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Final Independent External Peer Review Report for the Mississippi River – Gulf Outlet Ecosystem Restoration Plan Feasibility Study and Environmental Impact Statement

Prepared by
Battelle Memorial Institute

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

Contract No. W912HQ-10-D-0002
Task Order: 0010

June 3, 2011

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for the
Mississippi River-Gulf Outlet
Ecosystem Restoration Plan Feasibility Study
and Environmental Impact Statement

by

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505 King Avenue
Columbus, OH 43201

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Ecosystem Restoration Plan Feasibility Study
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EXECUTIVE SUMMARY

Project Background and Purpose

The Water Resources Development Act of 2007 (WRDA) authorized the Mississippi River-Gulf Outlet (MRGO) Ecosystem Restoration Plan Feasibility Study and environmental impact statement (EIS). Specifically, Section 7013 conditionally authorized the plan for construction, pending the determination that the project is cost-effective, environmentally acceptable, and technically feasible. As detailed in the WRDA authorization, the plan proposes to:

1. Physically modify the MRGO and restore the areas affected by the navigation channel
2. Restore natural features of the ecosystem that will reduce or prevent damage from storm surge
3. Prevent the intrusion of saltwater into the waterway
4. Integrate the recommendations of the Louisiana Coastal Area Report and the Louisiana Coastal Protection and Restoration Technical Report
5. Consider the use of native vegetation and diversions of fresh water to restore the Lake Borgne ecosystem.

The MRGO Ecosystem Restoration Plan Feasibility Study is being developed as a supplement to the June 2008 MRGO Deep-Draft De-Authorization Report and is intended to fully meet the requirements of WRDA Section 7013. This feasibility study is anticipated to result in a Chief's Report containing a recommended MRGO Ecosystem Restoration Plan. The Plan will address systematic ecosystem restoration and protection of the Lake Borgne ecosystem and areas affected by the MRGO navigation channel, and will include considerations of measures to reduce or prevent damage from storm surge. The study will integrate the findings of ongoing comprehensive restoration planning efforts for the study area, including the Louisiana Coastal Protection and Restoration (LACPR) Final Technical Report, the Louisiana Coastal Area (LCA) Program, and Louisiana's Comprehensive Master Plan for a Sustainable Coast.

This Independent External Peer Review (IEPR) will review the draft feasibility report and EIS for the MRGO Ecosystem Restoration Plan Feasibility Study, along with the associated appendices.

The study area includes portions of the Mississippi River Deltaic Plain in coastal southeast Louisiana and parts of coastal southwest Mississippi. It encompasses approximately 3.86 million acres (6,023 square miles) of land and open water.

- In Mississippi, the study area includes the Western Mississippi Sound, its bordering wetlands, and Cat Island. The Lake Borgne ecosystem and areas that may have been affected by the construction, operation, and maintenance of the MRGO navigation channel are included in the study area. The MRGO channel may have affected salinity as far northwest as Lake Maurepas. To the east, the MRGO channel was dredged through open water between Breton and Grand Gossier Islands (segments of the lower Chandeleur Island chain). The MRGO channel affected portions of the Lake Borgne ecosystem to the north and potentially altered hydrology to the west as far as the Bayou Terre aux Boeufs ridge.
- Louisiana parishes in the study area include Ascension, Jefferson, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Tammany, and Tangipahoa. Mississippi counties in the study area include Hancock and Harrison.Lake. Borgne is hydrologically linked to Lake Pontchartrain through tidal passes at The Rigolets, Chef Menteur Pass, and the Inner Harbor Navigation Canal (IHNC). The Lake Borgne ecosystem is influenced by the Pearl River to the north and is hydrologically connected to areas located as far south as Bayou Terre aux Boeufs.

There are a number of project measures in the tentatively selected plan: artificial oyster reef, shoreline protection, ridge restoration, fresh marsh restoration/nourishment, intermediate marsh restoration/nourishment, brackish marsh restoration/nourishment, cypress swamp restoration/nourishment and a freshwater diversion.

Plan C, which has been tentatively selected, would restore and protect approximately 58,861 acres of habitat in the study area, including 10,431 acres of cypress swamp, 13,950 acres of fresh and intermediate marsh, 33,966 acres of brackish marsh, 466 acres of saline marsh, and 48 acres of ridge habitat. Plan C encompasses approximately 70 miles of shoreline protection (including 7.5 miles of artificial oyster reef).

Approximately 11,222 acres of the restoration and protection features would be located in the East Orleans Landbridge/Pearl River area and approximately 9,301 acres of restoration features would be located in the Biloxi Marsh area, which have been determined to be critical landscape features with respect to storm surge. In addition, the cypress swamp and ridge restoration feature would include forested habitat, which has been shown to have some storm surge damage risk reduction benefits.

A freshwater diversion from the Mississippi River in the vicinity of Violet, Louisiana is a key component of the tentatively recommended plan. The freshwater diversion is a system driver to create conditions conducive to the restoration of historic estuarine habitat types in the vicinity of the MRGO. The Violet Freshwater Diversion would mimic the natural river flooding processes and enhance the sustainability of the system through the input of freshwater, nutrients, and sediment.

Independent External Peer Review Process

USACE is conducting an IEPR of the Mississippi River-Gulf Outlet Ecosystem Restoration Plan Feasibility Study and environmental impact statement (hereinafter MRGO FS/EIS). 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

MRGO FS/EIS. 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 panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

Seven panel members were selected to serve on the Panel based on the technical content of the MRGO FS/EIS and the overall scope of the project. The panel members were selected for their technical expertise in the following key areas: civil works planning, environmental/ coastal ecology, civil engineering/construction engineering, economics, hydrology and hydraulics engineering, fisheries biology, and coastal geomorphology. The first five technical areas of expertise listed above are those previously identified for Louisiana Water Resources Council (LWRC, as defined in WRDA 2007, Section 7009) Primary Panel Members. Battelle consulted with the five LWRC Primary Panel Members and confirmed that their expertise and schedule commitments made them suitable to serve on the Panel. The last two technical areas of expertise listed above (fisheries biology and coastal geomorphology) required for this IEPR were not among those previously specified for the LWRC Primary Panel or the Candidate Pool. These additional areas of expertise were required to address technical aspects of the MRGO project not covered by the LWRC Primary Panel. Battelle identified and recruited subject matter experts from outside of the LWRC Candidate Pool to serve in these two roles. USACE was given the list of candidate panel members, but Battelle made the final selection of the Panel.

The Panel received electronic versions of the MRGO FS/EIS documents, totaling more than 6,500 pages, along with a charge that solicited comments on specific sections of the documents to be reviewed. The Panel was also provided with a summary of the more than 30,000 public comments received by USACE, as well as representative comments for each topic. The charge was prepared by USACE according to guidance provided in USACE (2010) and OMB (2004). Charge questions were provided by USACE and included in the draft and final Work Plans.

The USACE Project Delivery Team briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review. In addition to this teleconference, a teleconference with USACE, the Panel, and Battelle was held partway through the review period to provide the Panel an opportunity to ask questions of USACE and clarify uncertainties. The Panel produced more than 500 individual comments in response to the 42 charge questions.

IEPR panel members reviewed the MRGO FS/EIS documents 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, 19 Final Panel Comments were identified and documented. Of these, six were identified as having high significance, and 13 had medium significance

Results of the Independent External Peer Review

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2010; p. D-4) in the MRGO FS/EIS document. The Panel agreed that the MRGO FS/EIS is comprehensive and, in general, is technically sound. The Panel recognizes that a great deal of work has been conducted and documented, which is an accomplishment for such a large and complex restoration plan. There are, however, aspects that should be strengthened. The final steps in formulating the Tentatively Selected Plan (TSP) rely on information and data insufficient to allow for discrimination among the similar plans of differing size and measures. In addition, the determination of the size and location of the proposed diversion needs further evaluation and justification. One overarching issue was that the preciseness of the modeling and analysis results presented in the EIS gives the impression of much higher accuracy than is justified. Thus, as the MRGO restoration plan is implemented, caution should be used in deciding on the final management measures in the final plan.

Table ES-1 lists the Final Panel Comments statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report. The following statements summarize the Panel's findings.

Plan Formulation Rationale: The Institute for Water Resources Planning process was used appropriately, generally resulting in a reasonably sized and costed restoration plan. However, the current level of detail and analysis are not sufficient to justify the location and scale of the Violet Diversion. Plans should consider other projects or restoration efforts in the area in addition to the MRGO project, and model assumptions should be subject to sensitivity analyses. The monitoring and adaptive management plan (MAMP) is not complete and requires specific details about how and when it would be applied. The Panel provided more specific recommendations and suggestions for improving the report.

Economics: The Panel found that the economics related to the MRGO FS/EIS were complete and provided a detailed analysis of the TSP.

Engineering: The Panel found the engineering design of the infrastructure components of the plan and the related geotechnical investigations to be satisfactory. However, some of the documentation of the modeling is incomplete, making it difficult to assess the adequacy of design and location of the freshwater diversion. The adequacy and acceptability of Cost and Schedule Risk Analysis (CSRA) could not be determined; however, the Panel identified several areas of uncertainty and risk that are potential concerns. The Panel also identified the need for using more detailed hydrodynamic models that are subject to greater calibration and testing than the models currently used in order to provide a more definitive characterization of the diversion.

Environmental: Considering the scope of the project, the Panel found that the environmental impacts and uncertainty of the plan are, in general, well described. While the discussion of environmental uncertainty and variability appears complete, there is a need for sensitivity analysis to determine the potential impacts to the project. In particular, documentation of the cumulative effects does not comply with the National Environmental Policy Act (NEPA) mandate to evaluate all past, present, and future actions that could affect, or be affected by, the

proposed project. The preliminary and incompletely documented Comprehensive Aquatic Systems Model (CASM) used for assessing many biological impacts should be finalized, and additional analyses of the impacts on certain high profile species are needed.

Table ES-1. Overview of 19 Final Panel Comments Identified by the MRGO FS/EIS IEPR Panel

Significance – High	
1	The adequacy and acceptability of Cost and Schedule Risk Analysis (CSRA) could not be determined.
2	The Monitoring and Adaptive Management Plan (MAMP) is missing key elements and is not funded sufficiently to assess project performance and address important uncertainties.
3	The specific location and magnitude of the proposed freshwater diversion is not supported by the technical analysis and information presented.
4	The cumulative effects analysis does not consider related planned projects and other foreseeable potential actions in the study area that could be affected by or affect the MRGO project.
5	The absence of a non-Federal sponsor poses a significant risk to the implementation of the MRGO project.
6	The UNO hydrology and hydraulics model may not accurately describe variations in spatial and temporal salinities.
Significance – Medium	
7	The Wetland Value Assessment (WVA) model analysis did not include site-specific information on habitat characterization.
8	The calibration and verification of the MIKE 21 hydrodynamic model limits the accuracy and robustness of the analysis in terms of flow velocity, marsh inundation and salinity.
9	The adequacy and acceptability of the Comprehensive Aquatic Ecosystem Model (CASM) model could not be evaluated due to the preliminary model version provided and the limited documentation.
10	The analyses are not sufficiently sensitive to discriminate between closely related management measures within plans or differentiate among alternative plans.
11	The planning objectives are overly specific and limit the range of measures and alternatives that could meet the project goals.
12	The ecological resource goals of the MRGO project are largely met through an increase in habitat area rather than improvements in habitat quality.
13	The post-closure baseline environmental conditions information provided does not allow for a complete evaluation of the predicted future without project (FWP) and future with project (FWOP) conditions.
14	The selection of the Violet diversion may not meet the USACE acceptability criterion.
15	The use of maintenance dredged material from locations other than Lake Borgne, especially the Mississippi River, were not fully evaluated as borrow source options.
16	The environmental effects of dredging operations in Lake Borgne, such as changes in turbidity, degraded water quality, and increases in wave energy and shoreline erosion, have not been sufficiently considered.
17	There is no documentation that the sediment properties and salinity of the dredged material can provide optimum conditions for marsh and swamp restoration.
18	Impacts of the TSP on oyster resources have not been thoroughly investigated.
19	The analyses of the impacts of the proposed alternatives on Gulf sturgeon were qualitative and are not supported by field data or an analysis of habitat requirements relative to proposed dredging activities.

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LIST OF ACRONYMS

AAHU	Average Annual Habitat Units
ATR	Agency Technical Review
BA	Biological Assessment
CASM	Comprehensive Aquatic Systems Model
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
COI	Conflict of Interest
CPRA	Louisiana Coastal Protection and Restoration Authority
CSRA	Cost and Schedule Risk Analysis
CWA	Central Wetlands Area
DrChecks	Design Review and Checking System
ECT	Electronic Calculation Template
EIS	Environmental Impact Statement
ERDC	Engineering Research and Development Center
FR	Feasibilty Report
FS	Feasibility Study
FVCOM	Finite Volume Coastal Ocean Model
FWOP	Future Without Project
FWP	Future With Project
FWS	United States Fish and Wildlife Service
IEPR	Independent External Peer Review
IHNC	Inner Harbor Navigation Canal
LACPR	Louisiana Coastal Protection and Restoration
LCA	Louisiana Coastal Area
LERRD	Lands, Easements, Rights-of-way, Relocations and Disposal sites
LiDAR	Light Detection and Ranging
LWRC	Louisiana Water Resources Council
MAMP	Monitoring and Adaptive Management Plan
MIKE 21	A numerical computer model developed by DHI Water & Environment
MRGO	Mississippi River Gulf Outlet
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
OMRR&R	Operation, Maintenance, Repair, Rehabilitation, and Replacement
RSLR	Relative Sea Level Rise
SAM	Standard Assessment Methodology
SBSP	South Bay Salt Pond Restoration Project
OCPR	Louisiana Office of Coastal Protection and Restoration
OMB	Office of Management and Budget
TSP	Tentatively Selected Plan
UNO	University of New Orleans hydrology and hydraulics model
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WRDA	Water Resources Development Act
WVA	Wetlands Value Assessment Model

1. INTRODUCTION

The Water Resources Development Act of 2007 (WRDA) authorized the Mississippi River-Gulf Outlet (MRGO) Ecosystem Restoration Plan Feasibility Study and environmental impact statement (EIS). Specifically, Section 7013 conditionally authorized the plan for construction, pending the determination that the project is cost-effective, environmentally acceptable, and technically feasible. As detailed in the WRDA authorization, the plan proposes to:

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This Independent External Peer Review (IEPR) will review the draft feasibility report and EIS for the MRGO Ecosystem Restoration Plan Feasibility Study, along with the associated appendices.

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A freshwater diversion from the Mississippi River in the vicinity of Violet, Louisiana is a key component of the tentatively recommended plan. The freshwater diversion is a system driver to create conditions conducive to the restoration of historic estuary habitat types in the vicinity of the MRGO. The Violet Freshwater Diversion would mimic the natural river flooding processes and enhance the sustainability of the system through the input of freshwater, nutrients, and sediment.

The objective of the work described here was to conduct an IEPR of the Mississippi River-Gulf Outlet Ecosystem Restoration Plan Feasibility Study and environmental impact statement (hereinafter MRGO FS/EIS) in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers (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 administering peer review panels, was engaged to coordinate the IEPR of the MRGO FS/EIS. 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 MRGO FS/EIS. The full text of the Final Panel Comments is presented 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 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 MRGO FS/EIS 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 (COI) 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

At the beginning of the Period of Performance, Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan.

Table 1 presents the schedule followed in executing the IEPR. Due dates for milestones and deliverables are based on the award date of February 10, 2010. Note that the work items listed in Task 7 occur after the submission of this report. Battelle will enter the 19 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. MRGO FS/EIS IEPR Schedule

Task	Action	Due Date
1	**Award Date**	2/10/2011
	Review documents available	3/3/2011
	*Battelle submits draft Work Plan	2/17/2011
	USACE provides comments on draft Work Plan	2/25/2011
	Teleconference (if necessary)	2/25/2011
	*Battelle submits final Work Plan	3/11/2011
2	Battelle requests input from USACE on the COI questionnaire	2/11/2011
	USACE provides comments on COI questionnaire	2/14/2011
	*Battelle submits list of selected panel members	2/16/2011
	USACE provides comments on selected panel members	2/18/2011
	Battelle completes subcontracts for panel members	3/4/2011
3	USACE provides Charge to be included in Work Plan	2/17/2011
4	USACE/Battelle kick-off meeting	2/17/2011
	Battelle sends review documents to IEPR Panel	3/7/2011
	USACE/Battelle/Panel kick-off meeting	3/14/2011
	Battelle convenes mid-review teleconference for Panel to ask clarifying questions of USACE	3/28/2011
5	Panel members complete their individual reviews	5/2/2011
	Battelle convenes Panel review teleconference	5/5/2011
	Panel members provide draft Final Panel Comments to Battelle	5/13/2011
6	*Battelle submits Final IEPR Report to USACE	6/3/2011
7	Battelle inputs Final Panel Comments to DrChecks; Battelle provides Comment Response template to USACE	6/7/2011
	Battelle convenes teleconference with USACE to review the Comment Response Process	6/7/2011
	USACE provides draft Evaluator Responses to Battelle	6/17/2011
	Battelle convenes teleconference with Panel, and USACE to discuss Final Panel Comments, and draft responses	6/28/2011
	USACE inputs final Evaluator Responses in DrChecks	7/6/2011
	Battelle inputs the Panel's BackCheck Responses in DrChecks	7/18/2011
	*Battelle submits pdf printout of DrChecks project file	7/19/2011
	End of Period of Performance	9/30/2011

Deliverables are noted with an asterisk (*)

3.2 Identification and Selection of IEPR Panel Members

The candidates for the Panel were evaluated based on their technical expertise in the following key areas: civil works planning, environmental/coastal ecology, civil engineering/construction engineering, economics, hydrology and hydraulics engineering, fisheries biology, and coastal geomorphology. These areas correspond to the technical content of the MRGO FS/EIS and overall scope of the MRGO project.

The first five technical areas of expertise listed above are those previously identified for Louisiana Water Resources Council (LWRC, as defined in WRDA 2007, Section 7009) Primary Panel Members. Battelle consulted with the five LWRC Primary Panel Members and confirmed that their expertise and schedule commitments made them suitable to serve on the Panel.

The two technical areas of expertise of fisheries biology and coastal geomorphology required for this IEPR were not among those previously specified for the LWRC Primary Panel or the Candidate Pool. These additional areas of expertise were required to address technical aspects of the MRGO project not covered by the LWRC Primary Panel. To identify candidate panel members for these two roles, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Information about the candidate panel members, including brief biographical information, highest level of education attained, and years of experience, was provided to USACE for feedback.

Battelle made the final selection of panel members according to the selection criteria described in the Work Plan. The final Panel was composed of seven expert reviewers, with five experts coming from the LWRC Panel and two experts recruited for additional roles specified by the scope of the MRGO project.

The candidates were screened for the following potential exclusion criteria or COIs.[1] These COI questions were intended to serve as a means of disclosure and to better characterize a candidate's employment history and background. Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

- Involvement by you or your firm[2] in ANY part of the Louisiana Coastal Protection and Restoration Authority's (CPRA) Comprehensive Master Plan for a Sustainable Coast

[1] 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."

[2] Includes any joint ventures in which your firm is involved.

(Master Plan), particularly the Mississippi River-Gulf Outlet (MRGO) Ecosystem Restoration Plan Feasibility Study and Environmental Impact Statement (EIS).

- Involvement by you or your firm[2] in ecosystem restoration projects in coastal Louisiana or Mississippi including (but not limited to) Lake Borgne, Lake Pontchartrain, The Rigolets, Chef Menteur Pass, the Inner Harbor Navigation Canal (IHNC), Bayou Terre aux Boeufs, East Orleans Landbridge/Pearl River area, Biloxi Marsh area, the Mississippi River Deltaic Plain in coastal southeast Louisiana, coastal southwest Mississippi, the Western Mississippi Sound, its bordering wetlands, and Cat Island.
- Current employment by the U.S. Army Corps of Engineers (USACE).
- Involvement with paid or unpaid expert testimony related to the CPRA's Master Plan, particularly the element listed in #1 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: CPRA, Louisiana Office of Coastal Protection and Restoration (OCPR), Southeast Louisiana Flood Protection Authority, National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (FWS), Natural Resources Conservation Service (NRCS), U.S. Environmental Protection Agency (USEPA), Minerals Management Service, and U. S. Geologic Survey (USGS) and currently working on CPRA-related projects (for pay or pro bono).
- Past, current or future interests or involvements (financial or otherwise) by you, your spouse or children related to the CPRA's Master Plan, particularly the elements listed in #1 above, including interest in CPRA-related contracts or awards from USACE.
- Financial or litigation association with USACE, "The State" (defined as the State of Louisiana and Local governing entities including Southeast Louisiana Flood Protection Authority), the Design A/E, their engineering teams, subcontractors, or construction contractors.
- Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the New Orleans District.
- Current firm[2] 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.
- Any previous employment by USACE as a direct employee or contractor (either as an individual or through your firm[3]) 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.

[3] Includes any joint ventures in which your firm is involved.

- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning ecosystem restoration and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in the CPRA's Master Plan, particularly the element listed in #1 above, or related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years came from USACE contracts.
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to CPRA's Master Plan, particularly the element listed in #1 above.
- Participation in prior Federal studies/programs relevant to CPRA's Master Plan, such as:
    - Louisiana Coastal Protection and Restoration (LACPR) Technical Report, 2009 Coast 2050 Plan
    - LCA Ecosystem Restoration Study, 2004
    - Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast, 2007
    - LCA Near-term Restoration Plan, 2004
    - MRGO Deep-Draft De-Authorization Report.
- Participation in prior non-Federal studies relevant to CPRA's Master Plan.
- 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 review? If so, please describe.

In selecting the final members of the Panel from the list of candidates, Battelle chose experts who best fit the expertise areas and had no COIs. The seven final reviewers were either affiliated with academic institutions or consulting companies or were independent engineering consultants. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. USACE was given the list of candidate panel members, but Battelle made the final selections of the Panel. Section 4 of this report provides names and biographical information on the panel members.

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

3.3 Preparation of the Charge and Conduct of the IEPR

Charge questions were provided by USACE and included in the draft and final Work Plans. In addition to a list of 42 charge questions/discussion points, the final charge included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Battelle planned and facilitated a final kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meeting, the IEPR Panel received an electronic version of the MRGO FS/EIS documents 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.

3.4 Review of Individual Comments

Prior to completion of the review of the MRGO FS/EIS documents, a teleconference with USACE, the Panel, and Battelle was held halfway through the review period to provide the Panel an opportunity to ask questions of USACE regarding uncertainties requiring clarification. At the end of the review period, the Panel produced approximately 500 individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other general impressions. As a result of the review, Battelle summarized the 500 comments into a preliminary list of 28 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 5-hour teleconference with the Panel so that the panel members, 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 Final 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.

During this teleconference any potential 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 initially identified 20 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 MRGO FS/EIS:

- 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 Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:
    1. Comment Statement (succinct summary statement of concern)
    2. Basis for Comment (details regarding the concern)
    3. Significance (high, medium, 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, success, or justification of the project. Comments rated as high indicate that the Panel analyzed or assessed the methods, models, and/or analyses and determined that there is a "showstopper" issue.
    2. Medium: Affects the completeness of the report in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium indicate that the Panel does not have sufficient information to analyze or assess the methods, models, or analyses.
    3. Low: Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information (tables, figures, equations, discussions) that was mislabeled or incorrect or data or report sections that were not clearly described or presented.
- Guidance for Developing Recommendations: The recommendation section was to include specific actions that USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

At the end of this process, 19 Final Panel Comments were prepared and assembled, with one Final Panel Comment being incorporated into the Summary of Final Panel Comments. 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 (who were screened for availability, technical background, and COIs), and provided it to USACE for feedback. Battelle made the final selection of panel members.

An overview of the credentials of the final seven primary members of the 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. MRGO FS/EIS IEPR Panel: Technical Criteria and Areas of Expertise

	Casavant	Crouch	Ellis	Kelsoe	Orr	Rose	Houser
Civil Works Planning (one expert needed)	**X**						
Familiarity with the USACE plan formulation process, procedures, and standards	X						
Familiarity with evaluation of alternative plans for both ecosystem restoration and flood risk management projects	X						
Familiarity with USACE standards and procedures	X						
Environmental/Coastal Ecology (one expert needed)		**X**					
Experience directly related to water resource environmental evaluation or review and National Enviornmental Policy Act (NEPA) compliance		X					
Experience working with coastal wetlands and estuarine ecosystems		X					
Familiarity with USACE calculation and application of environmental impacts and benefits		X					
Experience in the Gulf of Mexico coastal region is preferred but not required		X					
M.S. degree or higher in a related field		X					
Civil Engineering/Construction Engineering (one expert needed)			**X**				
Demonstrated experience in performing cost engineering/construction management for all phases of ecosystem restoration, flood risk management, coastal storm damage reduction, or related projects			X				
Wetland restoration/creation experience related to			X				

	Casavant	Crouch	Ellis	Kelsoe	Orr	Rose	Houser
the dredging and placement of slurry materials for beneficial use							
Familiarity with practices used in wetland restoration, flood/coastal storm damage reduction in the Gulf of Mexico coastal region is preferred but not required			X				
Capable of addressing the USACE Safety Assurance Review aspects of all projects			X				
Registered professional engineer			X				
Economics (one expert needed)				**X**			
Minimum 10 years experience directly related to water resource economic evaluation or review				X			
Familiar with USACE planning process, guidance, and economic evaluation techniques including cost effectiveness-incremental cost analysis (CE/ICA) and procedures associated with identifying the National Ecosystem Restoration (NER) plan				X			
M.S. degree or equivalent in economics				X			
Hydrology and Hydraulics Engineering (one expert needed)					**X**		
Experience in hydraulic and hydrologic modeling related to wetland restoration in coastal areas as well as flood/coastal storm damage reduction					X		
Experience in hydrologic and hydraulic engineering or as professor from academia with extensive background in hydrologic and hydraulic theory and practice					X		
Familiarity with USACE application of risk and uncertainty analyses in flood risk management studies					X		

	Casavant	Crouch	Ellis	Kelsoe	Orr	Rose	Houser
Familiarity with standard USACE hydrologic and hydraulic models including HEC-HMS, HEC-RAS, HEC-FDA and to a lesser degree HEC-DSS					X		
Registered professional engineer					X		
M.S. degree or higher in engineering					X		
Fisheries Biology (one expert needed)						**X**	
Minimum 10 years experience directly related to water resource environmental evaluation or review						X	
Extensive experience working with coastal and estuarine fisheries						X	
M.S. degree or higher in a related field						X	
Coastal Geomorphology (one expert needed)							**X**
Minimum of 10 years experience directly related to geologic processes in coastal environments							X
Extensive experience working with geomorphic processes in coastal wetlands and estuarine ecosystems							X
Experience in the Gulf of Mexico coastal region (preferred, but not required)							X
M.S. degree or higher in a related field							X

Ken Casavant, Ph.D.

Role: This panel member was chosen primarily for his civil works planning experience and expertise.
Affiliation: Washington State University

Ken Casavant, Ph.D., is a Professor and Economist in the School of Economic Sciences at Washington State University, having also served as an Adjunct Professor at the Upper Great Plains Transportation Institute, North Dakota State University specializing in Transportation Economics and Policy, Marketing, Agricultural Economics and Management. He earned his Ph.D. in economics from Washington State University in 1971. Dr. Casavant has more than 40 years of experience as an economist, with expertise in transportation economics and planning. He has served as an economic consultant detailing the tradeoffs necessary on several public works projects, most recently on studies of the deep draft national and international maritime industry.

Dr. Casavant also has more than 10 years' experience in plan formulation, evaluation and comparison of alternative plans for numerous ecosystem restoration projects, navigation studies, and feasibility studies including technical reviews of the Lower Columbia River Channel Deepening Project and the Upper Mississippi and Illinois Navigation Study. These USACE projects were large-scale Civil Works projects with significant public and interagency interests. He is familiar with USACE standards and procedures and the IWR-Planning Suite methodologies, with a focus on ecological output per dollar of relevant expenditure for alternative project formulations. Dr. Casavant was a member of the National Science Foundation (NSF) committee that reviewed the Mississippi-Ohio River navigation alternatives, as well as a member of the Pacific North West Power Planning Council, which addressed salmon restoration, the Endangered Species Act, power generation, and navigation.

Risk analysis and risk models are critical to many of his projects, including ecosystem restoration projects that included a methodological review of flood risk management. His expertise on the needs and policy alternatives for agricultural and system transportation, ranging from development of intelligent transportation system applications to logistical designs for port physical distribution systems, and competitive impacts from investments in infrastructure and regulatory changes has been sought out by public and private organizations, state governments, railroad/ truck/marine firms, and legal institutions.

He is a member of numerous professional associations including the Transportation Research Board - National Research Council, the International Agricultural Economics Association, and the Logistics and Physical Distribution Association. Dr. Casavant has served on numerous IEPRs as either economist or as Civil Works planner, including Freeport Harbor, Texas Draft Feasibility Report and Environmental Impact Statement and Houma Navigation Canal Navigation Improvement Project Draft Feasibility Report.

Kay Crouch

Role: This panel member was chosen primarily for her environmental/coastal ecology experience and expertise.
Affiliation: Crouch Environmental Services, Inc.

Kay Crouch is president of Crouch Environmental Services, Inc., a company specializing in NEPA analysis, wetland delineation, permitting, and wetlands mitigation design/construction, environmental site assessment, and public involvement for projects with high public and interagency interests. She earned an M.S. in biology/ecology in 1978 from Steven F. Austin State University, and has received additional academic training in the NEPA process from the Duke University Nicholas School of Environmental and Earth Sciences (2004-05). Ms. Crouch has more than 33 years of nationwide experience conducting wetlands delineation, permitting and mitigation, environmental site assessments, and NEPA impact assessments for complex multi-objective public works projects with competing trade-offs. She has performed numerous environmental evaluations throughout the coastal ecosystems of Louisiana and Texas in support of Federal Energy Regulatory Commission filings and NEPA documentation. In the mid-1990s, Crouch Environmental Services Inc. designed and constructed the Baytown Nature Center in Baytown, Texas. This project is a large coastal marsh creation for which the company received the 1998 Award of Excellence from the National Association of Landscape Architects.

For the first 10 years of her consulting career (1980s) Ms. Crouch worked predominately in Louisiana performing NEPA analyses for oil and gas pipelines crossing the Louisiana Coastal Zone. Ms. Crouch is familiar with USACE calculations and application of environmental impacts and benefits, and routinely performs cumulative effects analyses on high visibility public works projects as part of her extensive NEPA practice. She has substantial experience working with USACE including environmental analyses and flood damage reduction projects. Specific NEPA projects she has worked on are the EIS for the Bayport Container Terminal, the EA for reconstruction of the Addicks and Barker Dams, and public involvement for the Sabine Neches Waterway and Clear Creek Flood Damage Reduction Projects. Recently, Ms. Crouch planned, organized, and executed a public outreach plan for the Addicks and Barker Dam Safety Program (Houston, Texas). This effort was declared a "Best Practice" by USACE, for which Ms. Crouch and her staff received a written commendation from the Commander of the Galveston District. She has previously served as an environmental expert on two IEPRs of USACE projects.

Ms. Crouch is a member of the Society of Wetland Scientists and founder and president of fundmyresearch.org, and she is Chairman of the Board for the Houston Chapter of HeartGift.

Ralph Ellis, Ph.D., P.E.

Role: This panel member was chosen primarily for his civil/construction engineering experience and expertise.
Affiliation: University of Florida

Ralph Ellis, Ph.D., P.E., is an Associate Professor in the Department of Civil Engineering at the University of Florida specializing in the areas of engineering management, construction engineering and the legal aspects of construction. He earned a Ph.D. in civil engineering from

the University of Florida in 1989, and is a licensed professional engineer in Florida. Dr. Ellis has more than 30 years of construction engineering and management experience, and has worked on large-scale civil engineering projects both regionally and internationally. Prior to joining the University of Florida, he was president of the Hammer Corporation construction firm and Director of Projects for the FMI Hammer Joint Venture where he was responsible for estimating and delivering all construction projects, including numerous projects for USACE, U. S. Navy, and the Panama Canal Company. Many of these projects were located in South Florida and Central America and involved the construction of large-scale earthworks, some directly associated with flood control projects. He is familiar with all aspects required for the construction of pump station structures in South Florida, which typically required setting up complex dewatering operations. He has also directed the construction of temporary and permanent sheet pile walls for flood control purposes. Dr. Ellis is familiar with construction practices commonly required for Everglades Restoration projects in South Florida, as well as those used on the Gulf Coast projects. Through his background and project experience Dr. Ellis has an understanding of the USACE Safety Assurance design and analysis processes with regard to civil structures such as those constructed for flood control purposes.

Dr. Ellis's professional construction experience has included projects with marine operations including dredging. Dr. Ellis is fully knowledgeable with regard to current practices and the engineering considerations associated with dredging, including the transport and placement of dredged materials by hydraulic slurry methods for beneficial uses. Environmental restoration has become a key area in the construction engineering curriculum. He is familiar with incorporating environmental protection planning into project operations, and has been teaching earthwork construction methods and environmental protection planning to engineering students for more than 20 years.

Dr. Ellis has authored more than 55 construction-related research publications, and has performed more than 48 research projects focusing on construction management and construction technical issues. He has served as a construction cost engineering expert for the IEPRs of the Tamiami Trail Limited Re-evaluation Report, and the Integrated Feasibility Study and EIS for the Louisiana Coastal Area Restoration Small Diversion at Convent/Blind River (St. James Parish, Louisiana). Through his participation on these reviews he has gained a working knowledge of coastal storm damage reduction design, cost, and construction considerations.

Darrell Kelsoe

Role: This panel member was chosen primarily for his economics experience and expertise.
Affiliation: Brown and Gay Engineers, Inc.

Darrell Kelsoe is an economics manager at Brown & Gay Engineers, Inc. and has 25 years of experience in economics, financial, and flood damage reduction projects. He received his B.S. in agricultural economics (agri-business option) from Texas A&M University in 1983 and has worked extensively with USACE Galveston, Fort Worth, New Orleans, and Sacramento Districts on feasibility and general re-evaluation studies. His technical expertise includes risk-based analysis using the HEC-FDA modeling program, financial analysis, real estate appraisals, land use analysis, and social impacts. He has specific experience related to water resource economic

evaluation and review. Under Section 211f of WRDA, he has computed inundation, location, and recreation benefits for urban flood damage reduction projects and performed the structure inventory data sets for analysis on Brays Bayou, White Oak Bayou, Hunting Bayou and Halls Bayou, including without project conditions, component evaluation, alternative analysis, and National Economic Development (NED) plan formulation. For USACE, Galveston District, Mr. Kelsoe developed depth-damage curves and prepared structure inventory for the Addicks Reservoir. Mr. Kelsoe has experience with the computer program IWR Plan CE/ICA. Recently, he served as the Lead Economist for the Buffalo and Lower White Oak Bayou Section 211(f) Flood Risk Management Study for the Harris County Flood Control District and USACE, Galveston, for which he prepared the inventory for more than 30,000 structures within the 125 square mile watershed, appraised more than 300 structures using Marshall & Swift to validate the County's property data, and performed an incremental cost analysis, which included plan formulation and identifying a NER plan. Mr. Kelsoe has extensive knowledge of the USACE planning process relative to the Principles and Guidelines, the USACE Planning Guidance Notebook (ER 1105-2-100), and the Federal objective related to water resource projects.

Michelle Orr, P.E.

Role: This panel member was chosen primarily for her hydrology and hydraulics engineering experience and expertise.
Affiliation: ESA PWA (formerly Phillip Williams and Associates, Ltd.)

Michelle Orr, P.E., is Director of Wetlands and Estuaries at ESA PWA and has 18 years of experience in coastal wetland restoration planning and design, coastal and riverine flood management, environmental impact assessment, and project management. She earned an M.S. in water resources engineering from the University of California, Berkeley in 1995 and is a registered professional civil engineer in California. She is an experienced manager of multi-disciplinary ecosystem restoration projects, including major projects in San Francisco Bay, the Sacramento-San Joaquin Delta, San Diego Bay, and Puget Sound. Ms. Orr has completed more than 100 planning and engineering studies related to the management and restoration of estuaries, wetlands, and lagoons. For the South Bay Salt Pond Restoration Project in South San Francisco Bay she was responsible for engineering analyses related to flood risk reduction for 15 miles of coastal shoreline, including combined coastal and riverine flood modeling at the mouths of three major creeks/rivers.

She has experience using standard hydrologic, hydraulic, and sediment transport models (HEC-RAS, HEC-HMS, HEC-6) and has been responsible for numerous projects that use 1D and 2D hydrodynamic and sediment transport models to address circulation, flooding, and deposition/erosion (e.g., MIKE-11, MIKE-21, MIKE Flood, Delft 3D, UNET). Through her education and engineering experience, Ms Orr is familiar with aspects of USACE Safety Assurance Review such as assessment of appropriate methods, best practices, resilience, and performance monitoring.

Ms. Orr is an experienced manager of large, complex civil works projects with high agency, stakeholder, and public interest. She has led restoration planning and engineering design for more than 30,000 acres of coastal wetlands in San Francisco Bay and is currently developing

plans for restoration of 65,000 acres of tidal habitat in the Sacramento-San Joaquin Delta as part of the Bay Delta Conservation Plan. As the leader of the Environmental and Engineering Services Consultant Team for the South Bay Salt Pond Restoration Project, the largest wetland restoration on the West Coast (15,100 acres; $0.5B), she worked closely with a ten-member Project Management Team composed of representatives from Federal, state and local agencies, major foundations, the science community, and stakeholders. In addition, Ms. Orr has served as a hydrology and hydraulics expert for the IEPR of the Integrated Feasibility Study and Supplemental EIS for the Medium Diversion at White Ditch Plaquemines Parish, Louisiana, and the Model Review Report for the Western C-111 Spreader Canal (C111SC) Benefit Evaluation Methodology.

Kenneth Rose, Ph.D.

Role: This panel member was chosen primarily for his fisheries biology experience and expertise.
Affiliation: Lousiana State University

Kenneth Rose, Ph.D., is the E.L. Abraham Distinguished Professor in Louisiana Environmental Studies in the Oceanography & Coastal Sciences Department at Louisiana State University. He earned his Ph.D. in fisheries from the University of Washington in 1985 and has 25 years of experience in fish biology, ecology, and population dynamics, including extensive experience researching estuarine and coastal fisheries. His research interests include developing and applying mathematical and simulation models to better understand and forecast the effects of natural and anthropogenic factors on aquatic populations and communities, and using models in resource management and risk assessment. He has published more than 80 papers on ecological modeling and fish population dynamics, and teaches the graduate-level course "Population Dynamics Modeling."

Dr. Rose has applied the Habitat Evaluation Procedures' Habitat Suitability Index to coastal Louisiana planning, was a participant in a workshop on Developing Conceptual Ecological Models for Coastal Louisiana (Baton Rouge, 2008), served as a panel review member for proposals to the Coastal Impact Assistance Program in 2006, and was a member of the Technical Support Team of the Louisiana Coastal Area Science and Technology Program in 2005. Dr. Rose was a external peer reviewer for model certification of USACE's EnviroFish model and the Standard Assessment Methodology (SAM) and SAM Electronic Calculation Template (ECT) for the Sacramento River Bank Protection Project.

Dr. Rose is a Fellow at the American Association for the Advancement of Science and an editor for the Canadian Journal of Fisheries and Aquatic Sciences, San Francisco Estuary and Watershed Science, The Open Fish Journal, and Fisheries Research.

Chris Houser, Ph.D.

Role: This panel member was chosen primarily for his coastal geomorphology experience and expertise.
Affiliation: Texas A&M University

Chris Houser, Ph.D., is an assistant professor in the Department of Geography at Texas A&M University, with 10 years' experience in coastal geomorphology. He earned his Ph.D. in geography from the University of Toronto in 2004, where he conducted his dissertation research on feedback mechanisms in the morphodynamics of multiple-barred nearshores. His coastal geomorphology research has focused on nearshore and estuarine sediment transport and the role of aquatic vegetation in wave and current attenuation.

Since 1999, Dr. Houser has been conducting field research in process geomorphology with a focus on coastal geomorphology, which has led to 32 peer-reviewed journal publications related to coastal geomorphology/geology since 2004, and invitations to numerous national conferences (including those of the Geological Society of America and American Geophysical Union). He has taught undergraduate and graduate courses in coastal geomorphology and process geomorphology at Texas A&M and the University of West Florida.

His current research projects include salt marsh erosion by vessel-generated wakes, wave attenuation through seagrass beds, geomorphological controls on barrier island response to hurricanes and their recovery, the geologic framework of barrier islands in northwest Florida, and sediment transport and hydrodynamics of the swash zone. Dr. Houser has been working almost exclusively in the Gulf of Mexico since 2004, with funding from NSF and NPS to examine barrier island response and recovery from extreme storms.

5. SUMMARY OF FINAL PANEL COMMENTS

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2010; p. D-4) in the MRGO FS/EIS document. Table 3 lists the 19 Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A. The following statements summarize the Panel's findings.

Results of the Independent External Peer Review

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2010; p. D-4) in the MRGO FS/EIS document. The Panel agreed that the MRGO FS/EIS is comprehensive and, in general, is technically sound. The Panel recognizes that a great deal of work has been conducted and documented, which is an accomplishment for such a large and complex restoration plan. There are, however, aspects that should be strengthened. The final steps in formulating the Tentatively Selected Plan (TSP) rely on information and data insufficient to allow for discrimination among the similar plans of differing

size and measures. In addition, the determination of the size and location of the proposed diversion needs further evaluation and justification. One overarching issue was that the preciseness of the modeling and analysis results presented in the EIS gives the impression of much higher accuracy than is justified. Thus, as the MRGO restoration plan is implemented, caution should be used in deciding on the final management measures in the final plan.

Plan Formulation Rationale: The Institute for Water Resources Planning process was used appropriately, generally resulting in a reasonably sized and costed restoration plan. However, the current level of detail and analysis are not sufficient to justify the location and scale of the Violet Diversion. Plans should consider other projects or restoration efforts in the area in addition to the MRGO project, and model assumptions should be subject to sensitivity analyses. The monitoring and adaptive management plan (MAMP) is not complete and requires specific details about how and when it would be applied. The Panel provided more specific recommendations and suggestions for improving the report.

Economics: The Panel found that the economics related to the MRGO FS/EIS were complete and provided a detailed analysis of the TSP.

Engineering: The Panel found the engineering design of the infrastructure components of the plan and the related geotechnical investigations to be satisfactory. However, some of the documentation of the modeling is incomplete, making it difficult to assess the adequacy of design and location of the freshwater diversion. The adequacy and acceptability of Cost and Schedule Risk Analysis (CSRA) could not be determined; however, the Panel identified several areas of uncertainty and risk that are potential concerns. The Panel also identified the need for using more detailed hydrodynamic models that are subject to greater calibration and testing than the models currently used in order to provide a more definitive characterization of the diversion.

Environmental: Considering the scope of the project, the Panel found that the environmental impacts and uncertainty of the plan are, in general, well described. While the discussion of environmental uncertainty and variability appears complete, there is a need for sensitivity analysis to determine the potential impacts to the project. In particular, documentation of the cumulative effects does not comply with the NEPA mandate to evaluate all past, present, and future actions that could affect, or be affected by, the proposed project. The preliminary and incompletely documented Comprehensive Aquatic Systems Model (CASM) used for assessing many biological impacts should be finalized, and additional analyses of the impacts on certain high profile species are needed.

Table 3. Overview of 19 Final Panel Comments Identified by the MRGO FS/EIS IEPR Panel

Significance – High	
1	The adequacy and acceptability of Cost and Schedule Risk Analysis (CSRA) could not be determined.
2	The Monitoring and Adaptive Management Plan (MAMP) is missing key elements and is not funded sufficiently to assess project performance and address important uncertainties.
3	The specific location and magnitude of the proposed freshwater diversion is not supported by the technical analysis and information presented.
4	The cumulative effects analysis does not consider related planned projects and other foreseeable potential actions in the study area that could be affected by or affect the MRGO project.
5	The absence of a non-Federal sponsor poses a significant risk to the implementation of the MRGO project.
6	The UNO hydrology and hydraulics model may not accurately describe variations in spatial and temporal salinities.
Significance – Medium	
7	The Wetland Value Assessment (WVA) model analysis did not include site-specific information on habitat characterization.
8	The calibration and verification of the MIKE 21 hydrodynamic model limits the accuracy and robustness of the analysis in terms of flow velocity, marsh inundation and salinity.
9	The adequacy and acceptability of the Comprehensive Aquatic Ecosystem Model (CASM) model could not be evaluated due to the preliminary model version provided and the limited documentation.
10	The analyses are not sufficiently sensitive to discriminate between closely related management measures within plans or differentiate among alternative plans.
11	The planning objectives are overly specific and limit the range of measures and alternatives that could meet the project goals.
12	The ecological resource goals of the MRGO project are largely met through an increase in habitat area rather than improvements in habitat quality.
13	The post-closure baseline environmental conditions information provided does not allow for a complete evaluation of the predicted future without project (FWP) and future with project (FWOP) conditions.
14	The selection of the Violet diversion may not meet the USACE acceptability criterion.
15	The use of maintenance dredged material from locations other than Lake Borgne, especially the Mississippi River, were not fully evaluated as borrow source options.
16	The environmental effects of dredging operations in Lake Borgne, such as changes in turbidity, degraded water quality, and increases in wave energy and shoreline erosion, have not been sufficiently considered.
17	There is no documentation that the sediment properties and salinity of the dredged material can provide optimum conditions for marsh and swamp restoration.
18	Impacts of the TSP on oyster resources have not been thoroughly investigated.
19	The analyses of the impacts of the proposed alternatives on Gulf sturgeon were qualitative and are not supported by field data or an analysis of habitat requirements relative to proposed dredging activities.

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APPENDIX A

Final Panel Comments

on the

Mississippi River-Gulf Outlet
Ecosystem Restoration Plan Feasibility Study
and Environmental Impact Statement

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Comment 1:

The adequacy and acceptability of Cost and Schedule Risk Analysis (CSRA) could not be determined.

Basis for Comment:

Cost and schedule risks have not been adequately analyzed and quantified in this report. The MRGO Ecosystem Restoration Plan Feasibility Report and Environmental Impact Statement (MRGO FS/EIS) states that a CSRA will be prepared and the results incorporated in the final MRGO FS/EIS. However, the CSRA and any resulting modifications to the project plan were not available for Panel review. The results of a CSRA are required to quantify risk and define contingencies. A risk analysis would support management decision making and risk management as the project progresses through the design and construction phases. The MRGO FS/EIS states that a 35% cost contingency has been included in the budget as a preliminary amount, but provides no documentation as to how this amount was determined. The amount of schedule contingency is unknown.

An initial Panel review of the Tentatively Selected Plan (TSP) suggests several significant risk factors not addressed in the MRGO FS/EIS. For example:

Unknown Quantities – The restoration sites have not been surveyed at a sufficient resolution. Although light detection and ranging (LiDAR) data are available for the Central Wetlands area, it is not clear whether LiDAR penetrates the water and vegetation to provide the real marsh surface. In general, surface elevations as assumed may differ significantly from estimate assumptions. The marsh fills are relatively thin (approximately 2.0 feet of slurry depth). Consequently, variation in actual ground elevation can significantly influence the required volume of fill materials. Another potential issue is the estimated total consolidation of the clay slurry fill material. Marsh creation is the largest component of the project cost estimate. A variation in the actual amount of consolidation can significantly influence the total volume of material required and project cost. (See MRGO FS/EIS, Engineering Annex, Section 5.0 Civil Design, Marsh Restorations; and Engineering Annex Section 9.2 Detailed Cost Estimate.)

Effects of Tropical Storms – The Gulf Coast area has a history of frequent tropical storms. Given the duration of the project, it is appropriate to analyze the probability and impact of an extreme weather event on project cost and schedule. While a realistic estimate of future weather events (magnitude, frequency, speed, etc.) is difficult and uncertain, baseline data describing the impact of recent storm events would provide greater clarity on the potential future impacts. (See http://www.hurricanecity.com/city/neworleans.htm.)

Construction Price Escalation – This project will introduce a significant volume of construction work into the area. The economic effects of this project and other planned projects on the local construction market should be analyzed. Dredging and the pumping of dredged material is an equipment-intensive operation. Off-road diesel fuel prices in the Gulf Coast region have increased approximately 56% from the report cost estimate in September 2009 to date. (Refer to Department of Energy, U.S. Energy Information Administration, http://www.eia.doe.gov/oog/info/wohdp/diesel.asp#graph_buttons.)

The projections of cost escalations in the cost estimate may not be adequate to address

rising fuel prices. Sensitivity analyses of the impact of increasing fuel prices on overall construction costs would decrease the uncertainty of construction cost estimates. (See MRGO FS/EIS, Engineering Annex Section 9.2 Detailed Cost Estimate; Engineering Annex, Section 5.0 Civil Design, marsh restorations; also refer to http://www.hurricanecity.com/city/neworleans.htm).
Significance – High:
A determination of risks that could jeopardize the success of the MRGO project cannot be made without a review of the CSRA.
Recommendations for Resolution:
1. Present the results of a CSRA that includes an analysis of all significant project cost and schedule risks. 2. Consider the results of the CSRA when finalizing the MRGO FS/EIS.

Literature cited

Department of Energy, U.S. Energy Information Administration
http://www.eia.doe.gov/oog/info/wohdp/diesel.asp#graph_buttons
http://www.hurricanecity.com/city/neworleans.htm

Comment 2:

The Monitoring and Adaptive Management Plan (MAMP) is missing key elements and may not be funded sufficiently to assess project performance and address important uncertainties.

Basis for Comment:

The MRGO FS/EIS relies on monitoring and adaptive management to increase the likelihood of achieving the project goals and objectives given uncertainties in planning and design. This is appropriate if the MRGO Monitoring and Adaptive Management Plan is developed and sufficiently funded to assess post-implementation project performance and effectively address issues of concern. The MRGO FS/EIS states that the following issues will be addressed by the MAMP:

- Freshwater diversion operations (EIS, pp. 2-72 and 2-83)
- Sea level rise and climate change (Feasibility Report [FR], p. 2-129; EIS, p. 2-92)
- Limitations in analytical tools and the ability to predict ecological processes (EIS, p. 2-121)
- Risks and uncertainties generally (FR, p. 2-127, EIS, pp. 2-90 and 2-92).

It is the Panel's opinion that the MRGO MAMP does not provide sufficient information regarding funding and planning to address these and other issues.

An effective MAMP should identify objectives, performance criteria, key uncertainties, monitoring design, triggers for action, potential adaptive management actions, and a decision-making structure. The MRGO MAMP generally does a good job of identifying objectives, performance criteria, monitoring design, and a decision-making structure appropriate to the feasibility level of design. The MAMP is incomplete, however, in identifying key uncertainties, triggers for action, and potential adaptive management actions as described below.

Key Uncertainties -- As documented in the MRGO FS/EIS, the project has several large sources of uncertainty: ability of the freshwater diversion to meet the desired salinity regime; future sea level rise and other future conditions; limitations in analytical tools and the ability to predict ecological processes; lack of technical knowledge associated with swamp restoration, ridge restoration, and artificial oyster reefs; and effects of invasive species (FR, pp. 2-69 to 2-72 and pp. 2-127-2-131). Although the documents promise that many of these will be addressed in adaptive management, none of these uncertainties are mentioned in the MAMP. The MAMP lists only one uncertainty ("risk endpoint") – the risk of water quality impairment in Lake Borgne (MAMP, p. 12).

Triggers -- A "trigger" is a threshold that, when exceeded, prompts Adaptive Management Team review (shown in Figure 2 of the MAMP as "decision criteria"). Although monitoring is included in the MAMP, it is not clear how the monitoring data will be used to determine when the project is not meeting its objectives and action may be needed. For example, the salinity deviation (magnitude and duration) that will trigger an increase or decrease in diversion flow has not been identified.

Potential Adaptive Management Actions -- A fully developed MAMP presents a range of potential adaptive management actions. Actions are the essence of adaptive management and are appropriate to identify at the feasibility phase since they affect the likelihood of

project success and project cost. The MRGO MAMP provides a brief mention of potential adaptive management actions related to operation of the proposed diversion. Additional potential adaptive management actions mentioned in the MRGO FS/EIS, but not in the MAMP, are:

- Phased implementation. The Feasibility Report states that phased implementation "provides the opportunity to adjust project design and construction from lessons learned from projects constructed in the initial phase" (p. 2-130; see also Appendix H, p. 24). Adjustment of future designs is an adaptive management action. If appropriate design changes are not identified for a type of habitat restoration, implementation can be halted and resources shifted elsewhere.
- Response to higher sea level rise. The EIS states that "[i]f SLR increases in the initial implementation phase, the plan can be assessed for potential adjustments" and managed adaptively (p. 2-118). The MAMP does not identify these potential adjustments (e.g., placing deeper lifts of fill in future phases, accepting less total acreage of restoration).

Examples of potential adaptive management actions that would be appropriate for the MRGO project, but that have not been specifically identified, are increasing the level of effort for control of invasive species and herbivory (FS, p. 2-71) and changing the source of dredged material in later phases if borrow impacts to Lake Borgne are significant. The project could also consider pilot projects early in implementation to reduce uncertainty up front.

Not every project outcome has a feasible adaptive management response. It is reasonable to set limits on what adaptive management actions may be taken, but these limits must be transparent and stated during planning.

The Panel believes that the costs budgeted for the MRGO MAMP ($13.5 million over 10+ years) are not adequately detailed in terms of the monitoring and analyses that are necessary; more importantly, the stated budget is underestimated relative to the efforts described and relative to the efforts needed for effective adaptive management of a $3 billion project. Though each project is different, adaptive management costs for Phase 1 of the South Bay Salt Pond (SBSP) Restoration Project in San Francisco Bay are provided for comparison. Phase 1 of the SBSP Restoration Project has spent approximately $1M+/year on monitoring and adaptive management, about the same funding as proposed for the MRGO project, but covering a much smaller acreage (3,200 acres). Adaptive management costs are approximately 15% of estimated construction costs for Phase 1 of the SBSP Restoration Project, much higher than those for MRGO (less than 0.5%). The SBSP Restoration Project makes active use of adaptive management and Phase 1 includes several restorations with experimental designs, resulting in higher monitoring and adaptive management costs; costs are expected to decrease in future phases of implementation.

Significance – High:

The absence of key uncertainties, triggers for action, and potential actions in the MRGO MAMP, along with low funding levels, have the potential to affect the success of the project.

Recommendations for Resolution:
1. Identify key uncertainties that may affect the ability of the project to meet the objectives. 2. Identify triggers, or thresholds, for Adaptive Management Team review. 3. Identify and briefly discuss a full range of potential adaptive management actions, including identifying where there is no feasible adaptive management action to respond to a given project outcome. 4. Consider pilot projects early in implementation to reduce uncertainty for later phases. 5. Provide additional MAMP cost detail and ensure that the cost is realistic for a project of this size and complexity.

Comment 3:

The specific location and magnitude of the proposed freshwater diversion is not supported by the technical analysis and information presented.

Basis for Comment:

Final Panel Comments 3, 6, and 13 are interrelated and all focus on various aspects of the University of New Orleans (UNO) hydrology and hydraulics model. However, the Panel has concluded that due to their individual significance, they should be reported as individual issues identified during the IEPR.

There is adequate justification that a diversion is needed, but not for the size of diversion selected, (1,000/7,000 cfs, corresponding with low/high seasonal flow) and its location.

Size of Diversion – The specified flows (1,000/7,000 cfs) are good rough estimates, but need refinement based on the following:

- The primary model used to size the high flow diversion, the UNO model, has a large degree of uncertainty.
- The possibility of expanding the Caernarvon, Blind/Convent, and other diversions that may have an effect on salinity in the study area has not been fully explored. Conversely, there is the possibility that the Caernarvon or Blind/Convent diversions included in the model may not be built.
- The performance criterion (i.e., achieving the Chatry target 40% of the time) is only approximate, and was barely met in the month of May even when allowing for overlap based on ranges on the target values and on the model predicted salinities. Use of monthly average salinities filters out high frequency variability caused by winds, tides, and short runoff events. This is appropriate if it can be shown that the health of the relevant organisms (in this case, oysters) is dependent on the average salinity and that short-term spikes in salinity can be ignored or averaged out. Also, if the "4 out of 10 years" rule (Appendix N) refers to general conditions, then creating favorable salinity conditions for oysters in 4 out of 10 years may not be enough to get 4 out of 10 "good" years for oysters, given that other unfavorable conditions could occur during a year when the salinity conditions are met.
- There is no margin of safety built into the design of the diversion to reflect these uncertainties.

Location of Diversion **–** The inability of the existing Violet canal to convey more than 2,000 cfs is a key factor in screening this location from consideration, yet there is no documentation of the analysis used to reach this value. If the existing Violet canal can carry more than 2,000 cfs or the size of the required diversion has been overestimated, the existing Violet canal may be sufficient to carry the design flows.

Significance – High:

Significant changes to the location or size of the diversion could impact the cost and effectiveness of the MRGO as presented in the TSP.

Recommendations for Resolution:

1. Refine the UNO salinity modeling.
2. Fully explore the possibility of expanding the Caernarvon, Blind/Convent, and other diversions that may have an effect on salinity.
3. Update the modeling and diversion sizing during design to reflect the most recent conditions (likelihood that the Caernarvon and Blind/Convent diversions included in the model will be built, other diversion operations).
4. Add a safety factor (additional flows) into the design of the diversion to account for the uncertainties noted in this comment.
5. Model and document the maximum conveyance of the existing Violet canal.
6. Re-consider whether the diversion can be located at the existing Violet canal.

Comment 4:

The cumulative effects analysis does not consider related planned projects and other foreseeable potential actions in the study area that could be affected by or affect the MRGO project.

Basis for Comment:

Cumulative effects are defined by 40 CFR 1508.7 as: "The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions." Cumulative impacts can result from individually minor, but collectively significant, actions taking place over time.[1]

The primary purpose of the cumulative effects analysis in the National Environmental Policy Act (NEPA) process is to ensure that Federal decisions consider the full range of consequences. As such project proponents are required to evaluate the project proposal and all connected and similar actions that could contribute to cumulative effects. In the case of the TSP, the MRGO FS/EIS describes other related actions (i.e., other restoration projects planned for the area) that both affect the TSP and potentially are affected by the TSP, but does not fully describe the cumulative effects of these actions. Unrelated but foreseeable future actions in the project area may include continued oil and gas activity, as well as continued land development of various types. These actions may adversely affect the Federal project.

Conclusions reached in the MRGO FS/EIS with respect to cumulative effects seem to be based only on issues related to the primarily positive effects of the TSP and do not consider, as required, past, present and reasonably foreseeable future actions regardless of what agency or person undertakes such actions.

Foreseeable actions that may result in effects to the project, not just effects caused by the project, were not analyzed or addressed in the MRGO FS/EIS.

Significance – High:

The discussion of cumulative effects in the MRGO FS/EIS does not provide the detail required to comply with NEPA requirements.

Recommendations for Resolution:

1. Include an inventory of reasonably foreseeable future actions that may be undertaken in the project area, both those that are related to, and those that are unrelated to but affected by, the project.
2. Fully describe related restoration projects expected to be performed under other authorities. Their adverse and positive effects should be described in combination with those anticipated for the TSP.
3. Fully describe reasonably foreseeable activities that are anticipated to occur in the future in the project area (e.g. other Federal projects, development, infrastructure expansion, oil and gas exploration and production, pipeline system expansion and maintenance, and other similar activities) and forecast the cumulative effects, both adverse and positive, that the TSP may have on these activities, and the potential effects that these activities may have on the MRGO project.
4. Describe any measures anticipated to be implemented to mitigate adverse cumulative

effects, especially those that may be adverse to the Federal project.

[1] The terms “impacts” and “effects” are used interchangeably in NEPA practice.

Literature Cited

Code of Federal Regulations – Title 40: Protection of Environment, Chapter V – Council on Environmental Quality, Subchapter A, Part 1508 – Terminology and Index, 1508.7 – Cumulative impact.

Comment 5:

The absence of a non-Federal sponsor poses a significant risk to the implementation of the MRGO project.

Basis for Comment:

The MRGO FS/EIS indicates that involvement of non-Federal sponsors is a requirement for implementing the TSP. The MRGO FS/EIS states (p. S-1) that "In accordance with Section 103 of the WRDA 1986, as amended by section 210 of WRDA 1996, (33 USC 2213(c)), implementation of the ecosystem restoration plan requires a non-Federal sponsor responsible for providing 35 percent of the costs assigned to ecosystem restoration (except for the Violet Freshwater Diversion, for which Section 3083 of WRDA 2007 provides for a 25 percent non-Federal cost share); providing the lands, easements, rights-of-way, and dredged or excavated material disposal areas required for the plan, and performing all necessary relocations (LERRDs); and paying 100 percent of the costs of operation, maintenance, repair, rehabilitation, and replacement (OMRR&R)."

The states of Louisiana and Mississippi have been identified as likely local sponsors. The financial commitment on the part of these states would be very large and on-going. The State of Louisiana has stated that it does not intend to become a non-Federal sponsor for the MRGO project (see letter dated August 12, 2010 from the State of Louisiana: FR, p. 4-9). The State of Mississippi has expressed some willingness, but has not signed an agreement with USACE to sponsor (FR, p. S-1).

The absence of non-Federal sponsors could jeopardize implementation of the TSP, even with widespread public, state, Federal, and local agency support. Although the MRGO FS/EIS states this in introductory background information (FR, p. S-1), the absence of sponsors is not mentioned in the "risks and uncertainties" sections of the document.

The depth of the studies and the degree of public involvement in the process sets an expectation that a National Ecosystem Restoration (NER) Plan will be implemented. The Panel believes that the absence of sponsorship should be addressed in the "risks and uncertainties" section of the MRGO FS/EIS and it should be made clear that without the significant and on-going financial participation of the two states involved (or other as yet unidentified parties), the TSP will not move forward with either construction or operation and maintenance.

Significance – High:

The absence of required non-Federal sponsorship for construction and continuing maintenance of the NER Plan constitutes a significant risk that the plan will not be implemented.

Recommendations for Resolution:

1. Clearly explain in the risks and uncertainties sections that USACE cannot implement, maintain, or operate the TSP in the absence of non-Federal sponsorship.
2. Provide other information, if known, that would result in TSP implementation in the absence of non-Federal sponsorship.

Comment 6:

The UNO hydrology and hydraulics model may not accurately describe variations in spatial and temporal salinities.

Basis for Comment:

Final Panel Comments 3, 6, and 13 are interrelated and all focus on various aspects of the UNO model. However, the Panel has concluded that due to their individual significance, they should be reported as individual issues identified during the IEPR.

While the UNO model may be appropriate for initial screening, it is not appropriate for sizing and locating the diversion as documented in the MRGO FS/EIS. Inaccuracies in the UNO model could affect the sizing and location of the selected diversion. The representation of physical processes in the UNO model is limited by:

- The model uses a very large (10 x 10 km) grid cell. While this may be a reasonable scale to examine regional-scale changes in salinity, the large grid cells assume that salinity is well mixed within that grid cell.
- The bathymetry data presented are not current (Barrett 1970 and navigation charts are cited). Current conditions may be quite different from those modeled.
- The model cannot represent stratified flows. Differences in salinity can create a strong vertical gradient. The ability of the model to describe salinity in stratified sections of the study area is not discussed. While vertical mixing within a short distance of the diversion is a reasonable expectation, this was not demonstrated.
- Post-closure salinity data were not considered in the analysis. Construction of the MRGO closure has significantly lowered the salinity in Lake Borgne from the model calibration conditions (with MRGO open). Although almost no post-closure salinity data were available at the time of the modeling (Engineering Appendix, p. 2-26), these data are now available.
- Model documentation of some key inputs to the model and calibration results is incomplete. The bathymetry, model parameters, and calibration are not well documented. For example, the dispersion coefficients vary widely (three orders of magnitude) and there is no discussion of how they were selected. No time series of modeled versus observed salinities are provided for the calibration, only aggregated statistics. In addition, modeled versus observed salinities are provided for select points only, not for the entire model domain.
- No validation has been completed, with a lack of data cited as the reason. Given the length of the period modeled, 1999-2008, it would seem feasible to split the data into two sets and use one for calibration and one for validation.
- No sensitivity analyses have been completed. Sensitivity analyses would demonstrate how the results of the model are dependent on inherent inaccuracies in the input parameters and variables.
- Diversions below Caernarvon are excluded from the model (p. 2-29). Given the large effect of a 25% increase in flow at Caernarvon (the percent of time the salinity target is met in April increases from 41% to 85%; p. 2-30), the excluded diversions in this region could make a difference in the results.

- Salinity predictions are only accurate with respect to long-term monthly averages

and do not appear to be able to account for the considerable interannual variation. The average salinity may be correct, but the possible range of salinity conditions is not predicted.

Results from the UNO model could be compared to the results of the much higher-resolution Finite Volume Coastal Ocean Model (FVCOM) model to assess the effects of the course spatial scale, lack of vertical stratification, and other simplifications on the accuracy of the UNO model. This comparison was not done.

The UNO model was selected because it "provides a reasonable representation of the spatial distribution of salinity over large areas at … low frequencies (monthly)" (Appendix L, p. 24). This is appropriate if it can be shown that the health of the organism of interest (in this case, oyster) is dependent on the average monthly salinity and that shorter term fluctuations in salinity can be ignored or averaged out.

Significance – High:

If the UNO model does not realistically estimate salinities in the study area, then the design of the freshwater diversion may be too large or too small, and the location and cost effectiveness of the selected diversion could be different from that presented in the TSP.

Recommendations for Resolution:

1. Evaluate and document the assumption that salinity is well mixed within grid cells.
2. Evaluate the bathymetry data and update as needed.
3. Demonstrate that vertical mixing within a short distance of the diversion is a reasonable expectation.
4. Compare modeled post-closure salinity results to observations.
5. Revise model documentation for completeness.
6. Conduct model validation, if appropriate.
7. Conduct model sensitivity assessments.
8. Include diversions south of Caernarvon in the UNO model or provide a stronger rationale for excluding these diversions.
9. Compare the UNO model results with results from FVCOM to assess the effects of simplification on the accuracy of the UNO model.
10. Compare modeled time series of salinities and monthly average salinities at the Chatry Line for the two models.
11. Re-evaluate the sizing and location of the selected diversion if the revised modeling results differ sufficiently from the results presented in the MRGO FS/EIS.

Comment 7:

The Wetland Value Assessment (WVA) model analysis did not include site-specific information on habitat characterization.

Basis for Comment:

The WVA analysis is an appropriate approach for evaluating the benefits of alternative restoration plans, and the analysis is well-documented in the EIS. The WVA requires input data, and the accuracy of the calculated average annual habitat units (AAHU) values depends on the quality of the input data used. For example, the fresh/intermediate, brackish, and saline marsh WVA model consisted of six variables: (1) percent of wetland covered by emergent vegetation; (2) percent open water dominated by submerged aquatic vegetation; (3) degree of marsh edge and interspersion; (4) percent of open water less than or equal to 1.5 feet deep; (5) salinity; and (6) aquatic organism access.

In the WVA analysis for the MRGO project, however, there was little site-specific data available on the actual elevations and conditions of the wetlands, and thus the analysis relied on generic assumptions that were applied to all marsh creation and nourishment measures in the different alternative plans. While the list of variables used in each suitability function is complete and the rationales were previously documented, most of this information is not known for the study area and must be very crudely approximated. Further, this information must be specified for different habitat types, the same habitat type in different locations, and for each habitat type over 50 years (Appendix WVA: Master WVA Input Document Spreadsheet for TSP). Overlain on this uncertainty is that the habitat suitability uses this information to compute a suitability for a generic species. The usefulness of the AAHU values can be questioned because differences between measures may be due to highly uncertain assumptions about the magnitude and temporal changes in the variables used in the suitability functions. The results of the WVA analysis were then used to select among plans that were very similar in many of their constituent measures and so only differed by relatively small values of AAHU.

The WVA as described and interpreted in the MRGO FS/EIS appears overly rigorous. The WVA was used appropriately to identify candidate plans and the types of measures likely to be included in any reasonably sized and cost-effective plan, but did not have sufficient site-specific data to allow discrimination among many of the final alternative plans.

Significance – Medium:

The input data used in the WVA analysis is not site-specific and affects the identification of the specific measures included in the TSP.

Recommendations for Resolution:

1. Include a synthesis of site-specific data on elevations and inputs to the habitat suitability functions from individual studies.
2. Conduct a survey of the elevations and health of key wetlands to refine the WVA analysis.

Comment 8:

The calibration and verification of the MIKE 21 hydrodynamic model limits the accuracy and robustness of the analysis in terms of flow velocity, marsh inundation and salinity.

Basis for Comment:

An accurate assessment of changes in salinity, flow velocity, and sediment deposition within the Central Wetlands Area (CWA) is critical to estimates of habitat quality and sustainability with and without the proposed project. MIKE 21 is used to model inundation, current velocities, and salinity within the CWA, and these results are the basis for the Sand2 model that predicts sediment deposition over the life of the project. The MIKE 21 model appears to have been used in the appropriate manner and the set of simulations is straightforward and clear, but the limited calibration, spatial resolution, and focus on only two simulation periods raise questions about the accuracy and robustness of the model results.

As discussed in the *New Orleans -- Central Wetlands Area Hydrodynamic Modeling Study* (Appendix G of Annex 1 of the Engineering Appendix), referred to here as the CWA Modeling Study, calibration of the MIKE 21 model was limited to field data collected in May to June 2008 (water level) and June to July 2009 (salinity) (p. 19). Standard practice is for models to be calibrated against conditions representative of the distribution of water level and salinity. Calibration to a single point in time, such as the month of June (with limited water level and salinity variation), increases the accuracy and precision for the observed range of conditions, but does not necessarily increase the accuracy and precision over the entire range of possible water levels and salinity. It also appears that the model was calibrated against measurements from only two locations inside the CWA and that there are no field data available for the northern part of the CWA. It is not clear if the accuracy of the model at these sampling points is representative of the entire CWA.

Concern about model accuracy across the entire CWA is in part a reaction to the poor model performance at the sampling points. Figure 4.15 (p. 23) of the CWA Modeling Study suggests that the difference between modeled and observed salinity can reach 1 ppt. While it is suggested that the poor calibration "will not have a large influence on the conclusions" because "the effect of the fresh water inflow on the salinity in the CWA is large," this qualifier was assumed and not demonstrated. More importantly, it raises questions about model accuracy across the marsh, particularly when there can be large differences in the variability of the predicted salinity under different diversion lows.

The accuracy of the salinity and water level estimates may be further affected by the resolution of the flexible grid used for MIKE 21. As discussed in the Engineering Appendix (Section 4.3.1, p. 12), the resolution of the flexible grid is 15 ft in the main channels and 200 ft across most of the CWA where the marsh is hydraulically connected by small channels with widths <50 ft. If these channels are not captured by the model, the results under-predict connectivity within the CWA and may leave several areas of the CWA stranded or undrained following extreme water levels. The elevation data are also partly derived from LiDAR data that may or may not penetrate through the water or vegetation canopy. It is not clear if the interpolated surface is an accurate model of real surface and hydraulic connectivity.

Finally, several of the report graphics are not legible (e.g., Fig. 6.1) and the report did not include information such as key flooding elevations, so it is difficult to independently evaluate some of the conclusions and properly discriminate between diversion alternatives.

Significance – Medium:

The limited calibration of MIKE 21 in both space and time affects the understanding of the model results, the relationship to other models (e.g., Sand2), and potentially the selection of the TSP.

Recommendations for Resolution:

1. Provide calibration data and an estimate of model accuracy for water levels and salinity that are representative of the entire range of possible conditions.
2. Provide calibration data and an estimate of model accuracy for multiple locations within the CWA.
3. Provide evidence that the poor salinity calibration will not have an impact on the conclusions.
4. Clarify whether the interpolated surface of the CWA accurately represents the real surface and captures the hydraulic connectivity provided by channels smaller than the grid resolution.
5. Provide clearer graphics and key flooding elevations.

Comment 9:

The adequacy and acceptability of the Comprehensive Aquatic Ecosystem Model (CASM) model could not be evaluated due to the preliminary model version provided and the limited documentation.

Basis for Comment:

The CASM is based on sound scientific and ecological principles, and using CASM to evaluate the impacts of the TSP is reasonable. The Panel's comments are specific to the preliminary application of CASM to MRGO as reported in the EIS. The EIS stated, "As a result, modifications and adjustments to model runs for the CASM were not able to be done prior to release of the DEIS for public comment. None the less, adjustments to the CASM and reruns are planned and potential changes in results would be included in the Final EIS" (p. 2-121).

The MRGO version of the CASM was used to assess the impacts of the TSP on fish, oysters, and other aquatic organisms. However, the Panel was provided with a preliminary version of the model (EIS, p. 2-34), which was inadequately documented to allow for an evaluation of model application (i.e., model realism). In addition, the results of the averaged changes in productivity between the FWOP and the FWP were overly simplified.

For example, the calibration results in Appendix I were related to the earlier baseline simulation, rather than to the field data and targets that triggered the revision to the initial CASM application. Detailed information on model performance (e.g., comparison to field data, simulated diets) was not presented in either the original report (Bartell et al., May 2010) or the revised report (Bartell et al., October 2010). The revised report (Bartell et al., October 2010) also seemed to be aimed at the group involved with the modeling and its evaluation, rather than a broader audience who were not part of the discussions.

Several key issues with the MRGO version of CASM require further evaluation in the MRGO FS/EIS and the next model version:

- The limitations of simulating fish population dynamics and predator-prey interactions using one state variable per group that tracks only biomass
- The realism of treating juveniles and adults of the same species as independent state variables in the model
- The limitations imposed by extrapolating predictions at fixed spatial locations (nodal locations) to long-term changes in productivity without mixing or movement of organisms
- Demonstrating that the effects of salinity changes are not masked by combining salinity with other habitat variables before affecting consumption rates
- Including presentation of node-specific and year-specific predicted changes of productivity rather than just averaged changes (a good example was the spatial maps in Appendix I)
- Placing higher confidence in predicted changes of species that are well represented by CASM (e.g., bay anchovy) and less reliance on predictions for other species less realistically modeled (e.g., Gulf sturgeon).

Significance –Medium:
A complete assessment of the realism and accuracy of predicted impacts from the CASM model results cannot be conducted without additional information.
Recommendations for Resolution:
1. Update the CASM modeling to address the issues discussed above and the issues identified in Section 2.12.6 of the EIS and in Appendix I (p. 43). The results should then be re-applied to assess the impacts of the TSP. 2. Include more detailed calibration results of the MRGO version of CASM. 3. Present the predicted changes in productivities so that the changes in nodes and years are included. This can be achieved using cumulative distributions and box plots. Showing all predicted values is especially important for oysters (sessile) where large changes in certain nodes were not obvious by the reporting of changes averaged over all nodes.

Literature Cited

Bartell, S.M., S.K. Nair, and Y. Wu. (May 2010). Preliminary Evaluation of Proposed Freshwater Diversion in the Vicinity of Violet, Louisiana. Prepared for the U.S. Army Corps of Engineers–New Orleans District. E2 Consulting Engineers, Inc., Maryville, TN.

Bartell, S.M., S.K. Nair, and Y. Wu. (October 2010). Preliminary Evaluation of Proposed Freshwater Diversion in the Vicinity of Violet, Louisiana: Revisions to the Comprehensive Aquatic Ecosystem Model (CASM). Prepared for the U.S. Army Corps of Engineers–New Orleans District. E2 Consulting Engineers, Inc., Maryville, TN.

Comment 10:

The analyses are not sufficiently sensitive to discriminate between closely related management measures within plans or differentiate among alternative plans.

Basis for Comment:

The MRGO FS/EIS provides adequate detail as to why most of the major measures were screened out, but given the relatively high level of risk and uncertainty in this long-term project, (e.g., reliance on generic assumptions in the WVA and in assigning costs) the marginal differences among some of the measures cannot be certain discriminators. For example, the MRGO FS/EIS states: "However, survey data currently being collected and analyzed to develop feasibility level design for each plan feature in the TSP could significantly change the anticipated costs" (p. 2-92). The similarity in the TSP and other plans is shown in Tables 2-31 and 2-32. The 19 Best Buy plans in the final step can be grouped into four or five super-groups with acres and costs similar for alternative plans within each super-group. Further, Table 2-32 shows the plans were quite similar to each other; some plans differed by only one to four measures in comparison to the previous plan. Benefits (acres) and costs were order of magnitude estimates, rather than precise values. Thus, the resolution of the screening results is very general and may not discriminate well among similar alternative plans.

As a result, some measures that barely miss inclusion in the alternative plans may be appropriate as the project proceeds or, in fact, could have been the correct measures to include in the Best Buy plans. Inclusion of these measures as the adaptive management plan proceeds, rather than totally disregarding them, would provide flexibility to the TSP and overall project, and increase its likelihood of success and effectiveness.

The Panel found the measures dealing with the Bonnet Carre freshwater diversion channel and along the eastern boundary of the project may have not received the same detailed analysis as other measures.

Significance – Medium:

A more detailed discussion that identifies the key differences among management measures would strengthen the alternative plan selection process resulting in the TSP**.**

Recommendations for Resolution:

1. Interpret and discuss the TSP relative to the scale of the plan required for project success.
2. Reevaluate the measures that are marginally eliminated from those selected for the TSP, and carry those forward as an inventory into the adaptive management activities.
3. Reexamine the Bonnet Carre freshwater diversion measures more fully to identify all the benefits from these measures.
4. Develop information about the measures in the eastern boundary of the project, since the current treatment was not fully developed.

Comment 11:

The planning objectives are overly specific and limit the range of measures and alternatives that could meet the project goals.

Basis for Comment:

Consistent with the study authority, the overall goals are to (FR, p. 2-51):

1. Restore the Lake Borgne ecosystem and the areas affected by the MRGO navigation channel.
2. Restore natural ecosystem features that reduce or prevent storm surge.
3. Achieve ecosystem sustainability to the greatest degree possible.

During plan formulation, objectives were developed for salinity targets, storm surge reduction, and specific minimum acreages for cypress swamp, fresh/intermediate marsh, brackish marsh, and other habitats (FR Section 2.5.6). The minimum acreages by habitat type were based on the estimated past impacts of the MRGO on the ecosystem (Appendix V). While this type of historic habitat impact accounting is very useful as a point of reference for informing the overall restoration trajectory, the use of exact acreages as minimum targets ends up constraining the mix of habitats considered in plan formulation and alternatives selection.

The acreages are used as minimum targets by habitat type and actually reduce the ability of plan formulation to create alternatives that may better meet the ecosystem restoration, sustainability, and storm surge reduction goals. For example, it may be desirable to focus on current and future ecological value of potentially restored habitats, rather than on historic losses, to produce ecosystem benefits (Goal 1). This focus might result in a plan with measures designed to restore different habitat types (e.g., barrier island habitat) or more proven management measures (e.g., herbivory management) than in the TSP. Similarly, it may be desirable to restore more habitat (of all types) outboard of the levees and less habitat (cypress swamp and fresh/intermediate marsh) inboard of the levees to reduce storm surge (Goal 2). In addition, if freshwater marsh accretes faster than saline marsh, it may be desirable to restore more freshwater marsh and less saline marsh to create a more sustainable landscape with future sea level rise (Goal 3).

Many paths are possible to meet the project goals, but they have not been fully explored because of the narrow way the habitat acreages objectives (i.e., minimum values based on past impacts) were defined.

Significance – Medium:

The rationale for defining the project objectives relatively narrowly is not supported by the information provided in the review documents.

Recommendations for Resolution:

1. Provide a strong rationale for selecting specific, historically based objectives.
2. Re-evaluate the objectives (i.e., with more flexibility) if a strong selection rationale cannot be provided.
3. Consider any additional measures and alternatives that may result from revised objectives.

Comment 12:

The ecological resource goals of the MRGO project are largely met through an increase in habitat area rather than improvements in habitat quality.

Basis for Comment:

The primary goal of the proposed project is the "restoration of the Lake Borgne ecosystem," with a focus on increasing the ecological resource area. The Panel is concerned that too great a focus is placed on increasing area rather than increasing quality in terms of habitat and storm surge protection (Goal 2). Specifically, the different habitat types (ridge, marsh, and swamp) are given equal value in the WVA, independent of existing/baseline quality or storm surge protection. Similarly, all areas of a given wetland type (marsh, swamp, ridge, etc.) are given equal value without discriminating between existing quality and habitat subtypes. Without a detailed and site-specific survey of habitat quality across and within wetland types, it is unclear whether project benefits could be "synergistically maximized" by also considering quality and risk reduction.

For example, it would take a large marsh to provide the same level of storm surge protection afforded by a ridge that is also more sustainable with Relative Sea Level Rise (RSLR). Similarly, cypress swamp provides greater storm surge protection than marsh and, as noted in Section 2.5.1 of the EIS, is a scarce and unique habitat with high value. Finally, several shoreline protection measures (Table 2-11) were 'screened-out' because of low WVA (small area protected), but it is not clear if these features would have provided greater resiliency to adjacent (low quality) wetland environments and extended the area of surge attenuation.

Significance –Medium:

The ability to fully assess that the TSP "synergistically maximizes" benefits is impaired by the focus of the MRGO project on increasing the ecological resource area (i.e., quantity) without considering habitat quality and storm surge risk reduction.

Recommendations for Resolution:

1. Provide greater justification for equal habitat weightings in the WVA.
2. Provide an explanation of how the TSP maximizes the ecological resource area while also maximizing storm surge risk reduction and habitat quality.

Comment 13:

The post-closure baseline environmental conditions information provided does not allow for a complete evaluation of the predicted future without project (FWP) and future with project (FWOP) conditions.

Basis for Comment:

Final Panel Comments 3, 6, and 13 are interrelated and all focus on various aspects of the UNO model. However, the Panel has concluded that due to their individual significance, they should be reported as individual issues identified during the IEPR.

The assumptions about FWOP and FWP conditions and the need for the Violet Diversion are in part based on assumptions regarding existing coastal vegetation resources and salinity.

For example, the Violet Diversion and the required diversion flows are based on salinity estimated from the UNO model that was compared (not calibrated) against ensemble-averaged monthly average salinities. The UNO model is unable to accurately model interannual variations in salinity (Figures 19 and 20 of Engineering Appendix), which raises the concern that the modeled salinity for the post-closure scenario is not accurate. Results of the UNO model suggest a 32% to 66% decrease in salinity with the closure, which puts the post-closure salinity statistically close to the pre-MRGO conditions. However, this is a comparison of field and modeling data from different time periods and under very different conditions. Without the use of similar metrics (both scenarios modeled or measured) and a statistical test of difference, it is not clear whether the closure has already brought the salinity within the target range or whether the target can be met with smaller diversion flows. Unfortunately, there have not been post-closure field measurements to compare against pre- and post-MRGO conditions or to ensure that the model results are accurate.

The MRGO closure has only been in place since late 2009 and the effects of this closure on salinity, hydrology, and, ultimately, coastal vegetation resources have not yet been fully realized. It will take an undetermined number of years and storm events to quantify the impact the closure has had on coastal vegetation resources, but the FWOP and FWP are based solely on the pre-closure state. Without post-closure field sampling in a manner consistent with the field monitoring completed pre- and post-MRGO, it is not clear whether the coastal vegetation resources are already improving or stabilizing.

Significance – Medium:

Post-closure field monitoring is required to provide baseline conditions and calibrate the modeling to fully understand and evaluate the FWOP and FWP predictions.

Recommendations for Resolution:

1. Collect salinity data to either calibrate the UNO model to post-closure conditions or to make a direct comparison to pre- and post-MRGO conditions. This will provide greater confidence in the FWP and FWOP predictions and improve the rationale for the proposed diversion and the required diversion flows.
2. Complete a post-closure baseline survey of existing coastal vegetation resources and compare pre-closure states to demonstrate that the baselines for FWOP and FWP are accurate and appropriate.

Comment 14:
The selection of the Violet diversion may not meet the USACE acceptability criterion.
Basis for Comment:
According to USACE guidance, alternative plans are formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability (USACE, 2000). The criterion of acceptability is defined as the extent to which the alternative plans are acceptable in terms of applicable laws, regulations and public policies (USACE, 2000). The Panel has concerns about the desirability of the chosen alternative, particularly since the consideration of the existing Violet channel alternative in the plan formulation did not receive the same detailed analysis as the other alternatives. In addition, the community expressed broad and intense concerns in the public comments regarding the desirability of the chosen alternative for the Violet channel alternative. The community, churches, and land owners have not been convinced that the current channel could not be modified to serve as the diversion channel. As such, the acceptability criterion may not be met.
The Significance – Medium:
The explanation for conducting an in-depth analysis of only four alternatives for the Violet diversion but not of the existing channel needs to include scientific and community concerns before the USACE's acceptability criterion standard can be met.
Recommendations for Resolution:
1. Reexamine the status and usability of the existing channel to see if they meet scientific objectives. 2. Document the cost savings and benefits of the chosen Violet channel alternative by using the existing channel as one of five alternatives, thus showing the community the appropriateness of the chosen alternative.

Literature Cited

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

Comment 15:

The use of maintenance dredged material from locations other than Lake Borgne, especially the Mississippi River, were not fully evaluated as borrow source options.

Basis for Comment:

Dredged material from the Mississippi River was dismissed as an option due to the longer transport distance and corresponding increased cost. Technical issues with installing the overland dredge pipeline through existing levies and under existing highways and railroad tracks were cited as contributing to the additional cost. However, if material is available as a consequence of maintenance operations, then the total cost may be lower even with the increased transport cost. Information regarding the current disposition of dredged material from the Mississippi River and other suitable locations was not included in the MRGO FS/EIS. An analysis of any trade-offs between what is currently being done with dredged material and what could be done with respect to the TSP was not provided.

Using the Violet Diversion as a corridor for a pipeline may mitigate many of the technical challenges associated with the implementation of an overland dredge pipeline. For example, the pipeline might be run through the box culverts at highway and railroad crossings. Implementation of this option would require using Lake Borgne borrow until the Violet Diversion is implemented. Nevertheless, use of Mississippi maintenance dredged materials would reduce the amount of borrow required from Lake Borgne. In addition, as suggested in the MRGO project Value Engineering study, the existence of an overland pipeline transport feature may provide additional value for restoration efforts in the future.

Significance –Medium:

The use of dredged material from Lake Borgne has been economically justified in the TSP; however using other sources of borrow material that could result in fewer negative effects to the Lake Borgne system were not sufficiently evaluated.

Recommendations for Resolution:

1. Evaluate the possible use of maintenance dredged material from the lower Mississippi River and other locations, and document the results in the Final Feasibility Report.
2. Provide a trade-offs analysis comparing what is currently being done with dredged material from the Mississippi River and other sources with the TSP.

Comment 16:

The environmental effects of dredging operations in Lake Borgne, such as changes in turbidity, degraded water quality, and increases in wave energy and shoreline erosion, have not been sufficiently considered.

Basis for Comment:

Final Panel Comments 16, 17, 18 and 19 are interrelated in that they focus on potential impacts of proposed dredging activities. However, the Panel has concluded that due to their individual significance, they should be reported as individual issues identified during the IEPR.

The selection of Lake Borgne as a borrow source is a highly visible aspect of the TSP. However, the MRGO FS/EIS does not provide sufficient consideration of the environmental effects of dredging in Lake Borgne.

The possible environmental effects of dredging in Lake Borgne are destruction of bottom habitat, changes in turbidity, degraded water quality, and increases in wave energy and shoreline erosion. The MRGO FS/EIS provides a designation of borrow locations and a general description of the planned dredging operations. It gives a maximum borrow depth of 10 feet to 12 feet below lake bottom.

The lake bottom habitat will be altered in the borrow areas. Hydraulic dredging will result in resuspension of sediment during dredging operations and a possible long-term decrease in suspended sediment concentration as sediments are deposited in deeper areas where they cannot be resuspended. Stratification of the water column in the borrow pits may occur and result in low dissolved oxygen, as in the Lake Ponchartrain borrow pits. Although the Lake Ponchartrain borrow pits are deeper than those proposed for Lake Borgne, the differences and similarities of the borrow pits are not discussed. In addition, the Lake Borgne borrow pits may result in higher wave energy and erosion of the shoreline.

Significance – Medium:

The environmental effects of dredging operations may be sufficient to justify modifying the borrow plan, and to re-examine the selection of Lake Borgne as the sediment source.

Recommendations for Resolution:

1. Conduct an in-depth analysis of the potential environmental effects of dredging in Lake Borgne.
2. Identify mitigating measures to be used in the design and construction project phases.

Comment 17:

There is no documentation that the sediment properties and salinity of the dredged material can provide optimum conditions for marsh and swamp restoration.

Basis for Comment:

Final Panel Comments 16, 17, 18 and 19 are interrelated in that they focus on potential impacts of proposed dredging activities. However, the Panel has concluded that due to their individual significance, they should be reported as individual issues identified during the IEPR.

The Lake Borgne borrow locations have been selected in the TSP largely based upon economic considerations. The MRGO FS/EIS does not discuss whether the Lake Borgne borrow can create optimum conditions for forming marshes and swamps. The Lake Borgne borrow material is described as a soft clay in salt water. It is to be hydraulically transported to the adjacent restoration sites as slurry. It is not clear whether the slurry material contains the required soil nutrients, grain size distribution, and appropriate salinity to create marshes and swamps. It is possible that the salinity of the placed material could have a negative effect on marsh and swamp creation, at least until salinities equilibrate with new ambient conditions.

Significance – Medium:

The absence of a discussion of the suitability of dredged material for re-use in restoration affects understanding of the restored marshes' performance.

Recommendations for Resolution:

1. Provide the results of studies of the sediment properties and salinity of the Lake Borgne borrow material, if previously conducted.
2. Conduct an assessment of the nutrient, sediment, and salinity properties of the proposed dredged material with regard to providing optimum conditions for restoration.

Comment 18:

Impacts of the TSP on oyster resources have not been thoroughly investigated.

Basis for Comment:

Final Panel Comments 16, 17, 18 and 19 are interrelated in that they focus on potential impacts of proposed dredging activities. However, the Panel has concluded that due to their individual significance, they should be reported as individual issues identified during the IEPR.

The Panel identified two major issues relating to impacts on oysters resources: the effects of the dredging activity proposed for Lake Borgne, and the freshening of Lake Borgne and the Inner Biloxi marsh due to the proposed diversion. Dredging will destroy bottom habitat and temporarily generate poor water quality, and the proposed diversion will cause lower salinities that can create stressful conditions for oysters and a shifting in the locations where oyster beds can exist.

The assessment of dredging states that borrow locations will not be in historic oyster leases (thus avoiding habitat destruction); but that water quality issues (e.g., turbidity) are possible (EIS, p. 4-74). The EIS further states that the magnitude of these water quality impacts is highly uncertain, and that measures could be used to reduce the impacts. The qualitative and vague statements regarding small water quality effects are inadequate for a sensitive issue such as potential TSP impacts on oysters.

The MRGO FS/EIS relied heavily on CASM results to assess the impacts of freshening from the proposed diversion. The CASM results are considered preliminary in the EIS and thus are not of high confidence; the interpretation of the preliminary results was also overly simplified. The MRGO version of the CASM model and results could not be rigorously evaluated by the Panel because of limited documentation and the preliminary nature of the results. The EIS presented the changes in oyster productivity predicted by the MRGO CASM model that were averaged over years and locations, which can eliminate large year-to-year fluctuations.

When examined in more detail, the CASM predictions had oyster productivity in the Upper Lake Borgne and Inner Biloxi decrease in almost all years of the simulations (see Excel file WQ1-WQ6_%CH_FwoPvsFWP_NPr_AreaVstimeUNONodal). These predicted decreases were substantial in individual years, often >20% and sometimes 100%. A very important aspect of impacts on oysters is location and, while averaging CASM results over the entire area and years provides information on overall average ecological impacts; this does not consider the specific locations and times where large negative impacts will occur. The conclusion that impacts of the TSP on oysters will be small because overall averaged changes in oyster productivity predicted by CASM were small is not justified.

The impacts analysis of the MRGO restoration plans on oysters provided in the MRGO FS/EIS is too qualitative. The potential impacts of the project on oysters should be assessed in more detail now as part of the EIS since these impacts can affect major aspects of the TSP such as the source of sediments and the design of the proposed diversion.

Significance – Medium:
The potential impacts of the TSP on oyster habitat cannot be evaluated because of the incomplete information provided in the report.
Recommendations for Resolution:
1. Include additional analyses to determine the impacts of the TSP on oysters. a. Provide more quantitative predictions of impacts by simulating water quality and salinity with improved hydrodynamics models, and with the existing models designed to specifically examine the dredging and salinity questions. b. Update and refine the CASM model and results to provide more confidence in predictions of changes in oyster productivity in specific regions. 2. Include more detailed documentation of the locations of current and historical oyster leases, and discuss actions to minimize water quality impacts.

Comment 19:

The analyses of the impacts of the proposed alternatives on Gulf sturgeon were qualitative and are not supported by field data or an analysis of habitat requirements relative to proposed dredging activities.

Basis for Comment:

Final Panel Comments 16, 17, 18 and 19 are interrelated in that they focus on potential impacts of proposed dredging activities. However, the Panel has concluded that due to their individual significance, they should be reported as individual issues identified during the IEPR.

A major potential impact of the TSP is the dredging of Lake Borgne. This dredging would disrupt physical habitat for Gulf sturgeon and create poor water quality conditions. Habitat alteration and poor water quality have negatively affected Gulf sturgeon (Appendix B, p. 32), and Lake Borgne is considered critical habitat for this listed species (Appendix B, p.13). A Biological Assessment (BA) included in the EIS (Appendix G) relied on qualitative arguments and the results of the CASM model.

Dredging impacts were stated to be small based on the location of borrow sites. The BA stated (p. 88), "Borrow sites have been situated to avoid hard bottom substrates Gulf sturgeon forage over." The Panel considered this assurance too vague. It assumes that the relationship between hard bottom habitat and sturgeon foraging, and that the distribution of hard bottom habitats within Lake Borgne at relatively fine scales are fully understood. The EIS and BA relied on qualitative analyses that the effects of the TSP on prey species availability and turbidity in Lake Borgne would be temporary and small.

The conclusion of minimal effects on Gulf sturgeon was also based on CASM simulations of FWOP and FWP that predicted small changes to Gulf sturgeon productivity. CASM results were deemed preliminary by USACE pending further revisions to the model and model simulations. Furthermore, CASM is a biomass-based food web model that was applied to fixed, unlinked spatial locations (nodes) and is not designed to simulate the effects of localized perturbations on individuals or the population dynamics of a migratory endangered species like Gulf sturgeon.

In addition, the TSP generated significant comments related to Gulf sturgeon from the U.S. Fisheries and Wildlife Service (Appendix B), which were supported by the National Marine Fisheries Service and the Louisiana Department of Wildlife and Fisheries.

Significance – Medium:

The conclusion that dredging operations will not impact Gulf sturgeon has not been demonstrated based on the analyses presented.

Recommendations for Resolution:

1. Conduct additional analyses based on the use of field data (where and when are the sturgeon in the area).
2. Provide a more complete discussion of habitat requirements relative to potential impacts in order to predict potential impacts of the TSP on the Gulf sturgeon
   a. Predicted changes in habitat using habitat suitability functions specific to Gulf sturgeon would provide a stronger basis for evaluation of TSP impacts on this listed species.

b. Predicted changes in habitat can then be compared to the availability of high quality Gulf sturgeon habitat in Lake Borgne and will provide a more accurate context for evaluating localized habitat loss.

3. Conduct a follow-up investigation augmenting the preliminary tagging study to provide more substantial data that supports the preliminary study conclusion of absence of sturgeon in the study area.
4. Include more resolved calculations of expected spatial scale and temporal dynamics of predicted changes in turbidity to provide stronger evidence of minimal effects of turbidity on Gulf sturgeon.

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APPENDIX B

Final Charge to the Independent External Peer Review Panel
as
Submitted to USACE on March 11, 2011

on the

Mississippi River-Gulf Outlet
Ecosystem Restoration Plan Feasibility Study
and Environmental Impact Statement

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APPENDIX B
Final Charge Questions and Guidance to the Peer Reviewers
for the
Mississippi River-Gulf Outlet
Ecosystem Restoration Plan Feasibility Study
and Environmental Impact Statement IEPR

BACKGROUND

The Water Resources Development Act of 2007 (WRDA) authorized the Mississippi River-Gulf Outlet (MRGO) Ecosystem Restoration Plan Feasibility Study and environmental impact statement (EIS). Specifically, Section 7013 conditionally authorized the plan for construction, pending the determination that the project is cost-effective, environmentally acceptable, and technically feasible. As detailed in the WRDA authorization, the plan proposes to:

1. Physically modify the MRGO and restore the areas affected by the navigation channel
2. Restore natural features of the ecosystem that will reduce or prevent damage from storm surge
3. Prevent the intrusion of saltwater into the waterway
4. Integrate the recommendations of the Louisiana Coastal Area Report and the Louisiana Coastal Protection and Restoration Technical Report
5. Consider the use of native vegetation and diversions of fresh water to restore the Lake Borgne ecosystem

The MRGO Ecosystem Restoration Plan Feasibility Study is being developed as a supplement to the June 2008 MRGO Deep-Draft De-Authorization Report and is intended to fully meet the requirements of WRDA Section 7013. This feasibility study is anticipated to result in a Chief's Report containing a recommended MRGO Ecosystem Restoration Plan. The Plan will address systematic ecosystem restoration and protection of the Lake Borgne ecosystem and areas affected by the MRGO navigation channel, and will include considerations of measures to reduce or prevent damage from storm surge. The study will integrate the findings of ongoing comprehensive restoration planning efforts for the study area, including the Louisiana Coastal Protection and Restoration (LACPR) Final Technical Report, the Louisiana Coastal Area (LCA) Program, and Louisiana's Comprehensive Master Plan for a Sustainable Coast.

This Independent External Peer Review (IEPR) will review the draft feasibility report and EIS for the MRGO Ecosystem Restoration Plan Feasibility Study, along with the associated appendices.

The study area includes portions of the Mississippi River Deltaic Plain in coastal southeast Louisiana and parts of coastal southwest Mississippi. It encompasses approximately 3.86 million acres (6,023 square miles) of land and open water.

- In Mississippi, the study area includes the Western Mississippi Sound, its bordering wetlands, and Cat Island. The Lake Borgne ecosystem and areas that may have been affected by the construction, operation, and maintenance of the MRGO navigation channel are included in the study area. The MRGO channel may have affected salinity as

far northwest as Lake Maurepas. To the east, the MRGO channel was dredged through open water between Breton and Grand Gossier Islands (segments of the lower Chandeleur Island chain). The MRGO channel affected portions of the Lake Borgne ecosystem to the north and potentially altered hydrology to the west as far as the Bayou Terre aux Boeufs ridge.

- Louisiana parishes in the study area include Ascension, Jefferson, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Tammany, and Tangipahoa. Mississippi counties in the study area include Hancock and Harrison.Lake Borgne is hydrologically linked to Lake Pontchartrain through tidal passes at The Rigolets, Chef Menteur Pass, and the Inner Harbor Navigation Canal (IHNC). The Lake Borgne ecosystem is influenced by the Pearl River to the north and is hydrologically connected to areas located as far south as Bayou Terre aux Boeufs.

There are a number of project measures in the tentatively selected plan: an artificial oyster reef, shoreline protection, ridge restoration, fresh marsh restoration/nourishment, intermediate marsh restoration/nourishment, brackish marsh restoration/nourishment, cypress swamp restoration/nourishment and a freshwater diversion.

Plan C, which has been tentatively selected, would restore and protect approximately 58,861 acres of habitat in the study area, including 10,431 acres of cypress swamp, 13,950 acres of fresh and intermediate marsh, 33,966 acres of brackish marsh, 466 acres of saline marsh, and 48 acres of ridge habitat. Plan C encompasses approximately 70 miles of shoreline protection (including 7.5 miles of artificial oyster reef).

Approximately 11,222 acres of the restoration and protection features would be located in the East Orleans Landbridge/Pearl River area and approximately 9,301 acres of restoration features would be located in the Biloxi Marsh area, which have been determined to be critical landscape features with respect to storm surge. In addition, the cypress swamp and ridge restoration feature would include forested habitat, which has been shown to have some storm surge damage risk reduction benefits.

A freshwater diversion from the Mississippi River in the vicinity of Violet, Louisiana is a key component of the tentatively recommended plan. The freshwater diversion is a system driver to create conditions conducive to the restoration of historic estuary habitat types in the vicinity of the MRGO. The Violet Freshwater Diversion would mimic the natural river flooding processes and enhance the sustainability of the system through the input of freshwater, nutrients and sediment.

OBJECTIVES

The objective of this work is to conduct an IEPR of the MRGO Ecosystem Restoration Plan Feasibility Report and Environmental Impact Statement (MRGO 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.

The purpose of this IEPR is to "assess the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-209; p. D-4) for the MRGO 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.

The IEPR Panel will be "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. The Panel will identify, examine, and comment upon the assumptions underlying the analyses, as well as evaluate the soundness of models and analytic methods. The Panel will evaluate whether the interpretations of analyses and conclusions are technically sound and reasonable, provide effective review in terms of both usefulness of results and credibility, and have the flexibility to bring important issues to the attention of decision makers. The panel members may also offer opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The USACE will provide the following documents and supplemental information for review. **The documents and files presented in bold font are to be reviewed**. All other documents are provided for reference:

- **Feasibility Report (275 pgs.)**
  - **Appendix A: Engineering Appendix (2,225 pgs.)**
  - **Appendix B: Real Estate Appendix and Exhibits (45 pgs.)**
  - **Environmental Impact Statement (550 pgs.)**
  - **Appendix B: U.S. Fish and Wildlife Service Coordination Letter and Report (250 pgs.)**
  - **Appendix C: NOAA Fisheries Service Coordination Letter (5 pgs.)**
  - **Appendix E: 404(b)(1) draft (340 pgs.)**
  - **Appendix F: Coastal Zone Consistency Draft (40 pgs.)**
  - **Appendix G: Threatened and Endangered Species Consultation (215 pgs.)**
  - **Appendix H: Conceptual Ecological Model Report (20 pgs.)**
  - **Appendix I: Aquatics Model Report (80 pgs.)**
  - **Appendix J: Barrier Island Model Report (CASM) (1110 pgs.)**
  - **Appendix L: H&H Model Report (390 pgs.)**
  - **Appendix M: Wetland Value Assessment, Planting Plan, and Oper. Scheme (2 pgs.)**

- **Appendix N: Salinity Working Group Report (30 pgs.)**
- **Appendix O: Measures and Alternatives Screening Tables (50 pgs.)**
- **Appendix P: Air Quality Impacts (10 pgs.)**
- **Appendix Q: Phase 1 ESA/HTRW Report (420 pgs.)**
- **Appendix S: Water Quality (606 pgs.)**
- **Appendix T: Adaptive Management Plan (25 pgs.)**
- **Appendix V: Habitat Impacts of Construction of the MRGO (10 pgs.)**
- **Appendix W: Recreation Plan Development (30 pgs.)**

- **Comments submitted during public comment period (10-17,000 comments organized by topic by USACE)**
- Evaluation of Environmental Investments Procedures Manual Interim: Cost Effectiveness and Incremental Cost Analysis
- 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/)
- 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.

SCHEDULE

TASK	ACTION	DUE DATE
Conduct Peer Review	Battelle sends review documents to IEPR Panel	3/7/2011
	Battelle/IEPR Panel kick-off meeting	3/14/2011
	USACE/Battelle/Panel kick-off meeting	3/14/2011
	Battelle convenes mid-review teleconference for Panel to ask clarifying questions of USACE	3/21/2011
	Panel members complete their individual reviews	4/4/2011
Prepare Final Panel Comments and Final IEPR Report	Battelle provides Panel merged individual comments and talking points for Panel Review Teleconference	4/6/2011
	Battelle convenes Panel Review Teleconference	4/7/2011
	Battelle provides Final Panel Comments directive to Panel	4/8/2011
	Panel members provide draft Final Panel Comments to Battelle	4/15/2011
	Battelle provides feedback to Panel on draft Final Panel Comments; Panel provides revised draft Final Panel Comments per Battelle feedback (iterative process)	4/15/2011 – 4/26/2011
	Battelle finalizes the Final Panel Comments	4/26/2011
	Battelle provides Final IEPR Report to Panel for review	4/28/2011
	Panel provides comments on Final IEPR Report	4/29/2011
	*Battelle submits Final IEPR Report to USACE	5/4/2011
Comment/ Response Process	Battelle inputs Final Panel Comments to DrChecks; Battelle provides Comment Response template to USACE	5/6/2011
	Battelle convenes teleconference with Panel to review the Comment Response Process	5/6/2011
	USACE provides draft Evaluator Responses to Battelle	5/18/2011
	Battelle provides the Panel the draft Evaluator Responses	5/23/2011
	Panel members provide Battelle with draft comments on draft Evaluator Responses (i.e., draft BackCheck Responses)	5/26/2011
	Battelle convenes teleconference with Panel to discuss draft BackCheck Responses	5/26/2011
	Battelle convenes teleconference with Panel, and USACE to discuss Final Panel Comments, and draft responses	5/27/2011
	USACE inputs final Evaluator Responses in DrChecks	6/6/2011
	Battelle provides Evaluator Responses to Panel	6/7/2011
	Panel members provide Battelle with final BackCheck Responses	6/10/2011
	Battelle inputs the Panel's BackCheck Responses in DrChecks	6/16/2011
	*Battelle submits pdf printout of DrChecks project file	6/17/2011

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Mississippi River-Gulf Outlet Ecosystem Restoration Plan Feasibility Study and Environmental Impact Statement (MRGO FS/EIS) are credible and whether the conclusions are valid. The Panel is 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 panel members are not being asked whether they would have conducted the work in a similar manner.

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

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the MRGO 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 (Julian DiGialleonardo, digialleonardoj@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 panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Julian DiGialleonardo, digialleonardoj@battelle.org, no later than March 25, 2011, 10 pm EDT.

Independent External Peer Review
for the
Mississippi River-Gulf Outlet
Ecosystem Restoration Plan Feasibility Study
and Environmental Impact Statement

Final Charge Questions

General

1. Were all models used in the analyses used in an appropriate manner?

    a. Wetland Value Assessments

        - Appendix M of EIS; Section 2.4.1.1 Outputs (Benefits) of EIS

    b. SAND2

        - Appendix M of EIS; Section 2.4.1.1 Outputs (Benefits) of EIS

    c. CASM –

        - Appendix I of EIS; Section 2.3.4.3 Fisheries Modeling Study of EIS

    d. UNO Box Model

        - Annex 1 of Engineering Appendix; Section 2.5 Hydrodynamic Modeling of the Engineering Appendix

    e. MIKE 21

        - Annex 1 of Engineering Appendix; Section 2.5 Hydrodynamic Modeling of the Engineering Appendix

    f. IWRPLAN

        - Section 2.7.3 Cost Effectiveness/Incremental Cost Analysis of the Feasibility Study; Appendix O of the EIS.

2. Are the models used sufficiently discriminatory to support the conclusions drawn from them (i.e., identify meaningful differences between alternatives)?

        - See sections above.

3. Were risk and uncertainty sufficiently considered?

    - Feasibility Study Sections: 2.6.1.1 Risk and Uncertainty Associated with Restoration Measure Types; 2.8.1 Risks and Uncertainties; 2.5.4 Risk-Informed Planning Framework; 2.8.2 Relative Sea Level Rise Scenarios

    - EIS Sections: 2.7.1 Risk and Uncertainties; 2.12 Scientific Issues and Technical Uncertainties.

4. In your opinion, are there sufficient analyses upon which to base the recommendation?

    - Feasibility Study: Chapter 2 Plan Formulation

    - EIS: Chapter 2 Alternatives Formulation

Problem, Needs, Constraints, and Opportunities

5. Are the problems, needs, constraints, and opportunities adequately and correctly defined?

    - Feasibility Report Sections: 2.4 Problems and Opportunities; 2.5 Study Goals, Constraints, and Objectives

    - EIS Sections: 1.5 Habitat Goals; 1.6 Planning Objectives; 2.2 Conceptual Ecological Model

6. Do the identified problems, needs, constraints, and opportunities reflect a systems, watershed, and/or ecosystem approach, addressing a geographic area large enough to ensure that plans address the cause and effect relationships among affected resources and activities that are pertinent to achieving the study objectives (i.e., evaluate the resources and related demands as a system)?

    - See sections above.

7. Did the study address those resources identified during the scoping process as important in making decisions relating to the study?

    - Feasibility Report Sections: 2.4 Problems and Opportunities; 2.8.3 Comparison of Impacts to Significant Resources

    - EIS Sections: 2.2 Conceptual Ecological Model; Chapter 4 Environmental Consequences; Chapter 5 Public Involvement; Appendix A Scoping Report

8. Could there be other factors (e.g., sea level rise) which would have contributed to higher salinity levels in the study area even in the absence of the MRGO project?

    - Feasibility Study Sections 2.1 Key Planning Assumptions, 2.2 Existing Conditions, 2.3 Future Without Project Conditions

    - EIS Sections 3.0 Affected Environment, 4.0 Environmental Consequences

Existing and Future Without Project Resources

9. Has the character and scope of the study area been adequately described, and is the identified study area appropriate in terms of undertaking a systems/watershed/ ecosystem based investigation?

    - Feasibility Study Sections: 1.0 Introduction and Background; 2.1 Key Planning Assumptions; 2.2 Existing Conditions

    - EIS Sections: 1.3 Study Area; 3.0 Affected Environment

10. Do you agree with the general analyses of the existing social, financial, and natural resources within the study area?

    - Feasibility Study Sections: 2.1 Key Planning Assumptions; 2.2 Existing Conditions; 2.3 Future Without Project Conditions

    - EIS Sections: 3.0 Affected Environment; 4.0 Environmental Consequences

11. For your particular area of expertise, provide an in-depth review of whether the analyses of the existing social, financial, and natural resources within the project area are sufficient to support the estimation of impacts of the array of alternatives.

    - See sections above.

12. Given your area of expertise, does this section appropriately address the existing conditions of all resources pertinent to the study?

    - See sections above.

13. Were the surveys conducted to evaluate the existing social, financial, and natural resources adequate? If not, what types of surveys should have been conducted?

    - EIS: Appendix M Wetland Value Assessments

14. Were socioeconomic conditions adequately addressed? Were specific socioeconomic issues not addressed?

    - EIS Sections: 3.20 Socioeconomic and Human Environment ; 4.21 Socioeconomic and Human Environment

    - Feasibility Study Sections: 2.2.13 Socioeconomic and Human Resources; 2.3.4 Socioeconomic Consequences of Coastal Land Loss; 2.8.3 Comparison of Impacts to Significant Resources

15. Was the hydrology discussion sufficient to characterize current baseline conditions and to allow for evaluation of how forecasted conditions (with and without proposed actions) are likely to affect hydrologic conditions? Please comment on the completeness of the discussion on the relationship between subsurface hydrology and the hydrodynamics of the project area.

    - Feasibility Study Sections: 1.4.2 MRGO Environmental Impacts; 2.1 Key Planning Assumptions; 2.2.3 Hydrology; 2.3.5 Future Hydrology; 2.6.2 Initial Screening Process; 2.7.1 Preliminary Evaluation of Measures; 2.7.2 Violet Freshwater Diversion

    - Engineering Appendix Sections: 2.0 Hydrology and Hydraulics; Annex 1 Modeling Report

    - EIS Sections: 3.6 Hydrology-Hydraulics; 4.3 Hydrology-Hydraulics

16. Was the discussion of natural resources sufficient to characterize current baseline conditions and to allow for evaluation of forecasted conditions (with and without proposed actions)?

    - Feasibility Study Sections: 2.1 Key Planning Assumptions; 2.2 Existing Conditions; 2.3 Future Without Project Conditions

    - EIS Sections: 3.0 Affected Environment; 4.0 Environmental Consequences

17. Were the assumptions used as the basis for developing the most probable future without project conditions reasonable?

    a. Were adequate scenarios effectively considered (applied during analyses where relevant and/or reasonably investigated)?

    b. Were the potential effects of climate change addressed?

- Feasibility Study Sections: 2.1 Key Planning Assumptions; 2.2 Existing Conditions; 2.3 Future Without Project Conditions; 2.6.1.1 Risk and Uncertainty Associated with Restoration Measure Types; 2.8.1 Risks and Uncertainties; 2.5.4 Risk-Informed Planning Framework; 2.8.2 Relative Sea Level Rise Scenarios

- EIS Sections 3.0 Affected Environment; 4.0 Environmental Consequences EIS Sections 2.7.1 Risk and Uncertainties; 2.12 Scientific Issues and Technical Uncertainties.

18. Are the future conditions expected to exist in the absence of a Federal project logical and adequately described and documented?

    - Feasibility Study Sections: 2.1 Key Planning Assumptions; 2.2 Existing Conditions; 2.3 Future Without Project Conditions; 2.6.1.1 Risk and Uncertainty Associated with Restoration Measure Types; 2.8.1 Risks and Uncertainties; 2.5.4 Risk-Informed Planning Framework; 2.8.2 Relative Sea Level Rise Scenarios

    - EIS Sections: 3.0 Affected Environment; 4.0 Environmental Consequences

19. Please comment on the conclusion of the most probable future without project condition.

    a. Do you envision other potential probable outcomes?

Plan Formulation / Evaluation

20. Was a reasonably complete array of possible measures considered in the development of alternatives?

    - Feasibility Report Sections: S.3.5 Management Measure and Alternative Plans; S.3.6 Final Array of Alternatives; S.3.7 Comparison of Alternatives; S.3.8 Key Planning Assumptions; 2.0 Plan Formulation

    - EIS: Section 2.0 Alternative Formulation

    - Engineering Appendix: Section 1.2 Alternatives

21. Do the benefits associated with the tentatively selected plan for ecosystem restoration outweigh any impacts (i.e., will the resulting habitat be considered a more natural; sustainable habitat with higher ecological value)?

    - Feasibility Report Section: 2.0 Plan Formulation

- EIS Sections: 1.7 Habitat Evaluation Team; 1.8 National Environmental Policy Act; 2.3.1 Identification of Management Measures and Initial Screening Process – Description of Measures by Type; 2.11 Environmental Commitments; 2.12 Scientific Issues and Technical Uncertainties; Chapter 3: Affected Environment; Chapter 4: Environmental Consequences Chapter 6: Environmental Requirements

22. Does each alternative meet the formulation criteria of being effective; efficient; complete, and acceptable?

    - Feasibility Study Section: 2.9.1 Acceptability, Completeness, Effectiveness and Efficiency

23. Were the assumptions made for use in developing the future with project conditions for each alternative reasonable?

    a. Were adequate scenarios considered?

    b. Were the assumptions reasonably consistent across the range of alternatives and/or adequately justified where different?

    - Feasibility Study Sections: S.3.8 Key Planning Assumptions; 2.1 Key Planning Assumptions; 2.2 Existing Conditions; 2.3 Future Without Project Condition; 2.7.5 Final Array of Alternatives; 2.8 Evaluation of Alternative Plans

    - EIS Section: 4.0 Environmental Consequences

    - Engineering Appendix Sections: 2.5.3.5.3 Future Without Project (FWOP); 2.5.3.5.4 Future With Projects/Project Alternatives (FWP)

24. Are the changes between the without and with project conditions adequately described for each alternative?

    - Feasibility Report Sections: 2.3 Future Without Project Condition; 2.7.5 Final Array of Alternatives; 2.8 Evaluation of Alternative Plans

    - EIS Section: 4.0 Environmental Consequences

    - Engineering Appendix Sections: 2.5.3.5.3 Future Without Project (FWOP); 2.5.3.5.4 Future With Projects/Project Alternatives (FWP)

25. Are the uncertainties inherent in our evaluation of benefits, costs, and impacts, and any risk associated with those uncertainties, adequately addressed and described for each alternative?

- Feasibility Study Sections: 2.1 Key Planning Assumptions; 2.2 Existing Conditions; 2.3 Future Without Project Conditions; 2.6.1.1 Risk and Uncertainty Associated with Restoration Measure Types; 2.8.1 Risks and Uncertainties; 2.5.4 Risk-Informed Planning Framework; 2.8.2 Relative Sea Level Rise Scenarios

- EIS Sections: 3.0 Affected Environment; 4.0 Environmental Consequences EIS Sections 2.7.1 Risk and Uncertainties; 2.12 Scientific Issues and Technical Uncertainties.

- Engineering Appendix Section 9.0 Cost Estimates

26. Are future Operation, Maintenance, Repair, Replacement, and Rehabilitation efforts adequately described and are the estimated cost of those efforts reasonable for each alternative?

    - Feasibility Report Sections: 3.0 Tentative Recommendations; 4.1.8 Operation and Maintenance; 4.3 Division of Plan Responsibilities, Cost Sharing and Other Non-Federal Responsibilities

    - EIS Section: 2.10 Adaptive Management

    - Engineering Appendix Section: 8.0 Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R)

27. Please comment on the screening of the proposed alternatives.

    a. Are the screening criteria appropriate?

    b. In your professional opinion are the results of the screening acceptable?

    c. Were any measures or alternatives screened out too early?

    d. As measures and alternatives were screened out, was the process transparent?

    e. Were there any issues with the initial screening by geographic reach?

    f. Were there other alternatives which should have been carried into the final array?

    - Feasibility Report Sections: 2.4 to 2.10

    - EIS Section: 2.0 Alternatives Formulation

28. Were the engineering, economic, and environmental analyses used for this study consistent with generally accepted methodologies?

a. Why or why not?

- Applicable to all reports

29. Does any alternative include identified separable elements (a portion of a project that is physically separable; and produces hydrologic effects or physical or economic benefits that are separately identifiable from those produced by other portions of the project)?

    a. If so, is each identified separable element independently justified and are the benefits, costs, and effects of the separable elements correctly divided?

- Feasibility Study Sections: 2.6 to 2.10

Recommended Plan

30. Comment on whether you agree or disagree with how the selected alternative was formulated and selected.

    a. Comment on the plan formulation.

    b. Does it meet the study objectives and avoid violating the study constraints?

- Feasibility Report Sections: 2.6 Identification and Screening of Management Measures through 2.10 Tentative Plan Selection; and Chapter 3: Tentative Recommendations.

- EIS: Chapter 2: Plan Formulation

31. Are there any environmental impacts not identified and, if so, could they impact plan selection?

- Feasibility Report Sections: 2.2 Existing Conditions; 2.3 Future Without Project Conditions.

- EIS: Chapter 3 Affected Environment; Chapter 4 Environmental Consequences

32. Please comment on the likelihood that the recommended plan achieves the expected outputs.

- Feasibility Report Sections: 2.5 Study Goals, Constraints and Objectives to 2.10 Tentative Plan Selection.

- EIS Sections: 2.0 Plan Formulation; 4.0 Environmental Consequences.

- Engineering Appendix Sections: 2.0 Hydrology and Hydraulics; 4.0 Geotechnical; 5.0 Civil Design; Annex 1

33. Please comment on the completeness of the recommended plan (i.e., will any additional efforts, measures, or projects be needed to realize the expected benefits)?

    - Feasibility Report Sections: 2.9 Comparison of Alternative Plans; 2.10 Tentative Plan Selection; 3.0 Tentative Recommendations

    - EIS Sections: 2.0 Alternatives Formulation; 7.0 Conclusions and Recommendations

34. Please comment on the appropriateness of location, sizing, and design of plan features.

    - Feasibility Report Sections: 1.0 Introduction and Background; 2.0 Plan Formulation

    - EIS: Chapter 1 Introduction; Chapter 2 Alternative Formulation.

    - Engineering Appendix Sections: 2.0 Hydrology and Hydraulics; 4.0 Geotechnical; 5.0 Civil Design; Annex 1

Purpose Specific Questions: Ecosystem Restoration

35. Are the expected changes in the quality and abundance of desired ecological resources clearly and precisely specified in justifying the ecosystem restoration and protection investment?

    a. Is the significance of the sought ecological resources clearly determined by institutionalized national goals (e.g., the ESA national goal to sustain native fish and wildlife; the NEPA goal to preserve natural heritage)?

    b. Is the scarcity of the sought ecological resources characterized in terms of national abundance and significance (e.g., with indicators of low to high potential for sustainability)?

    c. Is the distinctiveness of the sought ecological resources quality indicated (are there closely related resources that substitute in most respects)?

    d. Are forecast changes in sought ecological resource quality quantified so as to indicate achievement of national goals?

    - Feasibility Study Sections: S.2.6 Federal Interest; S.7 Expected Project Performance; 1.8 Roadmap for Restoring Ecosystem Resiliency and Sustainability; 2.2 Existing Conditions; 2.3 Future Without Project Conditions; 2.8.3 Comparison of Impacts to Significant Resources; 2.9

Comparison of Alternatives; 2.10 Tentative Plan Selection; 3.0 Tentative Recommendations

- EIS Sections: 1.4 Purpose and Need for the Proposed Action; 2.2 Conceptual Ecological Model; 3.0 Affected Environment; 4.0 Environmental Consequences

36. Is it clear that restoration of the desired ecological resource quality is a function of improvements in habitat quality or quantity?

    a. Do planning models and procedures clearly link habitat improvement to the needs of the targeted ecological resources?

    b. Do planning models and procedures adequately consider and provide for limiting factors beyond quality and quantity of habitat?

    - Feasibility Study Sections: S.4 Systems/Watershed Context; S.7 Expected Project Performance; 2.2 Existing Conditions; 2.3 Future Without Project Condition; 2.7 Alternative Plan Formulation

    - EIS Sections: 2.2 Conceptual Ecological Model; 3.0 Affected Environment; 4.0 Environmental Consequences; Appendix M Wetland Value Assessments

37. Is it clear that the restored ecological resource quality will be sustainable over the long run?

38. Are the risks facing successful restoration of sustainable ecological resource quality clearly shown to be managed and any residual risks identified in terms of :

    a. Sufficient geophysical support (hydrology and geomorphology)?

    b. Sufficient environmental chemistry?

    c. Sufficient biological support (e.g., food, habitat and systems-stabilizing species)?

    d. Changes in climate and in the influential ecoregion (e.g., major land use changes)?

    - Feasibility Study Sections: 2.5.3 Challenges Associated with Limited Resources; 2.5.4 Risk-Informed Planning Framework; 2.5.5 Objectives Found to be Unattainable; 2.6.1.1 Risk and Uncertainty Associated with Restoration Measure Types; 2.8.1 Risks and Uncertainties; 2.8.2 Relative Sea Level Rise Scenarios; 2.10.2 Trade-Off Analysis

- EIS Sections: 2.7.1 Risk and Uncertainties; 2.12 Scientific Issues and Technical Uncertainties.

39. Are the required long-term commitments (both Federal and non-Federal) to sustaining the restored ecological resource quality adequately described and adequately demonstrated?

    - Engineering Appendix: 8.0 Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R)

    - Feasibility Study Sections: 3.0 Tentative Recommendations; 4.0 Plan Implementation

    - EIS Sections: 2.10 Adaptive Management; 2.11 Environmental Commitments; 6.0 Environmental Requirements; Appendix T Adaptive Management

Project-Specific Questions

40. Is there adequate justification for the selected sediment sources?

    a. Have all sources of sediment be adequately considered?

    b. Are temporary, localized adverse impacts to EFH justified by higher costs of alternative sources?

    - Feasibility Study Sections: 2.5.3 Challenges Associated with Limited Resources; 2.5.5 Objectives Found to be Unattainable

    - EIS Sections: 4.7 Sediments; 4.14 Aquatic and Fisheries Resources; 4.15 Commercial Fisheries; 4.17 Water Bottoms and Benthic Resources; 4.19 Essential Fish Habitat; 4.20 Threatened and Endangered Species; Appendix B USFWS Coordination/CAR: Appendix C NMFS Coordination; Appendix G Threatened and Endangered Species Consultation

41. Is there adequate justification for the selected freshwater diversion location and sizing?

    - Feasibility Study Sections: 1.4.2 MRGO Environmental Impacts; 2.1 Key Planning Assumptions; 2.2.3 Hydrology; 2.3.5 Future Hydrology; 2.6.2 Initial Screening Process; 2.7.1 Preliminary Evaluation of Measures; 2.7.2 Violet Freshwater Diversion

    - Engineering Appendix Sections: 2.0 Hydrology and Hydraulics; Annex 1 Modeling Report

- EIS Sections: 3.6 Hydrology-Hydraulics; 4.3 Hydrology-Hydraulics

FINAL OVERVIEW QUESTION

42. What is the most important concern you have with the document or its appendices that was not covered in your answers to the questions above?