battelle inputs Final Panel Comments to DrChecks	June 25, 2010
	USACE provides draft Evaluator Responses via e-mail (Word document)	July 9, 2010
	Teleconference convened with USACE, Battelle, and IEPR Panel to discuss Final Panel Comments	July 26, 2010

TASK	ACTION	DUE DATE
	USACE inputs final Evaluator Responses to Final Panel Comments in DrChecks	August 5, 2010
	IEPR Panel responds to USACE Evaluator Responses (Backcheck Responses)	August 19, 2010
	Battelle submits pdf of DrChecks file and closes out DrChecks[b]	August 20, 2010
	Project Closeout	October 26, 2010

[a] Requested to start on recruitment to meet the aggressive schedule

[b] Deliverable

[c] Task occurs after the submission of this report.

3.2 Identification and Selection of IEPR Panel Members

Each of the five LCA IEPRs required experts with identical areas of expertise corresponding to the technical content of the LCA projects: civil design/construction cost engineering, Civil Works planning, wetland ecology, hydrology and hydraulics engineering, and economics. Therefore, efforts were consolidated to identify and recruit experts.

Battelle initially identified 90 candidates for the five LCA 6 project IEPR panels, evaluated their technical expertise, and inquired about potential conflicts of interest. Of these, Battelle chose 29 of the most qualified candidates and confirmed their interest and availability. Of the 29 candidates, 25 were proposed for the final LCA panels (5 experts per panel) and 4 were proposed as backup panel members for individual areas of expertise (the civil design/construction cost engineering panel was presented without a backup). The backup panel members were the same for each of the five LCA IEPRs and would be able to serve on any panel that required their participation. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed conflicts of interest, or lack of the precise technical expertise required. The five primary and four backup panel members chosen for the Terrebonne report IEPR are described in Section 4.0 of this report.

The candidates were screened for the following potential exclusion criteria or conflicts of interest.[3] Participation in previous USACE technical peer review committees and other technical review panel experience was also considered.

[3] Battelle evaluated whether scientists in universities and consulting firms that are receiving USACE-funding have sufficient independence from USACE to be appropriate peer reviewers. See OMB (2004, p. 18), "….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."

- Involvement by you or your firm[4] in **<u>any</u>** part of the LCA program, particularly the following six elements:
    - Multipurpose Operation of Houma Navigation Lock
    - Terrebonne Basin Barrier Shoreline Restoration
    - Small Diversion at Convent/Blind River
    - Amite River Diversion Canal Modification
    - Medium Diversion at White's Ditch
    - Convey Atchafalaya River Water to Northern Terrebonne Marshes
- Involvement by you or your firm[4] in any work related to the Louisiana CPRA.
- Involvement by you or your firm[4] in ecosystem restoration, flood risk management, coastal storm damage reduction, or shoreline restoration projects in coastal Louisiana or Mississippi.
- Involvement by you or your firm[4] in the conceptual or actual design, construction, or operations and maintenance (O&M) of any projects for the LCA program, particularly the six elements listed in #1 above.
- Current employment by USACE.
- Involvement with paid or unpaid expert testimony related to the LCA program, particularly the six elements listed in the LCA projects above.
- Current or previous employment or affiliation with the non-Federal sponsors or any of the following cooperating Federal, State, County, local and regional agencies, environmental organizations, and interested groups: Louisiana CPRA, Louisiana Office of Coastal Protection and Restoration (OCPR), National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (USFWS), Natural Resources Conservation Service, U.S. Environmental Protection Agency (USEPA), Minerals Management Service, and U.S. Geological Survey (USGS) and currently working on LCA-related projects (for pay or pro bono).
- Past, current, pending, or future interests (financial or otherwise) by you, your spouse, or children related to the LCA program, particularly the six elements listed in #1 above, including interest in LCA-related contracts or awards from USACE.
- Current personal involvement with other USACE projects, including authoring any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, Engineer Research and Development Center [ERDC], etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the New Orleans District.
- Current firm[4] involvement with other USACE projects, specifically those projects/contracts that are with the New Orleans District. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role.

[4] Note: Includes any joint ventures in which your firm is involved.

- Any previous employment by the USACE as a direct employee or contractor (either as an individual or through your firm[4]) within the last 10 years, notably if those projects/contracts are with the New Orleans District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning:
    - shoreline restoration projects
    - hydrologic diversion projects
    - lock operation projects,

  and include the client/agency and duration of review (approximate dates).
- A significant portion (i.e., greater than 50%) of personal or firm[4] revenues within the last 3 years came from USACE contracts.
- Participation in relevant prior Federal studies/programs relevant to this project, such as:
    - Coast 2050 Plan
    - LCA Ecosystem Restoration Study, 2004
    - Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast, 2007
    - Louisiana Coastal Protection and Restoration Technical Report, 2009
    - LCA Near-term Restoration Plan, 2004
- Participation in relevant prior non-Federal studies/programs relevant to this project.
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the LCA program, particularly the six elements listed in LCA projects above.
- 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.

In selecting the final 29 members for the five panels from the list of candidates, Battelle chose experts who best fit the expertise areas and had no conflicts of interest. Then, to assign each selected panel member to a specific IEPR, Battelle evaluated his or her background and expertise in more detail for experience that may be most appropriate for the individual LCA projects. For example, if a panel member had experience with coastal restoration, Battelle assigned him or her to the Terrebonne IEPR. In addition, Battelle made every effort to have at least one expert on each panel who had previously served on another IEPR panel managed by Battelle. This ensured that panel members unfamiliar with the process would have someone, in addition to Battelle,who had experience and could provide guidance.

Once the five panel members for the Terrebonne report IEPR were chosen from the larger pool of candidates, Battelle established their subcontracts in which they indicated their willingness to participate and confirmed the absence of conflicts of interest through a signed Conflict of Interest form. Section 4.0 of this report provides names and biographical information of the Terrebonne IEPR panel members.

Prior to beginning their review and within 2 days of their subcontracts being finalized, all members of the Panel attended a kick-off meeting via teleconference that was planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication, and other pertinent information with the Panel.

3.3 Preparation of the Charge and Conduct of the IEPR

Battelle drafted a preliminary charge document for the Terrebonne report IEPR to assist USACE with the development of the charge questions to guide the peer review, according to guidance provided in USACE (2010) and OMB (2004). The draft charge was submitted to the USACE for evaluation as part of the draft Work Plan. USACE provided comments and revisions to the draft charge, which were used to produce the final charge. The final charge was submitted to USACE for approval. In addition to a list of 116 charge questions/discussion points developed for the Terrebonne IEPR, the final charge included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report). After the charge was reviewed and approved by USACE, it was sent to the Panel to guide the review of the Terrebonne report.

To begin the review, Battelle planned and facilitated kick-off meetings via teleconference during which USACE presented project details to the Panel. Two teleconference meetings were conducted for each of the five IEPRs; the first allowed USACE to provide an overview of the LCA Ecosystem Restoration Project as a whole, and the second allowed USACE to brief the individual panels on the specific project that they would be reviewing. Before the meeting, the Terrebonne IEPR Panel received an electronic version of the Terrebonne report and the final charge. A full list of the documents reviewed by the Panel is provided in Appendix B of this report. The Panel was instructed to address the charge questions/discussion points within a comment-response form provided by Battelle.

All IEPR activities conducted - from the review of the documents through the Final Panel Comment Backcheck process (described below) - were conducted solely by the Terrebonne IEPR panel members and not in conjunction with the other four panels participating under the LCA 6 project.

3.4 Review of Individual Comments

The Terrebonne Panel produced approximately 400 individual comments in response to the charge questions/discussion points. The individual comments were merged into a single table to facilitate the review of the five sets of comments received on the Terrebonne report. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle was able to summarize the 400 comments into a preliminary list of 33 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.5 IEPR Panel Teleconference

Battelle facilitated a 4.5-hour teleconference with the Panel so that the panel experts, many of whom are from diverse scientific backgrounds, 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 IEPR report and decide which panel member would 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 high-level importance to the findings, and merged any related individual comments. In addition, Battelle confirmed each Final Panel Comment's level of significance to the Panel.

The Panel also discussed responses to 18 specific charge questions where there appeared to be disagreement among panel members. The conflicting comments were resolved based on the professional judgment of the Panel, and all sets of comments were determined not to be conflicting. Each comment was either incorporated into a Final Panel Comment, determined to be consistent with other Final Panel Comments already developed, or determined to be a non-significant issue.

At the end of these discussions, the Panel identified 18 comments and discussion points that should be brought forward as Final Panel Comments.

3.6 Preparation of Final Panel Comments

Following the teleconference, Battelle prepared 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 Terrebonne Final IEPR Report:

- 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 the merged individual comments table, a summary 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 other IEPR 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 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, 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: Describes a fundamental problem with the project that could affect the recommendation or justification of the project
2. Medium: Affects the completeness or understanding of the reports/project
3. Low: Affects the technical quality of the reports but will not affect the recommendation of the project.

- Guidance for Developing the Recommendation: The recommendation was to include specific actions that the 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).

During the development of the Final Panel Comments, one was determined to be repetitive, and was combined with another Final Panel Comment, and one was determined not to be an issue and was removed. At the end of this process, a total of 16 Final Panel Comments were prepared and assembled. 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. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Final Panel Comments are presented in Appendix A of this report.

4. PANEL DESCRIPTION

Candidates for the Panel were identified using Battelle's Peer Reviewer Database, targeted Internet searches using key words (e.g., technical area, geographic region), searches of websites of universities or other compiled expert sites, and referrals. Battelle prepared a draft list of primary and backup candidate panel members (which were screened for availability, technical background, and conflicts of interest), provided it to USACE, and Battelle made the final selection of panel members.

An overview of the credentials of the final five primary members of the Terrebonne IEPR panel and their qualifications in relation to the technical evaluation criteria is presented in Table 2. More detailed biographical information regarding each panel member and his or her area of technical expertise is presented in the text that follows the table.

Table 2. Terrebonne Basin Barrier Shoreline Restoration: IEPR Panel: Technical Criteria and Areas of Expertise

	Hamilton	Bodge	Coronado	Battalio	Bergstrom
Civil Design/Construction Cost Engineering (one expert needed)	**X**				
Minimum of 10 years demonstrated experience	X				
Familiar with large, complex Civil Works projects with high public and interagency interests	X				
Degree(s) in civil engineering	X				
Demonstrated experience in performing cost engineering/construction management for all phases of ecosystem restoration, flood risk management, or related projects	X				
Familiar with similar projects across the United States and related cost engineering. Experience in associated contracting procedures, total cost growth analysis and related cost risk analysis is desired	X				
Familiar with construction industry and practices used in wetland restoration, flood damage/coastal storm damage reduction in the Gulf of Mexico coast	X				
Civil Works Planning (one expert needed)		**X**			
At least 10 years of demonstrated experience in Civil Works planning		X			
Familiar with large, complex Civil Works projects with high public and interagency interests		X			
Degree in planning or related field		X			
Experience with the plan formulation process		X			
Familiar with evaluation of alternative plans for ecosystem restoration projects		X			
Familiar with USACE standards and procedures		X			

	Hamilton	Bodge	Coronado	Battalio	Bergstrom
Wetland Ecology (one expert needed)			**X**		
At least 10 years of demonstrated experience in wetland ecology			X		
Familiar with the ecology of coastal wetlands and estuarine environments and restoration of coastal wetland and estuarine environments in the Gulf of Mexico			X		
Masters degree in ecology or biology			X		
Hydrology and Hydraulics Engineering (one expert needed)				**X**	
Minimum 10 years experience with engineering analyses related to wetland restoration in coastal areas				X	
Minimum 10 years experience with engineering analyses related to flood/coastal storm damage reduction				X	
Familiar with standard USACE hydrologic and hydraulic computer models				X	
Familiar with large, complex Civil Works projects with high public and interagency interests				X	
Registered professional engineer				X	
Minimum of an M.S. degree in civil engineering or hydrology and hydraulics				X	
Economics (one expert needed)					**X**
Minimum 10 years experience evaluating the appropriateness of cost-effectiveness/incremental cost analysis (CE/ICA), as applied to dollar costs and ecosystem restoration benefits					X
Familiar with USACE CE/ICA tool: Institute for Water Resources (IWR)-Planning Suite (per 3/26/10 kickoff, this is not required expertise for this IEPR)					
Experience with cost-effectiveness/cost-benefit analysis in general[a]					X
Familiar with large, complex Civil Works projects with high public and interagency interests					X

[a] As clarified during the March 26, 2010, kickoff teleconference, if a panel member does not have specific experience with IWR-Planning Suite, he or she needs to have experience with cost-effectiveness and cost-benefit analysis in general.

Douglas Hamilton
Role: Civil Design/Construction Cost Engineering
Affiliation: Exponent, Inc.

Mr. Douglas Hamilton, P.E., is a principal engineer and the Director of Water Resources Engineering at Exponent, Inc., specializing in water resources, hydrology and natural hazards, and the design of constructed facilities. He earned his M.S. in civil engineering from the University of California at Davis in 1985. He has over 25 years of experience in civil engineering and water resources and is a licensed Professional Engineer in California and South Carolina. Prior to joining Exponent, Mr. Hamilton worked from 1983-1986 at the Hydrologic Engineering Center (HEC), providing consulting and technology services to the Civil Works and military missions of the USACE. He has experience with large Civil Works projects, having worked on major national and international projects with high public and interagency interests such as the Fisherman's Wharf hydrodynamic design in San Francisco, California. He is experienced in construction management and contracting procedures for all phases of ecosystem restoration and flood risk management, having been responsible for the analysis, implementation, coordination, and cost control on-site for restoration of Iraqi Marshlands and the design of riparian flood control protection for the North Coachella Valley, California. Mr. Hamilton is experienced in total cost growth analysis and cost risk analysis for all phases of ecosystem restoration, reflected in such projects as the Federal Emergency Management Agency's (FEMA) Coastal Storm Surge Analysis for Hawaiian Islands. He is familiar with similar projects and the related cost engineering and construction industry practices used in wetland restoration and flood/coastal storm damage reduction in the Gulf of Mexico. Mr. Hamilton has co-authored over 50 publications, reports, and presentations, including "Analyses of special hazards and flooding problems in tropical island environments," "Multi-disciplinary approach to distinguishing flood hazards on alluvial floodplains," "Post-Katrina strategies to manage consequences of levee failure," and "Flood hazard analysis and mitigation." Mr. Hamilton is a member of the National Research Council's Water Science and Technology Board: Committee on the Evaluation of the National Flood Insurance Program Policy for Alluvial Fan Areas, and Diplomate, Water Resources Engineer, American Academy of Water Resources Engineers.

Dr. Kevin Bodge
Role: Civil Works Planner
Affiliation: Olsen Associates, Inc.

Dr. Kevin Bodge, P.E. is a senior engineer for Olsen Associates, Inc., with more than 27 years of experience in research and engineering activities related to a diverse mix of shore protection, navigation, and natural resource issues in the coastal environment. He earned his Ph.D. in engineering mechanics/coastal engineering from the University of Florida in 1986. Dr. Bodge has experience in planning and plan formulation, particularly in regard to the coastal/marine elements of large-scale Civil Works projects, from 1988 through the present. These projects have included the planning and layout of marinas, docks, and navigation channels; recreational beaches; dunes, beaches, and seawalls; and other coastal structures for purposes of shore protection. Dr. Bodge has been the principal investigator and/or engineer of record for dozens of studies engaged in coastal planning, with specific regard to ecosystem restoration. These studies

include shoreline protection (beach and dune nourishment), dune reclamation and revegetation, inlet sand management, coastal structure design, development of upland and offshore sand borrow areas, cost-benefit analysis and economic evaluation of incremental benefit analysis, and evaluation of non-structural plan alternatives including strategic acquisition/retreat. He has also reviewed dredge and fill plans for marsh restoration in Louisiana, prepared for the Louisiana Department of Natural Resources. Dr. Bodge is familiar with USACE plan formulation standards and procedures, as the coastal engineering consultant to the non-Federal sponsor for numerous navigation (inlet) and shore protection projects. He has been the project engineer and/or consulting coastal engineer for over a dozen large-scale public beach and island restoration projects encompassing many miles of shoreline, tens of millions of dollars, and diverse interagency interests. For example, his planning, permitting, design, and monitoring of inlet/shoreline improvements at Canaveral Harbor, Florida, requires his coordination of activities and approvals among the Canaveral Port Authority, U.S. Navy, U.S. Air Force, Brevard County, Florida Department of Environmental Protection, USACE, and the Cities of Cocoa Beach and Cape Canaveral, among others. He is a registered Professional Engineer in Florida, Hawaii, and Virginia.

Dr. Carlos Coronado

Role: Wetland Ecologist
Affiliation: South Florida Water Management District

Dr. Carlos Coronado is currently a Lead Scientist for the South Florida Water Management District specializing in coastal ecology of wetlands, mangrove forests, tree islands, resource management, habitat conservation planning, restoration, and enhancement. He earned his Ph.D. in Marine Sciences from Louisiana State University in 2000 specializing in tropical wetland and coastal ecology. He has over 24 years of experience in ecological research and monitoring. He is well versed in the study of biotic resources in fluvio-deltaic systems, wetland and estuarine restoration, and mangrove forest ecological function in the Gulf of Mexico, both in coastal United States and along the Yucatan Peninsula. More recently, Dr. Coronado's work has focused on the ecosystems of the Everglades and Florida Bay. Dr. Coronado's involvement with large Civil Works projects includes serving as a lead scientist for Restoration Coordination & Verification (RECOVER), a team that assesses the advance of the joint USACE/South Florida Water Management District Comprehensive Everglades Restoration Plan (CERP). He has taught advanced studies in tropical ecology and coastal management, as well as serving as an instructor at the Research and Advanced Studies Center (CINVESTA) in Merida, Yucatan, Mexico. He has authored or co-authored over 25 technical reports and publications on wetland-related assessments and coastal and tropical ecology for journals such as *Estuarine Coastal and Shelf Science*, *Aquatic Botany*, *Wetland Ecology and Management*, and *Journal of Coastal Research*. He has also coauthored chapters of the annual Everglades Consolidated Report *Ecological Effects of Hydrology on the Everglades Protection Area*, and the annual South Florida Environmental Report *Ecology of the Everglades Protection Area*. Dr. Coronado is a member of the Estuarine Research Federation, Society of Wetland Scientists, Long Term Ecological Research (LTER) USA Chapter, and LTER Mexico Chapter.

Bob Battalio
Role: Hydrology and Hydraulics Engineering
Affiliation: Philip Williams & Associates

Mr. Bob Battalio is currently a principal and senior coastal engineer with Philip Williams and Associates, Ltd. He earned his M.S. in civil engineering from University of California-Berkeley in 1985 and is a registered professional civil engineer in California, Oregon, Washington, and Louisiana. Mr. Battalio has 25 years of experience with flood management, restoration design, coastal engineering, and project management. His primary experience has focused on coastal and estuarine areas, wetland and creek restoration design, and waterfront civil engineering projects. Over the past 20 years, Mr. Battalio has had engineering responsibility for large Civil Works projects that included approximately 4,000 acres of successfully constructed tidal wetland restoration projects at multiple locations, including the Pacifica State Beach Restoration, Martinez Regional Shoreline Marsh Restoration, and the Hamilton Army Airfield Tidal Wetlands Restoration. For the latter project, Mr. Battalio was in charge of directing wind-wave analysis to develop total water level criteria for new levees; led the investigation of potential levee erosion; and supported the design of erosion control approaches. Mr. Battalio's extensive experience with erosion control design includes storm and flood damage assessments, which he conducted for the Southern Monterey Bay Coastal Erosion Studies project, the Alameda County Salt Pond Integration project, the Wind Wave Study for the San Joaquin Delta Risk Management Study, and the Martinez Regional Shoreline Marsh Restoration. For the South San Francisco Bay Salt Ponds Restoration Studies, he led the analysis of criteria for a new coastal flood protection system, which included analysis of extreme high estuarine water levels, wind set up, wind wave generation, effects of marshes, and relative sea level rise (RSLR). He was the project director of the State of California's Ocean Protection Council's Coastal Infrastructure and Vulnerability Impacts Assessment, which involved mapping coastal erosion hazards resulting from sea level rise scenarios and evaluating geomorphic response of various backshore types. He has experience with a variety of modeling programs, including GENESIS, RCPWAVE, STWAVE, HEC 1, HEC 2, HEC-RAS, UNET, RMA 2, DHI MIKE, and Delft3D.

John Bergstrom
Role: Economist
Affiliation: Independent Consultant and University of Georgia, Athens

Dr. John Bergstrom is currently the Richard B. Russell, Jr. Distinguished Professor of Public Policy and Professor of Agricultural and Applied Economics at the University of Georgia, Athens. He earned a Ph.D. in natural resource and environmental economics from Texas A&M University in 1986. He is familiar with the concepts of the USACE tool for cost-effectiveness and incremental cost analysis (CE/ICA) and Institute for Water Resources (IWR)-Planning Suite. He has been involved in numerous projects estimating ecosystem values, including ecosystem restoration benefits, for which CE/ICA was an important aspect. He has also been involved in numerous projects using benefit-cost analyses, including a large grant from the Heinz Center for Science, Economics, and the Environment to study benefit-cost analyses for changes to the National Flood Insurance Program in coastal erosion zones. Additionally, he teaches graduate economics courses in theory and techniques for natural resource valuation and benefit-

cost analysis (BCA). Dr. Bergstrom has over two decades of experience working with USACE, the Tennessee Valley Authority, U.S. Forest Service, and other Federal and State land and water resources agencies on natural resource valuation and management projects. His experience with large, complex Civil Works projects includes consulting work with a variety of power companies (e.g., Alabama Power Company, Alcoa Power Generating Inc., Central Maine Power Company) to assess regional economic impacts of reservoir water-level management effects on reservoirs and downstream river uses. Dr. Bergstrom has served on the editorial council of the *Journal of Environmental Economics and Management*.

5. SUMMARY OF FINAL PANEL COMMENTS

The Panel agreed on the "assessment of adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2010; p. D-4) in the Terrebonne report. Overall, the Panel agreed that the Terrebonne project is a good project with the potential to provide benefits to the island habitats proposed to be restored by the TSP and, to some degree, the estuary and wetlands on the leeward side of the islands within Terrebonne Bay. Furthermore, the Panel agrees that monitoring after the implementation of this project could capture valuable data, approaches, and lessons that would enhance the capacity to perform similar efforts on other islands in the LCA and beyond. The following statements summarize the Panel's findings, which are described in more detail in the Final Panel Comments (see Appendix A).

Plan Formulation Rationale: The Terrebonne report follows conventional protocol and presents the sequence used to determine the TSP (i.e., Alternative 11), including identifying project objectives, alternatives considered, CE/ICA, and eventually the project budget. Plan formulation was accurate and well done, although there are concerns about plan formulation being overly simplified by considering island acreage rather than island system benefits. However, the initial plan screening was not constrained by budget requirements. Additionally, the inclusion of some structural alternatives (breakwaters and terminal groins) and the exclusion of other structural alternatives (revetments) in the alternatives evaluation was not well justified by analyses or descriptions of prior project performance. The plan formulation identified the alternative which was estimated to yield the greatest gross benefit and best met National Ecosystem Restoration (NER) objectives (Alternative 5); however, this alternative was not chosen because it exceeded the project budget. A different alternative (Alternative 11) is chosen as the TSP based on the project budget. The Panel noted that the Terrebonne report should explain that, although the objectives of the Terrebonne project will be met by the TSP on a local scale, the project will not fully meet the LCA objective of restoring the geomorphologic form and function of the Terrebonne Basin Barrier Islands.

Economics: The CE/ICA is correctly applied and determined a relatively cost-effective plan in terms of island area created but not in terms of island system benefits. However, the TSP is based on the alternative that the project could afford given the budget allowed rather than the NER plan. The Panel noted that, in order to better inform readers, the Terrebonne report needs additional explanation of the economic criteria and approach used to justify the recommended project(s). In addition, the Panel noted that the Terrebonne report would benefit from

documenting the role of barrier islands in enhancing and protecting mainland socioeconomic and business benefits to emphasize the system-wide importance of the restoration project.

Engineering: The Panel noted that it was difficult to determine the accuracy of the engineering analyses conducted on this project given the documentation supplied in the Terrebonne report on the assumptions and models (STWAVE, SBEACH and GENESIS) used to predict the effects of storm events and sediment transport. In some instances, the Panel noted that USACE has access to stronger models (i.e., ADCIRC) to model some of the parameters. In addition, the analysis of physical processes was limited to individual islands rather than looking at the barrier island system as a whole. A system-wide analysis is necessary to formulate a preferred project that enhances the barrier island system. Some of the assumptions used to evaluate alternatives need to be explained and supported in more detail, and **l**essons learned from other projects should be used to justify and support the alternatives analysis.

Environmental: From an ecological standpoint, the project will be beneficial. However, the selection of project alternatives relies heavily on the output of models that is not well-explained and may not be accurate. The design, environmental, and construction considerations outlined for the TSP should be more detailed to better support the alternatives analysis and the selected plan, particularly with regard to physical and ecological processes that will be restored and adaptation to specific conditions and the existing environment. Furthermore, the initial short-term impacts to habitat due to project construction need to be better quantified, and revisions to designs and construction should be considered to reduce the extent of short-term impacts. The restoration project will provide an ideal opportunity to learn more about physical processes that are critical to the success of the project; however, the scope and cost-sharing of the Adaptive Management and Monitoring Plan requires additional detail to understand better how the restoration project will be measured and evaluated. The projected costs for its administration may be underestimated.

Table 3 lists the 16 Final Panel Comment statements by level of significance.

Table 3. Overview of 16 Final Panel Comments Identified by Terrebonne IEPR Panel

Significance – High	
1	The evaluation of structural measures (i.e., offshore breakwaters and terminal groins) needs to include additional information and analysis to support their inclusion in the National Ecosystem Restoration (NER) plan, while revetments are excluded.
2	Physical processes should be analyzed for the Terrebonne Basin barrier island system as a whole.
3	More information from critically important studies regarding physical processes (including modeling, analysis, and prior project performance) needs to be provided in the Terrebonne report.
4	The initial short-term impacts to habitat due to project construction need to be quantified in more detail, and revisions to designs and construction should be considered to reduce potential impacts.
Significance – Medium	

5	The accuracy of the predicted effects of storm events and sediment transport is uncertain.
6	The economic criteria and approach used for overall project justification and plan formulation need to be clarified.
7	Some of the assumptions used in the evaluation of alternatives need to be explained and supported in more detail.
8	The role of barrier islands in enhancing and protecting mainland socioeconomic and business benefits is understated.
9	The Terrebonne report should explain that, although the objectives of the Terrebonne project will be met by the Tentatively Selected Plan (TSP) on a local scale, the project will not fully meet the LCA objective of restoring the geomorphologic form and function of the Terrebonne Basin barrier islands.
10	The justification for parameter selection and model calculations, as well as information on validation and application of the Wetland Value Assessment (WVA) models, should be provided.
11	The construction design and expected performance of the TSP should be described in greater detail.
12	The description of the scope and cost-sharing for the Adaptive Management and Monitoring Plan requires additional detail, and the projected costs for its administration may be underestimated.
13	The Abstract and Executive Summary (ES) should be expanded to include more specific descriptions of the TSP and NER plan, and the Terrebonne main report should include graphic illustrations of these plans.
Significance – Low	
14	The approach used to calculate habitat acres created at Year 1 and subsequent years should be explained in more detail, including whether the number of acres calculated includes existing habitat.
15	Information from the risk and uncertainty (R&U) analysis in Appendix L-5 should be brought forward into the main body of the Terrebonne report.
16	Minor editorial and technical revisions to the Terrebonne report should be made to improve the quality of the report.

6. REFERENCES

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APPENDIX A

Final Panel Comments

on the

Integrated Feasibility Study and Environmental Impact Statement for the Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration Terrebonne Parish, Louisiana

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Comment 1:
The evaluation of structural measures (i.e., offshore breakwaters and terminal groins) needs to include additional information and analysis to support their inclusion in the National Ecosystem Restoration (NER) plan, while revetments are excluded.
Basis for Comment:
The ability to evaluate the project alternatives is limited by incomplete description and analyses regarding (1) the potential effect of breakwaters or terminal groins on the long-term performance of the improved islands and/or the adjacent shores, and (2) performance of rock revetments. Neither Section 3 of the Terrebonne main report nor the engineering appendix provides adequate justification for the use of offshore breakwaters and/or terminal groins as recommended in the NER plan. Furthermore, no data are presented to justify the exclusion of rock revetments. • The Terrebonne report does not present a description, relevant details of the modeling results, or prototype data from existing structures to explain the anticipated effects of structures upon the individual islands or the barrier island system as a whole. For example, the report does not discuss the adverse impacts that structures might cause to other adjacent (downdrift) shorelines, due to the disruption of sediment transport, or the anticipated degree and manner of storm and washover effects on the long-term performance of the structures. • The STWAVE/GENESIS evaluation of island response, particularly to structures, is not sufficient to justify the use of breakwaters or terminal groins in the NER plan. For example, in applying the GENESIS model, a very large cross-shore transport signal (background retreat rate) had to be introduced to the model, amounting to between seven and nine meters of retreat per year. It would appear that the result of this artificial signal influenced the outcome of the model predictions more than the alongshore transport signals developed by the model. Moreover, in modeling the breakwaters offshore of Whiskey Island, the cross-shore transport signal was manually reduced by 50% (Section 1.8.1, Annex L-3); but then the report concludes, in Table 1-3 of Annex L-3, that the shoreline change rate at Whiskey Island decreased from -13.8 meters/year without structures to -8.2 meters/year with structures. However, it is questionable whether most of this 40% reduction in shoreline retreat was associated with the artificially imposed 50% reduction in cross-shore transport (not the structures). Also, sand was “inserted” into the model to demonstrate the benefit of detached breakwaters. Justification for this addition was based upon qualitative observations at Raccoon Island which suggested that sand probably moved onshore from shoals beyond the “closure depth” (Annex L3, p. 15 and Figures 1-6, 7). As such, the manner in which the model was applied appears to have forced the model’s results, and these results were then used to justify inclusion of breakwater and terminal groin structures. • In contrast to the inclusion of breakwaters, revetments are eliminated without sufficient justification. Failure of revetments to meet project objectives is alluded

to in Lines #2371-3 and Lines #2388-93 of the Terrebonne report; but the reasons for this failure and/or specific performance of revetments are not clearly delineated in a manner that justifies elimination of this measure. Figures 2-26 through 2-28, for example, present photographs suggesting that the revetments on Timbalier and East Timbalier Islands may perform adequately. Revetments may result in less intertidal (beach) habitat along the shoreline upon which they are constructed, but their use may increase the longevity or size of habitat in their lee, thus creating a greater net output in the average annual habitat acre (AAHA) value, particularly relative to the cost of dredged sand. Given that limited use of rock revetments would appear to be an otherwise obvious, potentially less expensive and longer-lasting solution than dredge fill, this alternative is not adequately evaluated beyond the existing Wine Island project segment.

- In Section 3.2.3 (more specifically, in 3.2.3.1.1), terminal groins are never discussed. Table 3-1 (p. 3-17) lists groins, including terminal groins, as a measure that is removed from further consideration. Terminal groins are, however, retained in the analysis and are even included as an element of one project in the Final Alternatives Array.

Significance – High:

Insufficient descriptions and analyses of (1) the potential effect of breakwaters or terminal groins on the long-term performance of the improved islands and/or the adjacent shores, and (2) performance of rock revetments could impact the selection or justification of the NER plan.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include:

1. A detailed description, including data, of the performance of existing breakwater structures at the project area.
2. Alternative modeling of breakwater and revetment structures that addresses the structures' anticipated effect to adjacent islands and response to storm events.
3. Prototype data, a detailed description, and/or at least screening-level analysis that justifies exclusion of revetments as a project approach beyond Wine Island.
4. Revision of Section 3.2.3 by which terminal groins (not excluded from the alternatives) are distinguished from other groins (that are excluded from the alternatives).

Comment 2:
Physical processes should be analyzed for the Terrebonne Basin barrier island system as a whole.
Basis for Comment:
The analysis of physical processes was limited to individual islands. However, analysis of physical processes of the barrier island system as a whole is necessary to formulate a preferred project that enhances the barrier island system. Also, the effects of the proposed projects cannot be assessed without considering island system processes, such as sediment transport between islands and the surrounding sea bed. Understanding these aspects of sand transport is particularly important for the proposed structural measures (terminal groin and detached breakwaters), which are designed to reduce sand transport, because it is possible that these structural measures may be counter-productive. The description of system morphologic processes clearly links the islands in a system connected by sediment supply, subsidence, sand transport, and other physical processes at the regional level.. However, the Terrebonne project addressed simplified objectives of restoring individual island functions in terms of beach, dune, and marsh morphologies. The plan formulation therefore was simplified to consider the area of island created within certain elevation ranges. While practical, the viability of island area as a surrogate for barrier island system functions is not well established, and this is acknowledged. The sand transport analysis focused on individual islands and was limited to a one-line, equilibrium profile model (GENESIS) and a profile-based storm response model (SBEACH). These models only account for a portion of the sand transport process. The Terrebonne report qualitatively discusses sand transport between islands, and one reason provided for island degradation is blockage of sediment supply; however, this transport is not modeled or otherwise analyzed. The effects of sea level rise (SLR), subsidence, and changes in the rates of these processes also were not addressed. Inclusion of detached breakwaters and a terminal groin also has implications for island vs. system analysis. The effects of these structures were considered only in terms of local erosion prevention, not in terms of interfering with sediment transport between islands and with the sea bed. Because the analysis did not address the potential adverse effects of structures, especially between adjacent islands, the inclusion of structures seems arbitrary.
Significance – High:
Consideration of island-system physical processes is necessary to assess the ecosystem benefits and effects from the TSP and other alternatives to justify the selected plans and to avoid unintended adverse effects.

Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include a quantified description and analysis of physical processes affecting the morphology of the Terrebonne barrier island system, which provides benefits to the wetlands and estuary in the lee of the island chain. Specifically, the analysis should quantitatively describe the following processes for the barrier island system as a whole. 1. Island migration (vs. shoreline erosion) and system-wide sediment processes; the analysis should include: • Re-evaluation of sand transport along the sea bed below the estimated closure depth. • Combined wave and current modeling of sand transport along the island system, including episodic events such as surges due to frontal passage. • Geomorphic analysis of sand movement at inlets in normal and episodic forcing. • Island migration and evolution patterns, including marsh migration and sand/sediment trapping. • Effects and effectiveness of detached breakwaters, terminal groins, and any other structural measures that are included in alternatives. • Borrow pit effects on sediment transport. • Effects of accelerated SLR on the recession of the island shorelines and migration rates. 2. Land subsidence causes and whether future subsidence rates will be the same as historic rates or if they will increase or decrease. 3. Time scales of tidal wetland evolution vs. island migration. 4. Sediment budgets.

Comment 3:
More information from critically important studies regarding physical processes (including modeling, analysis, and prior project performance) needs to be provided in the Terrebonne report.
Basis for Comment:
Information that is central to understanding the physical causes and nature of the problem to be solved, and the potential for success and/or unanticipated adverse impacts of the proposed NER and TSP project solutions, is not sufficiently described in the report. Critically important studies are mentioned, but no information to support the project is provided. Some of these key studies include: • Borrow pit impact modeling (waves) • Historical aerial photograph analysis • Island migration analysis • Subsidence, and relationship to oil and gas extraction There is no description of the modeling effort, results, or prior project observations that relate to the effect of the offshore dredging upon the adjacent/leeward barrier islands. There is mention, but no inclusion, of historic aerial photographs that would otherwise illustrate the severity and physical mode of the islands' erosion, migration, and transconfiguration over the past few decades. There is also no discussion of the extent to which the islands themselves have subsided and the degree to which this might be related to mineral extraction. The description of the historical and existing sedimentation and erosion conditions in the study area is insufficient to understand causes of the islands' deterioration and the rate at which they are disappearing through alongshore migration, rollover, diffusion, subsidence, or more classical shoreface erosion. The performance to date of only some of the previously constructed projects is described. However, the details and performance of projects that relate to the subject of the TSP (such as TE-50 at Whiskey Island (lines #400-407)) are not described. It is not always clear what, if any, portions of the described projects have been actually built (e.g., TE-40, lines 370-376) vs. their stated objectives. For example, Section 1.5.1.5 (line #400) suggests that the TE-50 marsh project has been built on Whiskey Island, but its presence is not evident in the 2008 aerial photograph in Figure 2.9 (p. 2-6), and the report does not indicate whether the marsh project was built after the 2008 photograph. For those projects that have been built, it is difficult to understand what they look like and whether they have completely or partially met the performance expectations. The report does not describe those aspects of prior barrier island restoration projects that have been unsuccessful or which have exhibited substandard performance. Without this description, it is not clear (1) how the problems of unsuccessful projects have been addressed in the proposed plan, (2) what performance objectives of the proposed plan may be least certain or most difficult to achieve, and (3) which may be of particular importance to monitor.

Significance – High:
The ability to evaluate the potential physical effectiveness of the proposed TSP and/or NER plan is greatly limited by the absence of reliable, calibrated modeling of shoreline response to littoral transport, storms, dredging, and structures from previous projects and studies, and by the absence of a description of the historically observed changes to the islands from (1) prevailing natural processes and (2) prior project construction and performance.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include: 1. A discussion of the predicted effects of offshore dredging upon the islands based on previous studies. 2. A summary of the islands' historical migration/erosion patterns through representative (historical) aerial photographs and/or graphic overlays of historical island shorelines. 3. A description of the apparent, dominant modes of historical island erosion. 4. An expanded description of the extent to which specific prior projects (mentioned in the report) have already been constructed, and the degree to which these projects met objectives and/or anticipated performance. 5. The manner by which the proposed plan may result in improved project performance relative to prior, similar projects.

Comment 4:
The initial short-term impacts to habitat due to project construction need to be quantified in more detail, and revisions to designs and construction should be considered to reduce potential impacts.
Basis for Comment:
The conceptual restoration plans in Appendix B indicate that much of the existing islands will be buried with dredged material. This loss of existing habitat and the delay in new habitat establishment are not quantified or included in the calculation of ecologic benefits. Minimizing construction impacts is not discussed as a design objective. According to the letter from the U.S. Fish and Wildlife Service (USFWS) in Appendix A, it is likely that the project would seriously reduce food availability for piping plovers by killing most of the benthic invertebrates on the islands where construction is proposed. The USFWS also requested consideration of sea turtle nesting periods to avoid disrupting or disturbing nesting activities. However, the description of the project design and construction does not address how to minimize impacts to these sensitive populations. Although the Terrebonne report states that imperiled vegetative communities inhabit the islands, it is suggested that the only adverse effects to vegetative communities will be due to the smothering of vegetation scattered about the islands. These statements are not in agreement and are difficult to reconcile. The report also states that ecological function requires vegetated dunes and back barrier marsh, yet it appears that existing vegetation is not avoided in the designs, especially the higher-volume designs (e.g., designs D and E). Vegetation planting is included in the designs, but it is difficult to ascertain how effective the revegetation will be, and at what point in time created habitat will be sufficient to mitigate the construction effects. The benefits of the project as currently designed may be negative in the first few years (possibly up to a decade) after construction, due to the loss of existing habitat. The Terrebonne report repeatedly says that Alternative 5 (NER plan) would have similar effects as Alternative 11 (TSP), except that the NER plan is larger, and thus, the effects would be greater. This implies that the any initial loss of habitat may also be scaled up with the NER. The Terrebonne report (p. 3-48) indicates that the Wetland Value Assessment (WVA) method does not account for the differences in vegetation and habitat before and after construction, implying that project benefits are based solely on net acres of area created within defined elevation ranges. The conditions (whether vegetated or existing habitat) are not considered explicitly. For example, Table 3-7 indicates existing habitat to be 377 acres of dune habitat and 443 of intertidal habitat (Alternative 1), and that the Whiskey Island Plan C will result in 895 acres and 377 acres of dune and intertidal habitat, respectively. This suggests a net loss of about 14% wetland in Year 1. Table 3-22, Summary of Habitat Value for Alternative 5, indicates that intertidal habitat lost in Year 1 would amount to about 268 acres (1316-1048), which is approximately 20% loss. However, the loss of existing intertidal habitat (wetland) is probably much greater since

much of the net Year 1 intertidal area will be "restored" areas, and the engineering plans show burial of existing intertidal areas. The loss of existing dune and beach habitat due to construction is not defined.

The Engineering Appendix L, Section L6.6.5, states that the Whiskey and Raccoon Island designs were modified to avoid damaging restoration areas constructed previously. Therefore, the designs of Raccoon and Whiskey Islands will likely have fewer adverse construction impacts. However, the more extensive plans (D and E) appear to cover existing habitat (e.g., line 7 for Raccoon Island Plan E). Also, it is not clear whether and to what extent existing habitat will be considered in plans for other islands and as design continues (Timbalier Island is almost completely buried in Plan E).

Significance – High:

Failure to consider initial short-term impacts from project constructions could lead to designs that are more destructive to existing habitat than necessary and have lower success because recovery time will be extended.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include quantification and consideration of construction impacts to existing habitat and net habitat over time and space, including the following:

1. Describe and quantify habitat losses due to construction associated with the conceptual grading plans for the TSP and NER plan.
2. Include the anticipated evolution toward reestablishment of habitat, and calculate the net ecological benefits over time.
3. Refine the conceptual designs and design criteria to reduce construction impacts to existing habitat.
4. Revise fill placement limits/geometry to obtain the same net increase in habitat area but reduce loss of existing habitat.
5. In consultation with biologists/ecologists, use phased fill placement for reduced short-term impacts and more rapid recovery of impacted areas.
6. Use low-impact methods of fill placement, if identified.
7. Develop design criteria to be considered in subsequent design refinements.
8. Develop species protection criteria for sensitive and listed species.

Comment 5:
The accuracy of the predicted effects of storm events and sediment transport is uncertain.
Basis for Comment:
The accuracy of the predicted effects of storm events and sediment transport is uncertain for several reasons. • Hydrodynamic storm modeling was limited to wave hindcast data transferred using STWAVE. The sand transport modeling was limited to a one-line, equilibrium profile model (GENESIS) and a profile-based storm response model (SBEACH). The above models each cover a portion of the hydrodynamic and sediment transport processes affecting the islands. While often used, their utility to this study is limited, and other models and analyses could have been applied. • The GENESIS model does not address the processes which govern most of the shoreline change, as acknowledged in the Engineering Report (Appendix L and Annex L3). The GENESIS modeling did not address key processes such as onshore transport, inlets, island migration, and transport between islands. • Calibration data are not given for the SBEACH model results; therefore, it is not possible to determine how reasonable the results might be. Furthermore, the input values used for SBEACH are not given, and the basis for the outcome of the analysis is not apparent. • No data are presented to substantiate the depth of closure, which at only about 10 feet (ft) appears to be very shallow given the episodic occurrence of 30+-ft storm wave heights that are probably responsible for the majority of nearshore sediment transport. It appears that the closure depth for the Terrebonne Islands was recalculated using smaller wave heights (justified by wave dissipation) to better conform with the broad, relatively shallow nearshore depths in the vicinity of the study area. However, the closure depth may not indicate the depth limit of significant sand transport, as apparently assumed in the analysis. This assumption is not substantiated and may, in fact, be incorrect since it is also observed that sand moved onshore from offshore shoals at Raccoon Island. • Sand was “inserted” into the sediment transport model to demonstrate the benefit of detached breakwaters. This was justified by observations at Raccoon Island that sand probably moved onshore from shoals beyond the “closure depth” (Annex L3, p. 15 and Figures 1-6, 7). • The benefit of breakwaters was imposed as a 50% reduction in the residual retreat rate from the original long-term cross-shore related shoreline change rate (Section 1.8-1 of Annex L3). • The modeling does not represent the effects of SLR on increasing shoreline recession and island migration. Modeling these processes may be challenging, and applied geomorphology may provide better tools. Such methods include simplified geometric approximations such as the “Bruun Rule.”

The scope of analysis was probably constrained, perhaps due to complexity of the natural process. However, more effort could improve the NER plan and serve as a basis for technical development for future island restoration projects, within the context of a programmatic monitoring and adaptive management process.

Significance – Medium:

The success of the selected alternative may not be well understood because the analysis approach may not accurately predict the effects of storm events and sediment transport on project alternatives.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include:

1. Scientific justification for the assumptions and models used to predict storm events and sediment transport.
2. Use of a combined hydrodynamic circulation model and wave model with sediment transport to predict the likely sand transport patterns and rates with and without project, and to inform NER plan and Adaptive Management and Monitoring Plan refinements.
3. Calibration, validation, or verification data for the SBEACH profile response to storms using available data. In the absence of pre- and post-storm data along the Terrebonne Islands, profiles could be estimated for a given storm using aerial photographs and or survey data.
4. Quantification of island migration (vs. shore erosion) and system-wide sediment processes, including inlet bypassing and onshore sand transport. This should include:
    - Re-evaluation of sand transport along the sea bed below the estimated closure depth, including the influence of high storm waves upon the calculated depth of closure based on previous studies.
    - Combined wave and current modeling of sand transport along the island system, including episodic events such as surges due to frontal passage.
    - Geomorphic analysis of sand movement at inlets in normal and episodic forcing.
    - Island migration and evolution patterns, including sediment trapping, marsh migration, and sand trapping.
    - Effects and effectiveness of detached breakwaters, terminal groins, and any other structural measures included in alternatives.
    - Borrow pit effects on sediment transport.
5. Quantified effects of relative sea level rise (RSLR) using applied geomorphology, profile evolution modeling, and/or other modeling and sediment budget methods.
6. Complete sediment budgets for project conditions and predictions for the fate of sand transport.
7. A refined NER plan and Adaptive Management and Monitoring Plan based on the results of improved sand transport analysis.

8. Recommendations for future research and development that could develop technical tools to improve future island restoration projects.

Comment 6:
The economic criteria and approach used for overall project justification and plan formulation need to be clarified.
Basis for Comment:
The economic justification of the recommended project(s) is not clear because: • The economic criteria for determining whether or not a project is economically justifiable are not explicitly stated and discussed. • Although the plan formulation criteria are stated, in some cases they are ambiguously defined. • Particular aspects of the economic approach are not adequately documented and defended. The specific economic decision-making criteria used by the U.S. Army Corps of Engineers (USACE) to judge whether the projects are economically justified were not explicitly stated and defended in the Terrebonne main report or Appendix K. In particular, the choice of cost-effectiveness/incremental cost analysis (CE/ICA) over other economic decision-making criteria, such as benefit-cost analysis (BCA), was not explicitly discussed and defended. In addition, on p. 2-1 of the main report, it is stated that USACE considered both National Economic Development (NED) and NER objectives; however, it is not clear exactly how NED objectives were considered. Overall plan formulation criteria (not just economic criteria for deciding if a project is economically feasible) included "completeness, effectiveness, efficiency and acceptability" (as specified in ER 1105-2-100). The planning methods adequately met these criteria in terms of breadth of coverage (e.g., each of the criteria was addressed in the planning process). However, the definition of "efficiency" (p. 3-1, Terrebonne main report) is limited to relative cost-effectiveness, rather than the technical meaning of "economic efficiency" or "Pareto Efficiency" from an NED perspective. In general, achieving efficiency from an economic standpoint means that Pareto Efficiency (economic efficiency) has been achieved, or the project at least moves in the direction of Pareto Efficiency. Since a relatively cost-effective project, as defined in the Terrebonne main report, could be one for which the economic benefits are less than the economic costs, implementation of a relatively cost-effective project could actually move the nation (society) further away from Pareto Efficiency (economic efficiency). Economic decision-making approaches with the purpose of identifying and selecting economically preferred projects typically consider all relevant constraints from the beginning of the selection process, including budget constraints. It is not clear why USACE did not incorporate the Congressionally determined project budget constraint until near the end of the preferred project selection process. Incorporation of this budget constraint earlier in the plan formulation process would have greatly shortened and focused this planning process. The concept of "Best Buy" is not well defined and defended, including if and why it should be considered as "the best investment" and whether it leads to maximization of benefits in all plan formulation criteria for the least

amount of cost. The description of the ICA on the bottom of p. 3-1 and the top of p. 3-2 (main report) is incomplete. For example, it is not clear why Table K3-1 on p. 3-2 only includes Alternative 1, 2, and 5. The discussion of the WVA model results is also incomplete (e.g., Table 3-30 and related narrative does not include all 10 alternatives, leading to ambiguity in project selection). It is not clear, for example, why Alternative 6, 7, and 8 are not accepted as final Institute for Water Resources (IWR) "Best Buy" alternatives even though their cost per average annual habitat unit (AAHU) is similar to Alternative 9, which is among the final IWR ("Best Buy") alternatives. Other technical concerns with the economic approach include incomplete consideration of cost uncertainty; nonlinearity in project benefits and costs; hard revetments; and potential cost savings from using Whiskey Island Back Barrier (TE-50) Borrow Area 1, relative to the assumed Borrow Area 3a.

Significance - Medium

Providing more detail on the economic criteria and approach will enable better, more complete understanding of the plan formulation process, economic analysis, and economic justification of the proposed project(s).

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include:

1. Explanation and justification for the choice of CE/ICA as the economic decision-making criteria for judging whether a project is economically justifiable as compared to more traditional economic choice criteria such as BCA.
2. Discussion of how NED objectives were considered.
3. Justification for the definition of "efficiency" used in the report as compared to the more technically correct definition from Pareto Efficiency and NED perspectives.
4. Explanation regarding why the Congressionally determined project budget constraint was considered at the end of the preferred project selection process, rather than at the beginning of this process.
5. Justification for the "Best Buy" criterion, including professional publication references.
6. More detailed discussion of the ICA, including explanation of why Table K3-1 (p. 3-2) only includes Alternative 1, 2, and 5.
7. Consideration of all 10 alternatives in Table 3-30 (as done in Table K2-1, Appendix K) and the related narrative, and more discussion of why Alternative 6, 7, and 8 were not included as "Best Buy" alternatives.
8. Consideration of potential cost savings from using Borrow Area 1 instead of Borrow Area 3a, recognizing the fact that BA1 is about half the distance from the project site as compared to BA3a.
9. More discussion of why cost uncertainty, nonlinearity of project benefits and costs, and hard revetments did not receive more attention during the preferred project selection process.

Comment 7:

Some of the assumptions used in the evaluation of alternatives need to be explained and supported in more detail.

Basis for Comment:

Assumptions that underlie the engineering analyses that are the basis for the evaluation of alternatives seem to predetermine the outcome of the Terrebonne report. Specifically, there is not enough information to explain or support these assumptions about the storm surge, wave, and wind sheltering effects of the barrier islands on the leeward estuary and wetland habitat.

Stabilizing the Terrebonne barrier islands has obvious benefits above and beyond protecting areas bayside of the Terrebonne islands; however, analyses are not provided showing the degree to which waves or surges will be reduced nor are storm surge reduction, wind and wave energy dissipation, and other possible benefits of barrier island stabilization discussed in detail. The Panel acknowledges that the larger the dimensions of the barrier island, the greater the benefits that would accrue for wetland and ecological protection in Terrebonne Bay. However, there is no justification to support why this is so, and the report does not distinguish between the benefits of building the island higher in elevation vs. enlarging the planimetric area of the island.

Additional specific comments about the proposed alternatives include the following.

- Appendix L, pp. 3-3 and 6-9, design of the 5-, 10-, and 25-year protection schemes (Plans C, D, E) utilized long-term erosion rates for the beach from Williams et al. (1992) and for the marsh from the U.S. Geological Survey (USGS). The erosion rates for the beach from USGS are smaller and were not used; however, the assumptions behind the selection of erosion rates are not provided.
- There is a discrepancy in the islands' acreage values over the last 30 years between Section 2.5 and Appendix L3.3. The former states that Whiskey Island decreased to 564 acres in 1988 (line #1195), while Figure L3.3 shows a total land area of 830 acres in 1988, per USGS. This discrepancy should be explained. Likewise, Table L3-3 (from USGS) suggests that the Whiskey Island beach area is gaining by 4 acres per year; however, the text following the table states that the beach habitat will disappear by 2029. It is likely that Whiskey Island is being eroded or relocated. The assumptions regarding erosion rates are not clearly stated.

Significance – Medium:

Clarifying the assumptions used in the engineering studies will help the reader understand and recognize the innate benefits of preserving and enhancing the barrier islands.

Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include: 1. Analyses and detailed discussion that demonstrate the degree to which the restoration project will provide environmental benefits from protection of the barrier islands and Terrebonne Bay estuarine and wetland habitats. 2. Discussion of the reason for using the using long-shore erosion rates from Williams (1992) rather than the lower rates provided by the USGS. 3. Reconciliation of the island acreage values between Section 2.5 and Appendix L3.3, or an explanation of the differences. 4. A comparison of the benefits of building the island higher in elevation rather than enlarging the planimetric area of the island. 5. Clarification of assumptions regarding erosion rates. 6. A graphic illustrating the changes in shoreline early in the report, possibly using diagrams in McBride et al. (1992), or a similar source.

Literature cited:

McBride, R.A., S. Penland, M.W. Hiland, S.J. Williams, K.A. Westphal, B.E. Jaffe, and A.H. Sallenger, Jr. (eds) (1992). Analysis of barrier shoreline change in Louisiana from 1853 to 1989. In: Atlas of Shoreline Changes in Louisiana from 1853 to 1989: U.S. Geological Survey Miscellaneous Investigation Series I-2150-A. Chapter 4.

Comment 8:
The role of barrier islands in enhancing and protecting mainland socioeconomic and business benefits is understated.
Basis for Comment:
The Louisiana Coastal Area (LCA) ecosystem (composed of the Gulf of Mexico, Louisiana mainland coast, and barrier islands) is a complex interconnected ecological, economic, and social system. The Terrebonne report generally understates these connections and the roles barrier islands have in enhancing and protecting mainland socioeconomic and business benefits by inaccurately asserting that the project will not affect socioeconomic and business factors (e.g., environmental and social justice, employment, income, cultural, historical and recreational resources) because the barrier islands are "remote and uninhabited" (i.e., since there are no people living on the islands, it is inaccurately asserted that there are no socioeconomic and business impacts to consider). It is true that the LCA barrier islands of concern are "remote and uninhabitated," and thus that the project will not have socioeconomic and business impacts on the barrier islands themselves. However, as the barrier islands erode, coastal Louisiana wetlands are subject to greater exposure to erosive forces (e.g., wind, waves, storms), resulting in greater loss of coastal wetlands. This loss of coastal wetlands can have significant socioeconomic and business impacts on the mainland. For example, coastal wetlands serve as nursery grounds for commercial fish species. As coastal wetlands degrade, this nursery function can also degrade, leading to a decrease in commercial fish species and subsequent decreases in commercial fishing and in jobs and income on the Louisiana mainland that are related to the commercial fishing industry. Coastal wetlands also support recreational fishing by providing nursery grounds for recreational fish species and access points for Gulf of Mexico recreational fishing (e.g., boat ramps). As coastal wetlands degrade, recreational fish species and access points will also be degraded, leading to decreases in jobs and income on the mainland related to the recreational fishing industry. Decreases in jobs and income on the mainland tied to the negative impacts of coastal wetlands loss on the commercial and recreational fishing industries may fall disproportionately on low-income and/or minority human populations, raising environmental and social justice concerns. Coastal Louisiana wetlands are also home to unique human cultures with a rich history which are closely tied to fish and wildlife species (e.g., through fishing and hunting). These unique cultures and associated historical resources are also threatened by reductions in fish and wildlife populations caused by coastal wetlands loss. They are also the first populations to be impacted by flood damages from hurricanes and storm surges, the effects of which are reduced by effectively functioning barrier islands. If the socioeconomic benefits afforded by the Terrebonne Basin barrier islands are not described or quantified in sufficient detail, readers will not completely understand how barrier island loss may increase coastal Louisiana wetlands loss, which in turn will adversely impact mainland businesses (e.g., jobs, income) and socioeconomic resources

and concerns (e.g., cultural, historical, and recreational resources; environmental and social justice concerns).
Significance – Medium:
A description of the economic and cultural importance of ecological resources for the region is key to demonstrating that socioeconomic benefits of barrier island restoration that go beyond the barrier islands themselves, providing greater justification for the proposed project(s).
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include: 1. More discussion of the ecological, economic, and social connections between the LCA barrier islands and mainland, and, in considering these connections. 2. Discussion of how barrier island erosion may impact socioeconomic and business "triple-bottom line" (e.g., environment, economic, equity) concerns on the mainland.

Comment 9:
The Terrebonne report should explain that, although the objectives of the Terrebonne project will be met by the Tentatively Selected Plan (TSP) on a local scale, the project will not fully meet the LCA objective of restoring the geomorphologic form and function of the Terrebonne Basin barrier islands.
Basis for Comment:
The main objective of the LCA Restoration Project is to restore, at the regional level, the geomorphologic form and function of the Terrebonne Basin barrier islands for the protection of interior coastal resources from the direct effects of wind, waves, and storms. The proposed TSP will meet the objective of restoring habitats only in the vicinity of the limited area to be restored (Whiskey Island). Restoring and improving a single barrier island will not fully provide essential habitats for fish, migratory birds, and other terrestrial and aquatic species, as originally proposed. Nonetheless, the TSP will provide high-quality habitat at smaller scale. Also, by restoring one barrier island, sediment input to supplement longshore sediment transport processes along the Louisiana shoreline will be drastically reduced relative to the sediment input that would have been provided if all the Terrebonne Basin barrier islands were restored The restoration of a single island in the barrier island chain will not stop the current degradation trend, and the ability of the Terrebonne Basin barrier islands to provide functions that benefit leeward wetland habitat on the mainland will not be greatly improved. Therefore, the LCA objectives will not be met at the regional level, but the TSP will contribute to the enhancement of a degraded barrier island, ultimately providing higher habitat quality for migratory birds, flora, and fauna associated with barrier islands.
Significance – Medium:
By not clearly explaining that the TSP will only be able to provide ecological benefits locally, the reader may not understand that the objectives of the LCA Restoration Project will not be fully met and that the Terrebonne Basin barrier island system will continue to degrade.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include: 1. More detailed justification and explanation for restoring one single barrier island. 2. Greater detail on the benefits that coastal Louisiana will obtain from restoring Whiskey Island only. 3. A strong monitoring plan to determine the success of restoring Whiskey Island and its benefits to the Louisiana shoreline.

Comment 10:
The justification for parameter selection and model calculations, as well as information on validation and application of the Wetland Value Assessment (WVA) models, should be provided.
Basis for Comment:
The discussion on p. 3-42 in the Terrebonne main report references the WVA models, but the report does not explain why the WVA model defines a combination of dune, beach (supratidal), and marsh (intertidal) as the optimum habitat metric by which the island ecosystem functions should be compared. A detailed description of the ecosystem functions to be restored and how these functions are connected to dune, beach, and marsh acres is not provided. The Habitat Suitability Index (HSI) model described on p. 3-75 in the Terrebonne main report is used to capture both the quantity (e.g., acres) and quality of habitat. However, the report does not explain how the HSI incorporates quality. Although the variables included in the WVA models are recognized scientifically and technically as important for characterizing overall habitat quality, they are not the only variables that could have been selected. There is no justification or rationale in the Terrebonne report for model parameterization (i.e., why the variables selected for the WVA models were included). There also is no explanation or justification for the assignment of Suitability Index (SI) values to each of the model variables or how the variables were weighted in the HSI models. Furthermore, no information of the validation of the models is provided, and their performance is uncertain. This information is important for the reader to understand the scientific basis of the models, how the model outputs reflect habitat quality, and how accurate the model outputs may be.
Significance – Medium:
Without information on WVA model parameterization, calculations, validation, and application, confidence in the ability of the model outputs to accurately reflect habitat quality may be undermined because their scientific basis and performance is poorly understood.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include: 1. A better explanation of how the model is parameterized. 2. Explanation and justification for the assignment of SI values to the model variables. 3. A description of how the model has been validated and used in other restoration projects. 4. Information on the data that were used for input to the WVA model. 5. More complete explanation of why the WVA model outputs are an optimum habitat metric for measuring and comparing the ecosystem functions and services restored by different project(s).

Comment 11:
The construction design and expected performance of the TSP should be described in greater detail.
Basis for Comment:
The Terrebonne report provides only a limited amount of information on the construction design and expected performance of the TSP. The construction phase requires a better description because, at this point, there is no contract in place to implement the TSP. • The assumed beach and dune elevations (2.2 ft and 4.4 ft above mean high water [MHW]) seem low, and there is no explanation for how these elevations are consistent with existing ones. Changes to the proposed beach/dune geometries are not evaluated to determine if there is a potentially more efficient layout for the construction of the TSP that will result in greater benefits (i.e., further reduction in the rate of deterioration of the Terrebonne barrier islands and greater storm surge protection for leeward wetland habitats) and lower short-term impacts to existing habitats. • Section 3.9.1.2 (p. 3-99) should clarify that the itemized construction schedule of 560 days is for the TSP and does include a contingency. The itemized schedule calling for 348 days of dredging would require a potentially unrealistic dredge production volume of 25,574 cubic yards per day. However, when the contingency is added to the schedule, the projected dredge-production requirement is more realistic. • Regarding Appendix L, p. 9-8, Section L9.3.1, it is not clear whether the dredging quantities (in the cost estimates) included the 1.13:1 and 1.6:1 dredge-to-fill ratios. The physical basis of the volume quantities described in the report, including those used for cost estimating, should be explained more precisely. For example, regarding the sediment quantities considered to be the in-place pay-template measure, it is not clear if they include handling losses. Also, it is not clear if the sediment quantities include overfill allowance for long-term losses during fill equilibration associated with compatibility. • More explanation is required for the statement on p. 3-79 that, "The original contingency was also refined using Crystal Ball." It is not clear if separate analyses were done using Micro-Computer Aided Cost Estimating System (MCACES) and with Crystal Ball or if the refinement of the contingency was done jointly with both programs. • It appears that a 25-year duration of effectiveness is assumed, as the operations and maintenance (O&M) plan described will still allow the islands to continue to degrade. The Panel assumes that information and data about the rate of erosion are available, allowing estimates for the approximate time it would take for the existing islands to completely disappear under the No Action Alternative. However, this information is not presented in the report, and it is important for providing a reference point to compare the projected outcome of the TSP with the No Action Alternative.

- The benefits of the proposed barrier island restoration are a function of the marine forcing functions that occur during the suggested 25-year period. If it is expected that a series of small tropical storms will occur where wind waves dominate, then measurable benefits are more likely. If there are one or two larger hurricane storm surge events during the 25-year period, then it is less likely that there will be measurable benefits, and further degradation of the islands could occur. However, anticipated hurricane, tropical storm, and wind wave time-series conditions are not presented or discussed. The storm surge protection afforded by the TSP and the way in which it is expected to change over the 25-year life of the project are also not reported. Furthermore, the explanation of the "qualitative benefits" of the TSP mentioned on p. 3-80, line 3472, and the description of the components of the fully funded cost estimate ($120 million) provided on p. 3-81, line 3503, do not emphasize the downside of a No Action Alternative. Providing this information could further strengthen the presentation of the TSP.

Significance – Medium:

A complete description of the construction design and expected project performance is necessary to understand how the TSP should be implemented.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A detailed description of how the TSP should be constructed to obtain the greatest performance and minimize short-term impacts from the restoration.
2. Clarification of development of cost contingency factors discussed on pp. 3-79 and 3-80, especially how the various computer programs relate to each other.
3. Additional discussion of the effects of erosion and storm events on the order of a 25-year to 50-year return period. A qualitative assessment of the effects of larger events such as the 25-year to 50-year magnitude would be helpful. No new analysis or modeling is being recommended but should be provided if it was performed.
4. A comparison of the results of a No Action Alternative with the TSP to demonstrate the effectiveness of the TSP. For example, to emphasize the downside of a No Action Alternative, a more detailed explanation of the "qualitative benefits" of the TSP (p. 3-80, line 3472) should be provided, along with a brief description of the components of the fully funded cost estimate ($120 million) (p. 3-81, line 3503) should be provided.
5. The protection abilities of the TSP, the NER plan, and other alternatives from expected wind wave and storm conditions.

Comment 12:
The description of the scope and cost-sharing for the Adaptive Management and Monitoring Plan requires additional detail, and the projected costs for its administration may be underestimated.
Basis for Comment:
The monitoring plan is a significant element of the project because of the valuable information that it can provide to the planning and implementation of larger-scale (NER) projects. The monitoring plan is not sufficiently detailed to inform follow-on project(s) or to specifically address the uncertainties associated with formulation of the current (TSP) project. The project provides an excellent learning opportunity that may be among the project's most valuable contributions/achievements, provided that the monitoring plan is comprehensive and appropriately designed, detailed, and executed. Based on the following observations, the cost of monitoring, and its allocation within the project budget, is insufficiently evaluated and described. • The performance measures, desired outcome, and monitoring design were only generally described and did not provide sufficient detail to fully understand what will be done. For instance, the Terrebonne report implies that all of the islands in the Terrebonne Basin Barrier Shoreline restoration area will be monitored, but it is not explicitly specified which island(s) will be monitored, which environmental parameters will be monitored, or the frequency with which environmental data will be collected and reported. Furthermore, it is not clear who will conduct the monitoring program or evaluate the results of the monitoring program. • No procedures are described to estimate or measure the structure and function of the barrier island. For instance, the monitoring plan does not indicate how the success of the plant community will be evaluated, how nesting success of migrating birds will be evaluated, or whether vegetation maintenance will be required. This information is important to consider when measuring the success of the restoration project. • The methods for assessing the geomorphologic response of the barrier islands to local sea level rise (RSLR) upon the project area islands are not described in the monitoring plan. Specifically, the monitoring plan does not describe objectives relative to understanding, assessing and/or quantifying physical processes associated with island migration (rollover), deflation, longshore sediment transport/exchange between islands, the effects of tidal flows along/between islands, and the rate of RSLR at the islands vs. the nearby mainland. • The costs of executing and/or administering the monitoring program may not be sufficient to allow for a meaningful, comprehensive evaluation of the islands' physical processes and project performance, and to allow for unexpected anthropogenic and natural disasters. • The overall cost-sharing of monitoring is unclear. It is stated that this cost will start with a Preliminary Engineering Design (PED) phase and be listed in the construction budget. However, it does not appear that the $5 million+ cost of

monitoring is included in the overall project cost, in the budget sheets in Annex L-6, or in Section 3.9.2 of the Terrebonne main report.

- On p. 17 of Appendix I, the $5,821,200 value for adaptive management and monitoring is not justified because it is not supported by the addition of Tables 1, 2, and 3. It is not clear whether Tables 1 through 3 in Appendix I are intended to be additive. If so, they sum to $5,073,600, which is less than $5,821,200. Regardless, an allowance of approximately $5.1 million to $5.8 million may be unrealistic to administer a meaningful monitoring and assessment program that spans 10 years along such a broad study area, particularly if the program is successfully designed and detailed to inform the critical and much more costly follow-on NER project(s).
- The cost-sharing of the Adaptive Management and Monitoring Plan (Appendix I) is not clear in Section 3.9.3. This cost may be largely after construction. It is estimated as $340,000 (or more?) per year, but Section 3.9.3 does not clarify how or when these funds are to be expended, and which party is responsible for the cost.

Significance – Medium:

Whether the long-term benefit and success of the project will be well represented or well understood cannot be determined without the formulation of a more detailed Adaptive Management and Monitoring Plan that is adequately described and funded.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include:

1. A more detailed description of the physical (spatial) scope, frequency, and execution of the monitoring plan, including an outline of the agency(ies) that will perform the monitoring and interpret the results, as well as the frequency and scope of presentation of the results.
2. Expansion of the monitoring plan to better assess the physical processes that govern the geomorphologic changes of the islands, including sediment transport processes and the volume of sand that is transported away from the placement sites, and especially the effect of local, RSLR at the island complex (relative to that of the nearby mainland/marsh areas).
3. Further consideration of the short-term and long-term (10-year) costs of implementing and administering a comprehensive monitoring program.
4. Clarification of the costs associated with the Adaptive Management and Monitoring Plan, and the timing and cost-sharing responsibilities of those costs during and/or after the PED and construction stages of the project.

Comment 13:
The Abstract and Executive Summary (ES) should be expanded to include more specific descriptions of the TSP and NER plan, and the Terrebonne main report should include graphic illustrations of these plans.
Basis for Comment:
The ES, and especially the Abstract, do not clearly describe the elements of the TSP and NER plan. • The Abstract (p. A-2, ES lines #67-69) never describes what the TSP consists of. (This description appears later, in ES lines #271-3). Beyond the cost (ES line #89), the Abstract does not summarize the principal TSP elements (i.e., physical scope, cubic yards of fill, fencing/vegetation, anticipated sand sources, schedule, acreage output, and anticipated performance, including construction impacts and net habitat over time). • The Abstract describes the scope of the NER plan (ES lines #45-58); however, the ES (line #354) does not describe which alternative is the NER plan (i.e., Alternative #5). The cost of the NER plan is not described, nor is the physical size of the project in terms of cubic yards of fill, etc., or the use of offshore sand sources. • The Abstract refers to "Plan C" and "Plan E", but does not describe the physical meaning of these alphabetically labeled plan alternatives (i.e., allowance for X years of background erosion/land loss). • Neither the Abstract, the ES, nor the Terrebonne main report clearly indicate the amount of existing acreage of intertidal, beach/dune, and marsh habitat that will be directly impacted by construction (burial). • Graphic illustrations of the elements of the proposed TSP and NER plan that are central to understanding the physical scope of the project (e.g., planform and/or section views) are not included in the Terrebonne main report (i.e., Sections 3.6 and 3.7). Although plan drawings are included in Appendix L, Annex L-2, these are cumbersome for a typical reviewer to access in the report, and the Annex L-2 drawings do not identify which plates correspond to the TSP and NER plan. Furthermore, Section 3.7 (pp. 3-79 to 3-80) does not delineate what elements make up Alternatives 11 and 12, nor does it describe the physical size of at least the TSP (cubic yards of fill, fence, etc.). • The ES does not explicitly state that the fundamental metric for evaluating (screening and selecting among) the plans was the net increase in functional island area relative to construction cost. This simple statement is central to understanding the formulation and selection of the plan. It is important to realize that most readers will try to gain this information from the Abstract and ES.

Significance – Medium:
Without a clear description of the scope and elements of both the TSP and NER plan in the Abstract, ES, and main report, it is not possible to easily comprehend and assess the scope and benefits of the proposed project(s).
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include: 1. A more comprehensive description of the TSP and NER plan in the Abstract and the ES. 2. Graphic illustrations of the TSP and NER plan within the Terrebonne main report (i.e., copied from the appropriate plates in Annex L-2). 3. A brief description of the amount and type of existing acreage that will be directly impacted by construction of the TSP and NER plan. 4. A brief summary of the manner in which project benefits and costs (net output) were used toward selection of the TSP and NER plan, vs. the overall goal of restoring the island chain/system to protect the estuary and wetlands to the north.

Comment 14:
The approach used to calculate habitat acres created at Year 1 and subsequent years should be explained in more detail, including whether the number of acres calculated includes existing habitat.
Basis for Comment:
It is not clear how the acres of habitat restored were calculated. Calculation of the habitat acre estimates is found in Appendix L, p. 6-14, and also in Appendix K. Page 4-5 of Appendix K states that the TSP (Whiskey Plan C) involves 422 cubic yards/ft sand placement along 19,763 ft of shoreline for dune/beach creation. For a beach elevation of about +4 ft and closure depth of -10 ft (which is also close to the existing depth at toe of fill), a fill density of 422 cubic yards/ft should yield about 27/14 x 422 = 813 ft of net shoreline advance, according to the Bruun Rule. Along 19,763 ft of shoreline, this equates to 370 acres. Alternately, the Island Plans in Annex L2 for Whiskey Plan C show about 1,100 ft of initial fill width from landward-edge to the MHW line (elevation = 1.6 ft). Along 19,763 ft of shoreline, this equates to 500 acres of initial beach/dune construction above the waterline. So, in sum, the beach/dune fill, at about Year 1, should create at least 370 acres to as much as 500 acres of beach/dune. But Table 3-11, Table K4-2, and Table L6-7 indicate that the plan will create 895 acres of beach/dune at Year 1, or 1.8 times more acres than is suggested by the initial construction plan, or 2.4 times more acres than is suggested by a standard equilibration model. This may be because the tables include the existing conditions, but it is unclear. This discrepancy should be explained. Likewise, the Whiskey Plan C drawings (Annex L3) indicate marsh construction of about 900-ft width along 4500 ft of shorefront. This equates to 93 acres of intertidal marsh creation. In contrast, Tables 3-11, K4-2, and L6-7 indicate that 377 acres of marsh are created at Year 1. Again, this may be a function of the inclusion of existing conditions, but it is unclear.
Significance – Low:
There appear to be discrepancies in the acres of dune, beach, and marsh created by the various alternatives because the method by which the acreage calculation is made, or described, is not clear.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include: 1. An explanation of how acres of habitat created are estimated for Year 1 and subsequent years.

Comment 15:
Information from the risk and uncertainty (R&U) analysis in Appendix L-5 should be brought forward into the main body of the Terrebonne report.
Basis for Comment:
R&U is handled well in the analysis in Appendix L-5, but it is only briefly described in the Terrebonne main report. Section 3.8 does not summarize the R&U method or results (e.g., the adoption of 80% confidence levels, etc.). Similarly, Section 3.8 does not list the summary outcome of the analysis (such as is shown in Table 7 from Appendix L-5), nor does it specify that the costs include a 28% contingency that resulted from the R&U analysis in Appendix L-5 which reflects the 80% confidence level.
Significance – Low:
The readability of the Terrebonne report would be improved by bringing forward more information from the R&U analysis in Appendix L-5 into the main body of the report.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include: 1. A brief summary of the method used to evaluate R&U in Section 3.8 of the Terrebonne report. 2. Inclusion of Table 7 from Appendix L-5 in Section 3.8 of the Terrebonne report and/or a description that explains how the 28% cost contingency reflects the 80% confidence level developed through the R&U analysis.

Comment 16:
Minor editorial and technical revisions to the Terrebonne report should be made to improve the quality of the report.
Basis for Comment:
The Panel identified some issues that should be addressed in order to improve the quality of the Terrebonne report, including: • Line 2100 refers to greater description of details in Section 3.3.2.2, but that section is not found. Does Line 2100 mean to refer to Section 3.2.3.3? • On the CE/ICA figures in Section 3, the units on the "output" (horizontal axis) should be shown (e.g., HAs or HUs). • It is not clear why $cost/AAHU in Table 3-30 is different from Table K2-1 in Appendix K. • Sections 3.3.1 and 3.3.2 are missing from the report and Table of Contents.
Significance – Low:
The presence of technical errors and the absence of report sections reduces the quality and professional appearance of the Terrebonne report but will not affect the technical quality or comprehension of the information presented.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include: 1. A more detailed explanation for the items identified in the Basis for Comment. 2. A thorough technical review of the draft Terrebonne report to address all technical issues.

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APPENDIX B

Final Charge to the Independent External Peer Review Panel

on the

Integrated Feasibility Study and Environmental Impact Statement for the Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration Terrebonne Parish, Louisiana

as
Submitted to USACE on April 23, 2010

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Louisiana Coastal Area (LCA) Terrebonne Basin Barrier Shoreline Restoration Project Terrebonne Parish, Louisiana, Integrated Feasibility Study and Environmental Impact Statement

BACKGROUND

The Water Resources Development Act of 2007 authorized the Louisiana Coastal Area (LCA) program. Specifically, Section 7006(e)(3) requires the Secretary of the Army to submit one feasibility report to Congress on six elements by December 31, 2008. The six elements are

1) Terrebonne Basin Barrier Shoreline Restoration,
2) Small Diversion at Convent/Blind River,
3) Amite River Diversion Canal Modification,
4) Medium Diversion at Whites Ditch,
5) Convey Atchafalaya River Water to Northern Terrebonne Marshes, and
6) Multipurpose Operation of Houma Navigation Lock.

The Congressional language further authorizes construction of these six elements contingent upon submittal of a favorable report of the Chief of Engineers no later than December 31, 2010. The U.S. Army Corps of Engineers (USACE) is the Federal sponsor for the projects and the non-Federal sponsor is Louisiana's Coastal Protection and Restoration Authority (CPRA).

This Independent External Peer Review (IEPR) will review the Terrebonne Basin Barrier Shoreline Restoration project.

This project is located in LCA Subprovince 3, and provides for the restoration of the Timbalier and Isles Dernieres barrier island chains located in Terrebonne Parish and Lafourche Parish, Louisiana. The purpose of this study is to address the goal of the 2004 LCA Plan and to address the critical near-term needs for shoreline restoration in Terrebonne Basin through simulation of historical conditions. This will be achieved by enlarging the existing barrier islands (width and dune crest) and reducing the number of breaches. Additional objectives include analyzing the current conditions of the barrier islands, assessing impacts from the hurricanes of 2005 and 2008, and reaffirming the validity of the findings of the Final Programmatic Environmental Impact Statement (EIS). The Terrebonne Basin Barrier Shoreline Restoration Project Terrebonne Parish, Louisiana, Integrated Feasibility Study and EIS (TBBS FS/EIS) is based on a review of existing scientific and engineering reports, as well as geospatial, survey, and geotechnical data.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the LCA TBBS FS/EIS in accordance with the Department of the Army, U.S. Army Corps of Engineers, Water Resources Policies and Authorities' *Civil Works Review Policy* (EC 1165-2-209) dated January 31, 2010 and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released 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.

This purpose of the IEPR is to assess the adequacy and acceptability of economic, engineering, and environmental methods, models, and analyses used for the Terrebonne Basin Barrier Integrated FS/EIS. 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) with extensive experience in engineering, economics, and environmental issues relevant to the project. They should also have experience applying their subject matter expertise to ecosystem restoration.

The panel members will be "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-209, Appendix D, reviews 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 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 and reference materials that will be provided for the review. **The documents and files presented in bold font are those which are to be reviewed**. All other documents are provided for reference.

- **Integrated Feasibility Study and Environmental Impact Statement for the Louisiana Coastal Area (LCA) – Terrebonne Basin Barrier Shoreline Restoration Terrebonne Parish, Louisiana**
  - **Appendix A: Biological Assessment**
  - **Appendix B: U.S. Fish and Wildlife Service Coordination Letter and Report**
  - **Appendix C: NOAA Fisheries Service Coordination Letter**
  - **Appendix D: 404(b)(1) Water Quality Report**
  - **Appendix E: Louisiana Coastal Resources Program Consistency Determination**
  - **Appendix F: State Historic Preservation Officer Coordination Letter**
  - **Appendix G: Response to Comments**
  - **Appendix H: Value Engineering Report**
  - **Appendix I: Adaptive Management/Monitoring Plan**
  - **Appendix J: Real Estate Plan**
  - **Appendix K: Cost Effectiveness/ Incremental Cost Analysis**
  - **Appendix L: Engineering**

- **Annex L-1: Borrow Area Design Plans**
- **Annex L-2: Island Design Plans**
- **Annex L-3: Supplemental Modeling Reports**
- **Annex L-4: MII Cost Estimate Report**
- **Annex L-5: Risk Register**
- **Annex L-6: Total Project Cost Summary Report**

o **Appendix M: Hazardous, Toxic, and Radioactive Waste (HTRW) (incomplete)**

- USACE guidance *Civil Works Review Policy* (EC 1165-2-209) dated January 31, 2010
- CECW-CP Memorandum dated March 31, 2007
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.
- Evaluation of Environmental Investments Procedures Manual Interim: Cost Effectiveness and Incremental Cost Analysis[5]
- IWR Planning Suite, the cost effectiveness-incremental cost analyses software used by USACE on ecosystem restoration projects and mitigation of ecosystem impacts (accessible from http://www.pmcl.com/iwrplan/)[1]

[5] Provided to Economics Panel Member Only

SCHEDULE

TASK	ACTION	DUE DATE
1	**Notice to Proceed (NTP)**	3/12/2010
	Review documents available	3/19/2010
	End of Period of Performance	10/21/2010
	*Submit Draft Work Plan	4/9/2010
	USACE Provide comments on Draft Work Plan	4/14/2010
	Teleconference (if necessary)	4/14/2010
	*Submit Final Work Plan	4/19/2010
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	3/17/2010
	USACE Provides comments on COI	3/19/2010
	*Submit list of selected panel members	4/7/2010
	USACE provides comments on selected panel members	4/9/2010
	Complete subcontracts for panel members	4/27/2010
3	*Submit Draft Charge (combine with Draft Work Plan – Task 1)	4/9/2010
	USACE provides comments on draft charge	4/14/2010
	*Submit Final Charge (combined with Final Work Plan – Task 1)	4/19/2010
	USACE approves Final Charge	4/20/2010
4	USACE/Battelle Kick-off Meeting	3/26/2010
	Review documents sent to panel members	4/30/2010
	USACE/Battelle/panel Kick-off Meeting with panel members	4/27/2010
	External panel members complete their review	5/18/2010
5	Convene panel review teleconference	5/28/2010
	External panel members provide draft final panel comments to Battelle	6/8/2010
6	*Submit Final IEPR Report	6/28/2010
7	Input final panel comments to DrChecks Battelle provides final panel comment response template to USACE	6/30/2010
	USACE PDT provides draft Evaluator responses and clarifying questions to Battelle	7/9/2010
	Final Panel Comment Teleconference between Battelle, IEPR team, and PDT to discuss final panel comments, draft responses and clarifying questions	7/20/2010
	USACE inputs final Evaluator responses in DrChecks	7/30/2010
	Battelle inputs BackCheck responses in DrChecks	8/13/2010
	*Battelle submits pdf printout of DrChecks project file	8/16/2010
	Project Closeout	10/20/2010

Deliverables are noted with an asterisk (*)

CHARGE FOR PEER REVIEW

Members of this peer review panel are asked to determine whether the technical approach and scientific rationale presented in the Terrebonne Basin Barrier Integrated FS/EIS are credible and whether the conclusions are valid. The reviewers are asked to determine whether the technical work is adequate, competently performed, 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 reviewers are not being asked whether they would have conducted the work in a similar manner.

Specific questions for the panel members (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 Terrebonne Basin Barrier Integrated FS/EIS. Please focus on your areas 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 the following guidance. Note that the panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-209; Appendix D).

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 evaluation of 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 Independent Technical Review.
2. Please contact the Battelle deputy project manager (Amanda Maxemchuk, MaxemchukA@battelle.org) or project manager (Karen Johnson-Young, johnson-youngk@battelle.org) for requests or additional information.
3. In case of media contact, notify the Battelle project manager immediately.
4. Your name will appear as one of the panelists 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 Amanda Maxemchuk, MaxemchukA@battelle.org no later than May 13, 2010, 10 pm EDT.

Independent External Peer Review
Louisiana Coastal Area (LCA) Terrebonne Basin Barrier Shoreline Restoration Project Terrebonne Parish, Louisiana, Integrated Feasibility Study and Environmental Impact Statement

Charge Questions

General Questions

1. To what extent has it been shown that the project is technically sound, environmentally acceptable, and economically justified?

2. Are the assumptions that underlie the economic, engineering, and environmental analyses sound?

3. Are the economic, engineering, and environmental methods, models and analyses used adequate and acceptable?

4. In general terms, are the planning methods sound?

5. Are the interpretations of analysis and conclusions based on the analysis reasonable?

6. Will the proposed restoration (with O&M described in report) produce significant measurable benefits or is additional O&M or are additional restoration activities required for production of significant measurable benefits over the period of analysis? Consider the same question for production of significant measurable benefits beyond the period of analysis.

7. Has the value of geomorphic form and function been adequately addressed for the Terrebonne Basin Shoreline Study?

8. Please describe the value of barrier island restoration in the overall sustainability of marsh landward of the barrier island. How will benefits in the marsh change as the island chain erodes over the period of analysis?

Section 1.0 Study Information

1.1 Study Authority

No questions.

1.2 Purpose and Scope

No questions.

1.3 Study Area

No questions.

1.4 History of Investigation

No questions.

1.5 Prior Reports and Existing Projects

9. Have all critically important prior studies performed relative to the study area been described?

1.6 Planning Process and Report Organization

No questions.

1.7 USACE Campaign Plan

No questions.

SECTION 2.0 – Need for and Objectives of Action

2.1 National Objectives

10. Comment on whether the Terrebonne Basin Barrier Shoreline Restoration Project (TBBS) as proposed will contribute to national ecosystem restoration (NER) output.

2.2 Public Concerns

11. Have the public concerns been identified?

2.3 Problems, Needs, and Opportunities

12. Are the problems facing the TBBS area accurately described?

13. Is the project need clearly stated?

14. Are the study area opportunities to improve habitat conditions and address the problems accurately described?

2.4 Planning Objectives

15. Are the planning goal and objectives described clearly?

16. Comment on whether the TBBS Project as proposed will meet the planning objectives.

2.5 Planning Constraints

17. Are the planning constraints described clearly and comprehensively?

18. Comment on whether the TBBS Project as proposed fully considers and accounts for the planning constraints.

SECTION 3.0 – Alternatives

3.1 Plan Formulation Rationale

19. Is the rationale for developing the plan clear and complete?

20. Are the criteria for developing the plan comprehensive?

3.2 Management Measures

21. Are the management measures thorough and accurate?

22. Assess the development and grouping of the management measures.

23. Is the methodology to develop the screening criteria appropriate?

24. Is the screening process of the management measures appropriate and adequate?

25. Is the elimination of some of the management measures from further study clearly described?

3.3 Preliminary Alternative Plans

26. Assess the screening process of the potential alternative plans.

27. Was the elimination of some of the alternative plans from further study clearly described?

28. How accurate and comprehensive is the calculation of habitat acres associated with the alternatives?

29. How accurate and comprehensive is the calculation of costs and outputs used to determine the cost effective and best buy alternatives?

3.4 Final Array of Alternatives (Alternative Studied in Detail)

30. Is each of the different alternative plans clearly described?

31. Assess the screening process used to arrive at the final array of alternatives.

3.5 Comparison of Alternative Plans

32. Are the WVA ecosystem output models reasonable and appropriate for evaluating project benefits/impacts?

33. Is the way in which the models were applied for evaluating project alternatives appropriate?

    a. If there are any modifications to the models, are they appropriate?

    b. Is weighting of variable or habitat types appropriate?)

    c. If not, why?

34. Comment on the model reviewers' assessment of the technical quality, system quality, and usability of the WVA models.

35. Are the models used for the evaluation appropriate regarding:

    a. SI values assigned to variables

    b. The number of target years selected

    c. How AAHUs are calculated (i.e., estimating the sum rather than the arithmetic mean)

    d. How sea level change is incorporated into the models

    e. Whether policy or science is a more important driver for assigning an index value to model variables

    f. Whether calculations in the spreadsheets are correct and easy to use

    g. How risk and uncertainty is handled

    h. Whether the best data sources are used

    i. Justification for why the geometric mean or arithmetic mean is used to calculate HSIs.

3.6 NER Plan

36. Is the NER plan sufficiently detailed?

3.7 Locally-Preferred Plan

No questions.

3.8 Environmentally Preferable Alternative

37. Does the information provided support the selection of the Environmentally Preferable Alternative?

3.9 Plan Selection-Tentatively Selected Plan

38. Is the description of the components of the Tentatively Selected Plan sufficient?

39. Are the design, environmental, and construction considerations outlined for the Tentatively Selected Plan appropriate and adequate?

40. Does the preferred alternative give adequate consideration to ongoing or planned projects within the project area?

41. Have the impacts to existing infrastructure, such oil and gas infrastructure, been adequately addressed?

42. Does the plan address all real estate interests (private and public) and requirements resulting from the restoration project?

43. Have the operations and maintenance considerations of the Tentatively Selected Plan been addressed?

44. Are the proposed actions/solutions for addressing the potential issues surrounding privately owned lands adequate?

3.10 Risk and Uncertainty

45. Are the descriptions of the risk and uncertainties associated with the development, selection, and construction of the Tentatively Selected Plan sufficiently comprehensive?

3.11 Implementation Requirements (Also consider information in Appendix I)

46. Have all assumptions, regulations, and stipulations regarding cost sharing, including in-kind work, been clearly described?

47. How complete is the action plan outlined in the financial requirements?

SECTION 4.0 – Affected Environment

4.1 Environmental Setting of the Study Area

48. Is the general description of the proposed project area accurate and comprehensive?

49. Is the description of the climate in the study area sufficiently detailed and accurate?

50. Is the description of the geomorphic and physiographic setting of the proposed project area accurate and comprehensive?

4.2 Significant Resources

51. Does the description of existing conditions provide for a sufficient understanding of the presence and distribution of soils and waterbottoms in the study area?

52. Is the hydrology discussion sufficient to allow for an evaluation of the effects of implementation of the proposed plan compared to current baseline conditions?

53. Is the discussion on the relationship between flow and water levels and the hydrodynamics of the project area complete?

54. Are the factors affecting estuarine circulation adequately discussed? Based on your experience, are there additional factors to be considered?

55. Is the description of the historical and existing sedimentation and erosion conditions in the study area adequate?

56. Are the water quality and salinity discussions sufficient to allow for an evaluation of the effects of implementation of the proposed plan compared to current baseline conditions?

57. Is the description of the historical and existing wetland vegetation resources in the study area adequate?

58. Is the description of the historical and existing vegetation resources in the study area adequate?

59. Is the description of the historical and existing wildlife and habitat resources in the study area complete and accurate?

60. Is the description of aquatic resources in the project area complete and accurate?

61. Is the description of the historical and existing fishery resources in the study area complete and accurate?

62. Is the discussion on shrimp, crabs, and oysters sufficient to allow for an evaluation of the effects of implementation of the proposed plan compared to current baseline conditions?

63. Is the description of threatened and endangered species resources in the study area complete and accurate? (Also consider information in Appendix A)

64. Is the description of the historical and existing recreational resources in the study area complete and accurate?

65. Is the description of the historical and existing socioeconomic resources in the study area complete and accurate?

66. Public lands, navigation, and natural resources (esp. petrochemicals, fisheries, and oysters) are of major importance to the population in the study area. Have the existing and historic conditions been characterized properly?

SECTION 5.0 – Environmental Consequences

67. Are the scope and detail of the potential adverse effects that may arise as a result of project implementation sufficiently described and supported?

5.1 Soils and Waterbottoms

68. Are the environmental effects of changes to soils and waterbottoms in the project area, based on each alternative, adequately described?

69. Have the short- and long-term impacts associated with the alternatives been adequately discussed and evaluated?

70. Are assumptions related to accretion and subsidence rates valid? Will with-project conditions slow degradation, stabilize, or result in marsh building?

5.2 Hydrology

71. Are the environmental effects of changes to nearshore hydrology from the alternatives reasonable and factually supported?

72. Are environmental effects of changes to flow and water levels from the alternatives reasonable and factually supported?

73. Are environmental effects of changes to sedimentation and erosion from the alternatives reasonable and factually supported?

5.3 Water Quality and Salinity

74. Are environmental effects of changes to water quality and salinity from the alternatives reasonable and factually supported?

5.4 Air Quality

75. Are environmental effects of changes to air quality from the alternatives reasonable and factually supported?

5.5 Noise

No questions.

5.6 Vegetation Resources

76. Are environmental effects of changes to wetland vegetation resources from the alternatives reasonable and factually supported?

5.7 Wildlife and Habitat

No questions.

5.8 Aquatic Resources

77. Is the description of projected impacts to aquatic resources for each of the alternatives reasonable and factually supported?

5.9 Fisheries

78. Are environmental effects of changes to fishery resources from the alternatives reasonable and factually supported?

79. Are assumptions related to impacts to fisheries valid?

5.10 Essential Fish Habitat (EFH)

No questions.

5.11 Threatened and Endangered Species

No questions.

5.12 Cultural and Historic Resources

80. To what extent have the potential impacts of the alternatives on cultural resources been addressed and supported? (Also consider information in Appendix F)?

5.13 Aesthetics

No questions.

5.14 Recreation

81. Have the potential impacts to recreation resources from the alternatives been adequately considered?

5.15 Socioeconomic and Human Resources

No questions.

5.16 Hazardous, Toxic, and Radioactive Waste

No questions.

SECTION 6.0 – Public Involvement

82. Based on your experience with similar projects, has adequate public, stakeholder, and agency involvement occurred to determine all issues of interest and to ensure that the issues have been adequately addressed to the satisfaction of those interested parties? Should additional public outreach and coordination activities be conducted?

SECTION 7.0 –Coordination and Compliance

No questions.

SECTION 8.0 – Conclusions and Determinations

No questions.

SECTION 9.0 – Distribution List and Other

No questions.

Appendix A: Biological Assessment

No questions.

Appendix B: U.S. Fish and Wildlife Service Coordination Letter and Report

No questions.

Appendix C: NOAA Fisheries Service Coordination Letter

No questions.

Appendix D: 404(b)(1) Water Quality Report

83. Are the general characteristics of the dredged and fill material accurate and adequately described?

84. Is the quantity of the dredged and fill material adequate and factually supported?

85. Are the suspended particulate/turbidity determinations appropriate?

Appendix E: Louisiana Coastal Resources Program Consistency Determination

No questions.

Appendix F: State Historic Preservation Officer Coordination Letter

No questions.

Appendix G: Responses to Comments

No questions.

Appendix H: Value Engineering Report

86. Are the value engineering process and recommendations outlined in the report adequate?

87. Were the three basic value engineering (VE) principles (project function, cost, and ways of constructing the project at the same or a reduced cost) considered during the VE process?

Appendix I: Adaptive Management /Monitoring Plan

88. Are the performance measures, desired outcomes, and monitoring designs for each of the project objectives sufficiently detailed?

89. Are the proposed monitoring procedures appropriate and adequate?

90. Is the monitoring program assessment process appropriate and thorough?

91. Are the costs for administering a monitoring and assessment program reasonable and realistic?

Appendix J: Real Estate Plan

92. Does the plan adequately address all real estate interests (public and private) and requirements allowing for appropriate comparisons across all alternatives, including the Tentatively Selected Plan?

Appendix K: Cost Effectiveness/ Incremental Cost Analysis

93. To what extent have significant project design and construction costs been adequately identified and folded into the cost and benefit evaluation?

94. Is the calculation of net benefits used to describe the final array of alternatives adequate?

95. How complete and valid is the methodology used to conduct the incremental cost analysis?

Appendix L: Engineering

96. Have the design and engineering considerations presented been clearly outlined?

97. Are any additional design assumptions necessary to validate the preliminary design of the primary project components?

98. To what extent have significant project construction costs been adequately identified and described in Appendix L?

99. Are the assumptions used to develop the stages of cost estimating for the project: conceptual cost estimate, the refined conceptual cost estimate, and the preliminary cost estimate sufficiently clear?

100. Is the rationale clearly presented for the progressive refinements of the cost estimate?

101. Has the feasibility of constructing the proposed measures been adequately addressed?

102. Are the Wave Information Studies (WIS) baseline data, land/water surveys, and shoreline changes estimates for use in coastal processes modeling adequate and valid? Are these data sufficient to conduct a valid analysis of coastal processes?

103. Is the shoreline location used to calibrate the STWAVE/GENESIS model adequate? Are the modeling results valid for use on a project-wide basis?

104. Based on past storm events (wave height and volume losses), are the results from the SBEACH model reasonable and the ability of the model to predict project success adequate?

105. Has the role of background erosion and sea level rise been adequately considered in the model analysis?

106. Is the proposed borrow material well-suited for beach fill material from an engineering, economic, and environmental standpoint?

107. Is the volume of available borrow material a factor in future nourishment activities?

108. Are the available geotechnical data to predict offshore borrow locations, characteristics, and construction activities adequate?

109. Were the technical assumptions used to determine the proposed barrier island components and hard-structural measure designs valid?

110. What other assumptions should be included to justify the preliminary design?

111. Are the proposed construction methods and sequence outlined for the off-shore dredging, transportation and placement of the borrow, beach, and dune fill material appropriate and adequate?

112. Is the length of the estimated time for construction adequate?

113. Have all the significant issues been taken into consideration in estimating construction timeframe?

114. Are the assumptions used to determine the cost of operations and maintenance for the proposed project adequate?

115. Appendix M: Hazardous, Toxic, and Radioactive Waste Report

116. This information in this report is currently incomplete; therefore, there are no questions regarding this report.