Battelle
The Business of Innovation

December 4, 2013

Final Independent External Peer Review Report for the Integrated Feasibility Report and Draft Environmental Impact Statement for Bogue Banks, Carteret County, North Carolina



Prepared by
Battelle Memorial Institute

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

Contract No. W912HQ-10-D-0002
Task Order: 0049

Final Independent External Peer Review Report for the Integrated Feasibility Report and Draft Environmental Impact Statement for Bogue Banks, Carteret County, North Carolina

by

Battelle
505 King Avenue
Columbus, OH 43201

for

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

December 4, 2013

Contract No. W912HQ-10-D-0002
Task Order: 0049

This page is intentionally left blank.

Final Independent External Peer Review Report for the

Integrated Feasibility Report and Draft Environmental Impact Statement for Bogue Banks, Carteret County, North Carolina

EXECUTIVE SUMMARY

Project Background and Purpose

The Bogue Banks study is being pursued under the Corps of Engineers' General Investigation (GI) Program. The Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS) is being conducted in response to the following resolution adopted July 23, 1998:

> Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives that the Secretary of the Army is requested to review the report of the Chief of Engineers dated November 27, 1984, on Bogue Banks and Bogue Inlet, North Carolina, and other pertinent reports, to determine whether any modifications of the recommendations contained therein are advisable at the present time in the interest of shore protection and related purposes for Bogue Banks, North Carolina.

The area known as Bogue Banks is a barrier island located entirely within Carteret County on the central North Carolina coast. The island faces the Atlantic Ocean on the south and extends approximately 25.4 miles from Beaufort Inlet on the east to Bogue Inlet on the west. Bogue Sound separates Bogue Banks from the mainland to the northern communities of the island, from east to west, include Fort Macon State Park, Atlantic Beach, Pine Knoll Shores, Salter Path, Indian Beach, and Emerald Isle. The non-federal sponsors' interest is in developing a plan for reducing storm damages. The study area extends landward approximately 500 feet from the shoreline. Seaward the study area extends from the shoreline approximately 1 mile. The study area also includes offshore borrow areas lying 1 to 8 miles from the shoreline and borrow areas in Beaufort Inlet and Bogue Inlet.

The Bogue Banks feasibility study is investigating measures and plans for coastal storm damage reduction. The study is also documenting incidental recreation benefits. Located between Cape Lookout and Cape Fear, Bogue Banks is a frequent target for hurricanes and tropical storms tracking along the mid-Atlantic coast. In addition to these direct landfalling storms, many storms that have passed offshore without making landfall have also impacted the study area. Local impacts on the study area have varied depending on the landfall location and strength of the storm.

Typical solutions considered for this study area are berm and dune beachfills using material dredged from offshore borrow sites, and in some cases building relocations, or coastal structures such as groins or breakwaters.

Independent External Peer Review Process

The U.S. Army Corps of Engineers (USACE) is conducting an Independent External Peer Review (IEPR) of the Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS) for Bogue Banks, Carteret County, North Carolina (hereinafter Bogue Banks IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, is free from conflict of interest (COI), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2012). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate the IEPR of the Bogue Banks IEPR. 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 (2012) 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).

Based on the technical content of the Bogue Banks IEPR review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: coastal engineering, economics/Civil Works planning, and biology/ecology. Three panel members were selected for the IEPR. USACE was given the list of candidate panel members, but Battelle made the final selection of the Panel.

The Panel received an electronic version of the 847-page Bogue Banks IFR/DEIS, along with a charge that solicited comments on specific sections of the documents to be reviewed. USACE prepared the charge questions following guidance provided in USACE (2012) and OMB (2004), which were included in the draft and final Work Plans.

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

IEPR panel members reviewed the Bogue Banks IEPR 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, nine Final Panel Comments were identified and documented. Of these, three were identified as having high significance, five had medium significance, and one had low significance.

Results of the Independent External Peer Review

The panel members agreed among one other on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Bogue Banks IEPR review documents. 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 summarizes the Panel's findings.

The Panel agreed that the Bogue Banks review documents and appendices are well-written and organized, and information is presented in a way that is accessible to readers of diverse backgrounds. It is clear that USACE has made a concerted effort to collaborate with Carteret County to achieve common objectives. While the Panel deemed the report well-written with robust documentation in many areas, it identified areas where additional documentation and clarification is warranted.

Engineering – The Panel found many aspects of the engineering analyses to be technically sound, the model assumptions well-documented and appropriate, and the majority of the engineering analysis thoroughly described (e.g., specification of representative profiles, grains size analyses); however, other areas lacked the same set of robust documentation, or did not appear to follow contemporary methods. The three primary issues identified by the Panel in their review of the IFR/DEIS concern the engineering analysis. The Panel found that non-historical storm events, other than alternate astronomical tide possibilities, have not been considered in the Beach-fx analysis. The IFR/DEIS also does not present a basis for the selection of the storms making up the storm set used in Beach-fx. It is plausible that storms outside the range provided in the historical record could occur, but they are not considered in the Beach-fx analysis. Reliance on the historical storm population alone could lead to errors in the damage estimates, or at the very least add measurably to the uncertainty. Omission of plausible non-historical events and/or significant contemporary historical events from this storm set could affect the economic analysis and alternative selection process, including the identification of the Tentatively Selected Plan (TSP). The Panel believes this issue can be addressed by discussing (a) the adequacy of the historical storm sample to represent all plausible future events, (b) the impact of omitting plausible non-historical storms on the Beach-fx results, in terms of uncertainty added, and (c) how the number of lifecycle realizations used in the Beach-fx analysis was verified as suitable for this study area.

The Panel found that the uncertainties in the coastal engineering numerical modeling inputs and outputs are not presented and do not appear to be considered in the economic analysis and carried into the benefit to cost ratio. As a result, the relative magnitude of these uncertainties and their implications for the economic analysis and the alternative selection process cannot be determined. The Panel believes this concern can be addressed by clarifying if and how engineering numerical modeling uncertainty was quantified and discussing the uncertainty (i.e., error) in the coastal engineering numerical modeled estimates of surges, waves, storm erosion, and beach-fill evolution in the context of impacts on alternative selection and project justification.

The Panel also noted the Planform Evolution Model used to predict beach-fill evolution and renourishment interval does not appear to have been validated for use in the study area. In order for the Panel to assess the adequacy and acceptability of the model results, documentation that the model is sufficiently accurate and that it has been used appropriately in this study needs to be provided. Reliable estimation of the renourishment interval is critically important to the economic justification and engineering success of the proposed project. To address this concern, the Panel recommends that the IFR/DEIS include references such as peer reviewed articles and technical papers for the Planform Evolution Model that demonstrate the model is an appropriate choice for renourishment interval estimation and is vetted by the coastal engineering community.

Economics/Plan Formulation – The Panel found that the economic presentation was well organized, concise, and that the with- and without-project condition damages were presented in a very useful incremental evaluation format. However, the Panel has some concerns regarding the non-structural alternatives, the without-project conditions, other social effects and recreational benefits.

The Panel cannot make a reasonable judgment on the completeness of the non-structural screening process. The screening of non-structural alternatives from the areas of highest economic damage has not been presented and it is unknown if the full array of non-structural alternatives was considered. There is no discussion of the screening of other non-structural measures and alternatives, such as barrier walls and partial ring levees. This issue can be addressed by describing the affected structures in 10 (of the 117) reaches to support the disproportionately high structural/content damage associated with wave and attendant flooding damage, as well as providing the analysis to support the assertion that non-structural alternatives from the five cited reaches create engineering unsustainability.

The economic analysis provided in the IFR/DEIS does not reflect a non-Federal beach nourishment effort, which is highly probable to occur, as part of the future without-project conditions. The assumption that non-Federal nourishment would not occur under future without-project conditions contradicts historical activities and adds uncertainty to the economic analysis. The Panel believes this issue can be addressed by providing a history of nourishment efforts for Bogue Banks and revising the project cost, if necessary, to reflect any change in the interpretation of the future without-project condition.

Risk and uncertainty are addressed specifically in the main report and a probabilistic approach is used in the engineering modeling as it affected the economic consequences. However, the modeled storm conditions appear to have additional costs associated with achieving recreational benefits that have not been quantified. A storm that could damage the front line or first three rows of residential and commercial structures would also flood the remainder of the barrier island, and damage residential and commercial properties as well as considerable infrastructure throughout the barrier island. Therefore, although the TSP would reduce these residual risks to the first three rows of residential and commercial structures, the remainder of the island would have to be rehabilitated to realize the recreational benefits associated with the TSP. The Panel recommends that a discussion to quantify the effects of residual risks on project-related recreational benefits be provided to help address this issue.

Finally, it is not clear whether public concerns have been identified and described or project benefits and impacts have been communicated to the public. This concern can be addressed by incorporating public and agency comments into the IFR/DEIS and revise them, as necessary.

Environmental – The Panel found that the environmental commitments described in Appendix G are appropriate to address and minimize the environmental impacts associated with dredging and placement of sand on the beach. Furthermore, the description of dredging methods in the Environmental Effects Chapter is well-done and informative, and the description of the Affected Environment in the IFR is complete and well-documented with references. However, after reviewing the documentation provided, the Panel is not certain if USFWS is aware of the extent of Off Road Vehicle (ORV) use on Bogue Banks. The Panel is concerned whether existing and future ORV use has been considered by USFWS, since these activities may affect nesting sea turtles, piping plovers, and seaside amaranth, which are all federally listed species. This issue can be addressed by including language in the IFR/DEIS clarifying that USACE has discussed the potential impacts of ORV use on listed species occurring in Bogue Banks with USFWS, and that these impacts do not affect USFWS's decision to not issue a new Biological Opinion.

Table ES-1. Overview of Nine Final Panel Comments Identified by the Bogue Banks IEPR Panel

No.	Final Panel Comment
	Significance – High
1	Limiting the Beach-*fx* storm population to those storms that have historically affected the area is not consistent with contemporary methods, and by excluding plausible storm events potential failure of the beach and related consequences may not have been fully evaluated.
2	The uncertainties in the coastal engineering numerical modeling inputs and outputs are not presented and do not appear to have been considered in the economic analyses and carried through to the benefit-to-cost ratio.
3	The Planform Evolution Model used to predict beach-fill evolution and renourishment interval does not appear to have been validated for use in the study area.
	Significance – Medium
4	The screening of non-structural alternatives from the areas of highest economic damage has not been presented and it is unknown if the full array of non-structural alternatives was considered.
5	The assumption that non-Federal nourishment would not occur under future with-out-project conditions contradicts historical activities and adds uncertainty to the economic analysis.
6	The economic impact on recreational benefits resulting from damage to the first three rows of residential and commercial structures that could occur under modeled storm conditions has not been quantified.
7	Off Road Vehicle use within the project area has not been factored into the analysis of impacts on protected species.
8	It is not clear whether public and governmental agency concerns have been identified and described, or if project benefits and impacts have been communicated to the public.
	Significance – Low
9	The IFR/DEIS does not include a discussion of how the TSP will provide increased accessibility for low-income segments of the population, as discussed in ER-1105-2-100 and to be fully compliant with Executive Order 12898.

This page is intentionally left blank.

Table of Contents

List of Tables

LIST OF ACRONYMS

ASCE	American Society of Civil Engineers
ATR	Agency Technical Review
CEDAS	Coastal Engineering Design and Analysis System
COI	Conflict of Interest
COPRI	Coasts, Oceans, Ports, and Rivers Institute
CWRB	Civil Works Review Board
DEIS	Draft Environmental Impact Statement
DrChecks	Design Review and Checking System
EC	Engineer Circular
EFH	essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIMP	Fire Island to Montauk Point
FR	Feasibility Report
GI	General Investigation
IEPR	Independent External Peer Review
IFR	Integrated Feasibility Report
MMPA	Marine Mammals Protection Act
NED	National Economic Development
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NRC	Nuclear Regulatory Commission
O&M	Operations and Management
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
ORV	Off Road Vehicle
PDT	Project Delivery Team
SAR	Safety Assurance Review
TSP	Tentatively Selected Plan
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

1. INTRODUCTION

The Bogue Banks study is being pursued under the Corps of Engineers' General Investigation (GI) Program. The Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS) is being conducted in response to the following resolution adopted July 23, 1998:

> Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives that the Secretary of the Army is requested to review the report of the Chief of Engineers dated November 27, 1984, on Bogue Banks and Bogue Inlet, North Carolina, and other pertinent reports, to determine whether any modifications of the recommendations contained therein are advisable at the present time in the interest of shore protection and related purposes for Bogue Banks, North Carolina.

The area known as Bogue Banks is a barrier island located entirely within Carteret County on the central North Carolina coast. The island faces the Atlantic Ocean on the south and extends approximately 25.4 miles from Beaufort Inlet on the east to Bogue Inlet on the west. Bogue Sound separates Bogue Banks from the mainland to the northern communities of the island, from east to west, include Fort Macon State Park, Atlantic Beach, Pine Knoll Shores, Salter Path, Indian Beach, and Emerald Isle. The non-Federal sponsors' interest is in developing a plan for reducing storm damages. The study area extends landward approximately 500 feet from the shoreline. Seaward the study area extends from the shoreline approximately 1 mile. The study area also includes offshore borrow areas lying 1 to 8 miles from the shoreline and borrow areas in Beaufort Inlet and Bogue Inlet.

The Bogue Banks feasibility study is investigating measures and plans for coastal storm damage reduction. The study is also documenting incidental recreation benefits. Located between Cape Lookout and Cape Fear, Bogue Banks is a frequent target for hurricanes and tropical storms tracking along the mid-Atlantic coast. In addition to these direct landfalling storms, many storms that have passed offshore without making landfall have also impacted the study area. Local impacts on the study area have varied depending on the landfall location and strength of the storm.

Typical solutions considered for this study area are berm and dune beachfills using material dredged from offshore borrow sites, and in some cases building relocations, or coastal structures such as groins or breakwaters.

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) for the IFR/DEIS for Bogue Banks, Carteret County, North Carolina (hereinafter Bogue Banks IEPR) in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers (USACE) Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE, 2012) and Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004). 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 Bogue Banks IEPR. 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 (2012).

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

In this case, the IEPR of the Bogue Banks IFR/DEIS was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-214). Battelle, a 501(c)(3) organization under the U.S. Internal Revenue Code, has 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 (2012) and in accordance with OMB (2004) guidance. Supplemental guidance on evaluation for conflict 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. In addition, 62 charge questions were provided by USACE and included in the draft and final Work Plans. This charge included two additional questions added by Battelle that sought summary information from the IEPR Panel. The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Table 1 presents the schedule followed in executing the IEPR. Due dates for milestones and deliverables are based on the award/effective date of September 11, 2013. The review documents were provided to Battelle by USACE on September 11, 2013. Note that the work items listed in Task 6 occur after the submission of this report. Battelle will enter the nine Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports

and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle. Battelle will provide USACE and the Panel a pdf printout of all DrChecks entries, through comment closure, as a final deliverable and record of the IEPR results.

Table 1. Bogue Banks IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	9/11/2013
	Review documents available	9/11/2013
	Battelle submits draft Work Plan[a]	9/23/2013
	USACE provides comments on draft Work Plan	9/26/2013
	Battelle submits final Work Plan[a]	9/30/2013
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	9/18/2013
	USACE provides comments on COI questionnaire	9/20/2013
	Battelle submits list of selected panel members[a]	9/30/2013
	USACE confirms the panel members have no COI	10/3/2013
	Battelle completes subcontracts for panel members	10/10/2013
3	Battelle convenes kick-off meeting with USACE	9/24/2013
	Battelle sends review documents to panel members	10/11/2013
	Battelle convenes kick-off meeting with panel members	10/15/2013
	Battelle convenes kick-off meeting with USACE and panel members	10/15/2013
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	10/25/2013
	Civil Works Review Board (CWRB)	4/2014 Tentative
4	Panel members complete their individual reviews	10/29/2013
	Battelle provides panel members with talking points for Panel Review Teleconference	11/4/2013
	Battelle convenes Panel Review Teleconference	11/5/2013
	Battelle provides Final Panel Comment templates and instructions to panel members	11/6/2013
	Panel members provide draft Final Panel Comments to Battelle	11/13/2013
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	11/14-11/21/2013
	Battelle finalizes Final Panel Comments	11/22/2013

Table 2. Bogue Banks IEPR Schedule (continued)

Task	Action	Due Date
5	Battelle provides Final IEPR Report to panel members for review	11/26/2013
	Panel members provide comments on Final IEPR Report	12/2/2013
	Battelle submits Final IEPR Report to USACE[a]	**12/4/2013**
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	12/6/2013
	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	12/6/2013
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	12/6/2013
	USACE provides draft PDT Evaluator Responses to Battelle	12/13/2013
	Battelle provides the panel members the draft PDT Evaluator Responses	12/16/2013
	Panel members provide Battelle with draft BackCheck Responses	12/19/2013
	Battelle convenes teleconference with panel members to discuss draft Back-Check Responses	12/19/2013
	Battelle convenes Comment-Response Teleconference with panel members and USACE	12/20/2013
	USACE inputs final PDT Evaluator Responses to DrChecks	12/31/2013
	Battelle provides final PDT Evaluator Responses to panel members	1/6/2014
	Panel members provide Battelle with final BackCheck Responses	1/9/2014
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	1/10/2014
	Battelle submits pdf printout of DrChecks project file[a]	1/13/2014
	Contract End/Delivery Date	5/5/2014

a Deliverable.

b Task 6 occurs after the submission of this report.

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: coastal engineering, economics/Civil Works planning, and biology/ecology. These areas correspond to the technical content of the Bogue Banks IEPR and overall scope of the Bogue Banks IEPR.

To identify candidate panel members, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle evaluated these candidate panel members in terms of their technical expertise and potential COIs. Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected three experts for the final Panel.

The three selected reviewers constituted the final Panel. The remaining candidates were not

proposed for a variety of reasons, including lack of availability, disclosed COIs, or lack of the precise technical expertise required.

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.

- Previous and/or current involvement by you or your firm[2] in the IFR/DEIS for Bogue Banks, Carteret County, North Carolina or technical appendices.
- Previous and/or current involvement by you or your firm[2] in coastal storm damage reduction projects in North Carolina
- Previous and/or current involvement by you or your firm[2] in the IFR/DEIS for Bogue Banks, Carteret County, North Carolina related projects.
- Previous and/or current involvement by you or your firm[2] in the conceptual or actual design, construction, or operations and maintenance (O&M) of any projects in the IFR/DEIS for Bogue Banks, Carteret County, North Carolina related projects.
- Current employment by the USACE.
- Previous and/or current involvement with paid or unpaid expert testimony related to the IFR/DEIS for Bogue Banks, Carteret County, North Carolina.
- Previous and/or current employment or affiliation with members of the cooperating agencies or local sponsors: Carteret County Shore Protection Office (for pay or pro bono).
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to Bogue Banks, North Carolina.
- Current personal involvement in 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 Wilmington District.

[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 a panel member's firm is involved and if the firm serves as a prime or as a subcontractor to a prime.

- Previous or current involvement in the development or testing of models that will be used for or in support of the IFR/DEIS for Bogue Banks, Carteret County, North Carolina project.
- Current firm[2] involvement in other USACE projects, specifically those projects/contracts that are with the Wilmington District. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please also clearly delineate the percentage of work you personally are currently conducting for the Wilmington District. Please explain.

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. One of the three final reviewers is affiliated with an academic institution and the other two are affiliated with consulting companies. 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 selection of the Panel. Section 4 of this report provides names and biographical information on the panel members.

3.3 Conduct of the IEPR

Prior to beginning their review and within 1 day 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. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge as well as the Bogue Banks IEPR review documents and reference materials listed below. The documents and files in bold font were provided for review; the other documents were provided for reference or supplemental information only.

- **Integrated Feasibility Report and Draft Environmental Impact Statement Bogue Banks, Carteret County, North Carolina (918 pp) with appendices:**
  - **Appendix A - Coastal Engineering (100 pp)**
  - **Appendix B - Economics (77 pp)**
  - **Appendix C - Geotechnical Engineering (25 pp)**
  - **Appendix D - Cost Engineering (72 pp)**
  - **Appendix E - Archaeological Survey (76 pp)**
  - **Appendix F - Biological Assessment (72 pp)**
  - **Appendix G - Environmental Commitments (9 pp)**
  - **Appendix H - Real Estate (33 pp)**
  - **Appendix I - Parking and Access (35 pp)**
  - **Appendix J - Cumulative Impact Assessment (27 pp)**
  - **Appendix K - 404b1 Analysis (8 pp)**
  - **Appendix L - Draft Fish and Wildlife Coordination Act Report (184 pp)**

In addition, throughout the review period, USACE provided documents at the request of panel members. These documents were provided to Battelle and then sent to the Panel as additional information only and were not part of the official review. A list of these additional documents requested by the Panel is provided below.

- Feasibility Report and Environmental Assessment Moorhead City Harbor Improvement Moorhead City, North Carolina
- Summary of Morehead City Harbor Section 111 Study and Status Report on Other Projects Related to Beach Erosion at Bogue Banks
- Final Detailed Project Report on Improvement of Navigation and Environmental Impact Statement Bogue Inlet North Carolina.

About half way through the review of the Bogue Banks IEPR review documents, a teleconference was held with USACE, the Panel, and Battelle so that USACE could answer any questions the Panel had concerning either the review documents or the project. Prior to this teleconference, Battelle submitted 41 panel member questions to USACE. USACE was able to respond to a majority of the questions during the teleconference; the remaining panel member questions that required additional coordination within USACE were addressed by USACE by November 14, 2013.

3.4 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response table provided by Battelle. At the end of the review period, the Panel produced individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle summarized the individual comments into a preliminary list of 12 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.5 IEPR Panel Teleconference

Battelle facilitated a 4-hour teleconference with the Panel so that the panel members could exchange technical information. The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments in the Final IEPR Report and decide which panel member 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.

At the end of these discussions, the Panel identified nine 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 Bogue Banks IEPR:

- Lead Responsibility: For each Final Panel Comment, one Panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. Battelle modified lead assignments at the direction of the Panel. To assist each lead in the development of the Final Panel Comments, Battelle distributed 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 the other panel members as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.
- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:
    1. Comment Statement (succinct summary statement of concern)
    2. Basis for Comment (details regarding the concern)
    3. Significance (high, medium, 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).

Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. At the end of this process, nine Final Panel Comments were prepared and assembled. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The 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 three 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. Bogue Banks IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Irish	Bastian	Thoemke
Coastal Engineering			
Minimum 10 years of experience in coastal and hydraulic engineering with an emphasis on large public works projects, ***or*** a professor from academia with extensive background in coastal processes and hydraulic theory and practice.	X		
Familiarity with large, complex Civil Works projects with high public and interagency interests	X		

Table 2. Bogue Banks IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Irish	Bastian	Thoemke
Familiarity with the USACE application of risk and uncertainty analyses in coastal storm damage reduction studies.	X		
Demonstrated experience in design of stabilizing dunes and beach berms.	X		
Familiarity with standard USACE coastal computer models	X		
Familiarity with the SBEACH and BEACH-fx programs models	X		
Familiarity with geotechnical engineering principles including sediment characterization.	X		
Capable of addressing the USACE Safety Assurance Review (SAR) aspects of projects	X		
M.S. degree or higher in engineering	X		
Registered Professional Engineer	X		
Economics/Civil Works Planner			
Minimum 10 years of demonstrated experience in public works planning.		X	
Minimum of 10 years of experience in coastal economics evaluation and flood risk evaluation.		X	
Familiarity with large, complex Civil Works projects with high public and interagency interests		X	
High level of familiarity with USACE plan formulation process, procedures, and standards.		X	
Familiarity with USACE coastal storm damage reduction projects.		X	
Experience related to regional economic development, and ability to evaluate traditional National Economic Development plan benefits associated with hurricane and coastal storm damage reduction projects.		X	
Familiarity with the Beach-fx models.		X	
M. S. or higher degree in economics		W[1]	
Biologist/Ecologist			
Minimum 10 years of demonstrated experience with projects on the southeast Atlantic coast of the United States			X
Familiarity with large, complex Civil Works projects with high public and interagency interests			X

Table 2. Bogue Banks IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Irish	Bastian	Thoemke
Knowledge of construction impacts on the marine and terrestrial ecology of coastal regions and characterization of benthic communities.			X
Familiarity with all National Environmental Policy Act (NEPA) EIS requirements			X
Experience with:			X
• the Endangered Species Act (ESA)			X
• essential fish habitat (EFH)			X
• the Marine Mammals Protection Act (MMPA)			X
M.S. or higher degree in an appropriate field of study.			X

[1] *Waiver statement presented as part of Task 2 deliverable and approved by USACE*

Jennifer Irish, P.E., Ph.D.

Role: Coastal engineering experience and expertise
Affiliation: Virginia Tech

Dr. Irish is an associate professor in the department of Civil and Environmental Engineering at Virginia Tech. She earned her Ph.D. in civil engineering from the University of Delaware in 2005, is a licensed professional engineer in New York, and a Diplomate of Coastal Engineering. She has 19 years of experience in the coastal and civil engineering field. Dr. Irish was a coastal engineer for USACE from 1994 to 2005, and held a research position at the USACE Coastal and Hydraulics Laboratory from 1994 to 2001.

In this role she performed research on the measurement of bathymetry and ocean waves, navigation channel shoaling, wetlands restoration, shore protection, and coastal processes. From 2001 to 2006 she was a coastal engineer and coastal engineering regional technical specialist at the USACE New York District and North Atlantic Division where she led studies on storm damage reduction, including numerical modeling and risk assessment of storm surge, waves, and morphological response. She was the lead technical engineer for surge modeling in support of the Fire Island to Montauk Point (FIMP) Storm Damage Reduction Study and technical expert on the Hurricane Katrina surge study for New Orleans, Louisiana (Interagency Performance Evaluation Task Force). Her expertise in coastal processes and hydraulic theory derives from her experience teaching courses on related topic and from research and engineering activities related to fluid dynamics, storm surge, coastal hazard risk assessment, wave mechanics, coastal storm morphodynamics, flow and wave dynamics in vegetated regions, beach erosion, barrier island breaching, beach nourishment, and tidal inlet dynamics.

Dr. Irish is familiar with large, complex Civil Works projects with high public and interagency interests through her work at USACE. During that time, she was involved in a number of public

works projects, both as a project team member and as a reviewer in her role as regional technical specialist for the USACE North Atlantic Division. Additionally, she led engineering modeling activities for the large FIMP project. The FIMP project involved significant complexities related to balancing engineering, environmental, policy, and political views and objectives from a host of Federal and local agencies.

Dr. Irish has an in-depth understanding of USACE application of risk and uncertainty analyses in coastal storm damage reduction projects, with coastal flooding probability, risk, and uncertainty a main focus of her research. She has published numerous papers on the subject in such journals as the Journal of Geophysical Research, Coastal Engineering, Natural Hazards, Geophysical Research Letters, and American Society of Civil Engineers (ASCE) Waterway, Port, Coastal, and Ocean Engineering. She was integrally involved in the development and evaluation of JPM-OS, which has become the USACE, Federal Emergency Management Agency (FEMA), and Nuclear Regulatory Commission (NRC) standard for hurricane surge probability analysis. She is also experienced in the use of the Empirical Simulation Technique.

Dr. Irish has extensive experience with USACE coastal numerical models. She has detailed knowledge of ADCIRC, STWAVE, and SBEACH, which she uses in her classes or research. She has additional experience with non-USACE models of a similar nature including the Delft3D suite and XBeach. She has used SBEACH for engineering projects in Long Island, New York, and teaches SBEACH in coastal engineering courses. Dr. Irish has also followed the development of Beach-fx and is familiar with the principles and utility of this model.

In addition, Dr. Irish has extensive experience with beach nourishment and beach performance principles (berm and dune). In particular, she has conducted research on storm-induced overwash and breaching and the influence of nearshore bathymetric changes on swash inundation, and has several publications related to these efforts, including journal papers in Coastal Engineering. Recently she conducted field research on Hurricane Sandy, which involved evaluation of beach systems in storm damage reduction, with initial work published in Coastal Engineering. Additionally, she routinely teaches beach nourishment principles in her coastal engineering courses. Dr. Irish is familiar with the sediment analyses required for beach nourishment design (e.g., grain size analysis).

Dr. Irish is familiar with USACE SAR, and has served as a technical consultant and reviewer for numerous USACE, FEMA, NRC and U.S. Geological Survey (USGS) projects. Dr. Irish has authored more than 35 journal publications, either published or in review, two book chapters in press and more than 30 published conference proceedings relating to civil engineering. She is a member of the ASCE, ASCE Coasts, Oceans, Ports, and Rivers Institute (COPRI), and the American Shore and Beach Preservation Association. Dr. Irish has been the recipient of numerous USACE and U.S. Army achievement awards, including 2008 Department of the Army Superior Civilian Service Award (U.S. Army Director of Civil Works) and the 2006 Department of the Army Commander's Award for Civilian Service (USACE New York District and USACE Mississippi Valley Division).

David Bastian, P.E.

Role: Economic and Civil Works planning experience and expertise
Affiliation: Independent Consultant/David Bastian Consulting

Mr. Bastian is an independent consultant and professional engineer for David Bastian Consulting in Annapolis, Maryland, specializing in USACE compliance and policy review, plan formulation and incremental cost analysis, flood risk reduction, and hydraulic and river engineering. He earned his B.S. in civil engineering from Georgia Institute of Technology and a M.S. in river engineering from Delft University, Holland.

Mr. Bastian has over 35 years of experience with USACE and as contractor/consultant on USACE projects involved in feasibility studies and public works planning, all based on the USACE six-step planning process. As a HQ USACE reviewer, he is familiar with and has direct experience of ER 1105-2-100 as well as other USACE engineering regulations, manuals, and pamphlets. He co-authored the USACE Planner's Workshop Manual. His project history has resulted in his review and collaboration of over 100 USACE reports evaluating and comparing alternative plans.

Mr. Bastian has 20 years of experience in coastal economics evaluation and flood risk evaluation. He has direct experience in identification and evaluation of flood risk, having been involved for nine years in the coastal economic evaluation for coastal Louisiana restoration, the greater New Orleans hurricane and storm damage risk reduction system, and four other study areas along the Louisiana and Texas coasts. He is familiar with large, complex Civil Works projects with high public and interagency interests through his extensive involvement with the Louisiana Coastal Study area pre- and post- Hurricane Katrina. Additionally, he has spent four years working for the greater New Orleans Hurricane and Storm Damage Risk Reduction System planning and constructing the 133-mile levee, floodwall, and massive pumping system.

Mr. Bastian is familiar with USACE coastal storm damage reduction projects and has evaluated and conducted National Economic Development (NED) analysis procedures, particularly as they relate to hurricane and coastal storm damage risk reduction through his participation on the following related projects. He managed the hydrologic and hydraulic studies and contributed to the draft Donaldsonville to the Gulf hurricane risk reduction feasibility study report and the draft Larose to Golden Meadow hurricane risk reduction feasibility study report. He has reviewed the Morganza to the Gulf hurricane risk reduction feasibility study report. He prepared and collaborated on many of the Project Description documents (mini feasibility decision documents) required for the segments comprising the New Orleans Hurricane and Storm Damage Risk Reduction System. Additionally, he participated and was recognized for his work on the Louisiana Coastal Protection and Restoration study where he assisted in writing the report and managing the application of surge model studies. Mr. Bastian is familiar with the USACE flood risk and hurricane/coastal damage risk reduction analysis and economic benefit calculations, including the use of standard USACE computer programs such as HEC-FIA. He has reviewed HEC-FIA and other model applications and their outputs for several flood risk reduction projects for technical economic justification. Mr. Bastian is familiar with the use and application of BEACH-fx models.

Mr. Bastian's previous employment at USACE included positions as Deputy Chief of Staff for Support, Office Chief of Engineers; Assistant Director of Civil Works, Office Chief of Engineers; technical and policy compliance review expert, Washington Level Review Center; and navigation research, USACE Institute for Water Resources. He has served as a USACE Washington level technical and policy compliance review expert and managed interdisciplinary reviews of over 70 feasibility reports. Mr. Bastian's participation in professional societies includes the ASCE, the American Association of Port Authorities, the Permanent International Association of Navigation Congresses, and the Western Dredging Association.

Kris Thoemke, CEP, Ph.D.

Role: Biology and ecology experience and expertise
Affiliation: Coastal Engineering Consultants, Inc.

Dr. Thoemke is a senior scientist for Coastal Engineering Consultants Inc. He received his Ph.D. in biology from the University of South Florida in 1979 and is a certified environmental professional. He has 34 years of experience as a professional ecologist in South Florida, he has been a researcher and land manager for the State of Florida, private ecological consultant, environmental and outdoor communicator, Everglades project manager for a non-profit organization, and teaches undergraduate and graduate level environmental management, fisheries management and fish and wildlife policy and management courses for the American Public University System.

For the past eight years, Dr. Thoemke, as an environmental consultant, has conducted marine and estuarine environmental assessments, environmental permitting and listed species surveys along the Atlantic and Gulf coasts in Florida. His experience with wetlands and estuarine ecosystems includes his Ph.D. work on estuarine invertebrates; 11 years as manager of Rookery Bay National Estuarine Research Reserve in Naples, Florida; four years as a wetlands ecologist conducting Everglades restoration work; and seven years as a wetlands and estuarine consultant. Dr. Thoemke is familiar with large, complex Civil Works projects with high public and interagency interests from his work as a wetland scientist on the Florida Everglades restoration program, ongoing involvement as the environmental scientist for the Charlotte County Florida Erosion Control Project for Stump Pass, and as part of a team working on large Civil Works restoration projects for the State of Louisiana in the Mississippi Delta region.

Dr. Thoemke's experience with construction impacts on marine and terrestrial ecology of coastal regions and characterization of benthic communities includes identification and assessment of construction impacts on seagrass, mangrove, shorebird, and dune plant communities at Stump Pass and Blind Pass, Florida and gopher tortoise habitat at Clam Pass and Vanderbilt Beach Parks, Florida. His Ph.D. research focused on estuarine benthic invertebrates and he has worked for more than 30 years characterizing benthic communities. He also has extensive experience permitting and mitigating for construction impacts resulting from coastal and upland development including assessing and monitoring impacts on beach and dune systems, nesting sea turtles, shorebirds, and upland listed species found in the coastal and beach/dune habitats. In addition, he has conducted post-storm analysis of beach and dune systems.
Dr. Thoemke is familiar with all NEPA and EIS requirements. He knows environmental policies and processes, having prepared reports and served on IEPR panels, including the Walton County

Florida Hurricane and Storm Reduction Feasibility Report and Draft Environmental Assessment, and the Central Everglades Planning Project Draft Project Implementation Report and EIS.

Dr. Thoemke was a member of an integrated team of scientists and engineers that prepared the EIS for the Terrebonne Basin Barrier Island Shoreline Restoration Project, Louisiana that included Endangered Species Act, EFH, and NEPA requirements. In addition, he has reviewed EISs and Environmental Assessments for other coastal restoration projects in the Mississippi Delta. Dr. Thoemke was project manager on the Port Everglades ODMDS Environmental Assessment, which included Marine Mammals Protection Act listed species. Additionally, he has completed Section 7 assessments for listed species under National Marine Fisheries Service jurisdiction for projects in several south Florida locations; and he coordinated with USFWS to prepare an updated Biological Opinion for swimming sea turtles and shorebirds on Marco Island, Florida. He has provided EFH consultation to several projects and continues to prepare EFH for marine and estuarine species as a part of the permitting work. Dr. Thoemke is a member of the National Association of Environmental Professionals and is a member and Chairman of the Certification Review Board of the Academy of Board Certified Environmental Professionals.

5. SUMMARY OF FINAL PANEL COMMENTS

The panel members agreed among one other on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Bogue Banks IEPR document. Table 3 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 summarizes the Panel's findings.

The Panel agreed that the Bogue Banks review documents and appendices are well-written and organized, and information is presented in a way that is accessible to readers of diverse backgrounds. It is clear that USACE has made a concerted effort to collaborate with Carteret County to achieve common objectives. While the Panel deemed the report well-written with robust documentation in many areas, it identified areas where additional documentation and clarification is warranted.

Engineering – The Panel found many aspects of the engineering analyses to be technically sound, the model assumptions well-documented and appropriate, and the majority of the engineering analysis thoroughly described (e.g., specification of representative profiles, grains size analyses); however, other areas lacked the same set of robust documentation, or did not appear to follow contemporary methods. The three primary issues identified by the Panel in their review of the IFR/DEIS concern the engineering analysis. The Panel found that non-historical storm events, other than alternate astronomical tide possibilities, have not been considered in the Beach-fx analysis. The IFR/DEIS also does not present a basis for the selection of the storms making up the storm set used in Beach-fx. It is plausible that storms outside the range provided in the historical record could occur, but they are not considered in the Beach-fx analysis. Reliance on the historical storm population alone could lead to errors in the damage estimates, or at the very least add measurably to the uncertainty. Omission of plausible non-historical events and/or significant contemporary historical events from this storm set could affect the economic analysis and alternative selection process, including the identification of the Tentatively Selected

Plan (TSP). The Panel believes this issue can be addressed by discussing (a) the adequacy of the historical storm sample to represent all plausible future events, (b) the impact of omitting plausible non-historical storms on the Beach-fx results, in terms of uncertainty added, and (c) how the number of lifecycle realizations used in the Beach-fx analysis was verified as suitable for this study area.

The Panel found that the uncertainties in the coastal engineering numerical modeling inputs and outputs are not presented and do not appear to be considered in the economic analysis and carried into the benefit to cost ratio. As a result, the relative magnitude of these uncertainties and their implications for the economic analysis and the alternative selection process cannot be determined. The Panel believes this concern can be addressed by clarifying if and how engineering numerical modeling uncertainty was quantified and discussing the uncertainty (i.e., error) in the coastal engineering numerical modeled estimates of surges, waves, storm erosion, and beach-fill evolution in the context of impacts on alternative selection and project justification.

The Panel also noted the Planform Evolution Model used to predict beach-fill evolution and renourishment interval does not appear to have been validated for use in the study area. In order for the Panel to assess the adequacy and acceptability of the model results, documentation that the model is sufficiently accurate and that it has been used appropriately in this study needs to be provided. Reliable estimation of the renourishment interval is critically important to the economic justification and engineering success of the proposed project. To address this concern, the Panel recommends that the IFR/DEIS include references such as peer reviewed articles and technical papers for the Planform Evolution Model that demonstrate the model is an appropriate choice for renourishment interval estimation and is vetted by the coastal engineering community.

Economics/Plan Formulation – The Panel found that the economic presentation was well organized, concise, and that the with- and without-project condition damages were presented in a very useful incremental evaluation format. However, the Panel has some concerns regarding the non-structural alternatives, the without-project conditions, other social effects and recreational benefits.

The Panel cannot make a reasonable judgment on the completeness of the non-structural screening process. The screening of non-structural alternatives from the areas of highest economic damage has not been presented and it is unknown if the full array of non-structural alternatives was considered. There is no discussion of the screening of other non-structural measures and alternatives, such as barrier walls and partial ring levees. This issue can be addressed by describing the affected structures in 10 (of the 117) reaches to support the disproportionately high structural/content damage associated with wave and attendant flooding damage, as well as providing the analysis to support the assertion that non-structural alternatives from the five cited reaches create engineering unsustainability.

The economic analysis provided in the IFR/DEIS does not reflect a non-Federal beach nourishment effort, which is highly probable to occur, as part of the future without-project conditions. The assumption that non-Federal nourishment would not occur under future without-project conditions contradicts historical activities and adds uncertainty to the economic analysis. The Panel believes this issue can be addressed by providing a history of nourishment efforts for Bogue Banks and revising the project cost, if necessary, to reflect any change in the interpretation of the future without-project condition.

Risk and uncertainty are addressed specifically in the main report and a probabilistic approach is used in the engineering modeling as it affected the economic consequences. However, the modeled storm conditions appear to have additional costs associated with achieving recreational benefits that have not been quantified. A storm that could damage the front line or first three rows of residential and commercial structures would also flood the remainder of the barrier island, and damage residential and commercial properties as well as considerable infrastructure throughout the barrier island. Therefore, although the TSP would reduce these residual risks to the first three rows of residential and commercial structures, the remainder of the island would have to be rehabilitated to realize the recreational benefits associated with the TSP. The Panel recommends that a discussion to quantify the effects of residual risks on project-related recreational benefits be provided to help address this issue.

Finally, it is not clear whether public concerns have been identified and described or project benefits and impacts have been communicated to the public. This concern can be addressed by incorporating public and agency comments into the IFR/DEIS and revise them, as necessary.

Environmental – The Panel found that the environmental commitments described in Appendix G are appropriate to address and minimize the environmental impacts associated with dredging and placement of sand on the beach. Furthermore, the description of dredging methods in the Environmental Effects Chapter is well-done and informative, and the description of the Affected Environment in the IFR is complete and well-documented with references. However, after reviewing the documentation provided, the Panel is not certain if USFWS is aware of the extent of Off Road Vehicle (ORV) use on Bogue Banks. The Panel is concerned whether existing and future ORV use has been considered by USFWS, since these activities may affect nesting sea turtles, piping plovers, and seaside amaranth, which are all federally listed species. This issue can be addressed by including language in the IFR/DEIS clarifying that USACE has discussed the potential impacts of ORV use on listed species occurring in Bogue Banks with USFWS, and that these impacts do not affect USFWS's decision to not issue a new Biological Opinion.

Table 3. Overview of Nine Final Panel Comments Identified by the Bogue Banks IEPR Panel

No.	Final Panel Comment
	Significance – High
1	Limiting the Beach-fx storm population to those storms that have historically affected the area is not consistent with contemporary methods, and by excluding plausible storm events potential failure of the beach and related consequences may not have been fully evaluated.
2	The uncertainties in the coastal engineering numerical modeling inputs and outputs are not presented and do not appear to have been considered in the economic analyses and carried through to the benefit-to-cost ratio.
3	The Planform Evolution Model used to predict beach-fill evolution and renourishment interval does not appear to have been validated for use in the study area.
	Significance – Medium
4	The screening of non-structural alternatives from the areas of highest economic damage has not been presented and it is unknown if the full array of non-structural alternatives was considered.
5	The assumption that non-Federal nourishment would not occur under future with-out-project conditions contradicts historical activities and adds uncertainty to the economic analysis.
6	The economic impact on recreational benefits resulting from damage to the first three rows of residential and commercial structures that could occur under modeled storm conditions has not been quantified.
7	Off Road Vehicle use within the project area has not been factored into the analysis of impacts on protected species.
8	It is not clear whether public and governmental agency concerns have been identified and described, or if project benefits and impacts have been communicated to the public.
	Significance – Low
9	The IFR/DEIS does not include a discussion of how the TSP will provide increased accessibility for low-income segments of the population, as discussed in ER-1105-2-100 and to be fully compliant with Executive Order 12898.

6. REFERENCES

Executive Order No. 12,898, 59 Fed. Reg. 7629 (Feb. 11, 1994). Environmental Justice and Minority and Low Income Populations

Irish, J.L., Resio, D.T., Divoky, D.D. (2011). Statistical properties of hurricane surge along a coast. Journal of Geophysical Research, 116(C10):C10007.

Niedoroda, A.W., Resio, D.T., Toro, G.R., Divoky, D.D., Das, H.S., Reed, C.W. (2010). Analysis of the coastal Mississippi storm surge hazard. Ocean Engineering, 37:82-90.

OMB (2004). Final Information Quality Bulletin for Peer Review. Executive Office of the President, Office of Management and Budget, Washington, D.C. Memorandum M-05-03. December 16.

Pippin, J. (2013). Turtle Habitat Designation for Bogue Banks Draws Concern. http://www.havenews.com/news/local-news/turtle-habitat-designation-for-bogue-banks-draws-concern-1.184928?page=0

Resio, D.T., Irish, J., Cialone, M. (2009). A surge response function approach to coastal hazards assessment - part 1: basic concepts. Natural Hazards, 51:163-182.

Resio, D.T., Wamsley, T.V., Cialone, M.A., and Massey, T.C. (2012). The estimation of very-low probability hurricane storm surges for design and licensing of nuclear power plants in coastal areas. NUREG/CR-7134. Nuclear Regulatory Commission. http://pbadupws.nrc.gov/docs/ML1231/ML12310A025.pdf

The National Academies (2003). Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports. The National Academies (National Academy of Science, National Academy of Engineering, Institute of Medicine, National Research Council). May 12.

USACE (2012). Water Resources Policies and Authorities: Civil Works Review. Engineer Circular (EC) 1165-2-214. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. December 15.

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

This page is intentionally left blank.

APPENDIX A

Final Panel Comments

on the

Bogue Banks IEPR

This page is intentionally left blank.

Final Panel Comment 1

Limiting the Beach-fx storm population to those storms that have historically affected the area is not consistent with contemporary methods, and by excluding plausible storm events potential failure of the beach and related consequences may not have been fully evaluated.

Basis for Comment

Over the last decade, there have been significant advances in the state-of-knowledge on selection of storm conditions, predominantly hurricane conditions, for coastal engineering analysis (e.g., Niedoroda et al. 2010, Resio et al., 2009, Resio et al. 2012). Most notably, it has been shown that reliance on only the historical storm population directly affecting the study area does not adequately reflect exposure risk (e.g., Irish et al. 2011). In this study, non-historical storm events have not been considered in the Beach-fx analysis, only historical events occurring on alternate tide conditions. For this study area, it is plausible that storms outside the range provided in the historical record could occur, but they are not considered in the Beach-fx analysis. Reliance on the historical storm population alone can lead to errors in the damage estimates, or at the very least add measurably to the uncertainty. The exclusion of plausible storms outside the range of the historical storms considered here, particularly those that generate larger surge and/or waves, also denotes that potential failure and related consequences have not fully been evaluated.

The Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS) also does not present a basis for the selection of the storms making up the storm set used in Beach-fx. The period considered for extratropical storms is 1978-1992, and for tropical storms is 1893-1999. While the low rate of occurrence of tropical storms necessitates considering a longer period, no justification is given as to why the storm periods considered for both extratropical and tropical storms do not extend through the current period. As a consequence, the implied storm rate of occurrences in the Beach-fx analysis may be inaccurate. Also, since the 2005 Hurricane Ophelia is used to calibrate SBEACH (the model used to populate storm erosion for the storm set used in Beach-fx), it is inconsistent not to include the historical record through 2005, at a minimum.

In addition, the IFR/DEIS does not address what physical criteria (e.g., observed surge threshold, wave threshold, erosion threshold) were used to select tropical and extratropical storms within the time periods considered.

While Table 4 (Coastal Engineering Appendix, p. A-17) suggests multiple storms per year may be selected within the Beach-fx analysis, it is not clear whether the Beach-fx analysis considers consecutive storms occurring in a short time period, for example, in back-to-back weeks where beach recovery between storms is limited.

Finally, the Panel could not determine how the number of lifecycle realizations used in the Beach-fx analysis was verified as suitable for this study area. This is important since convergence in the Beach-fx results is essential for the economic analysis and

alternative selection process.

Significance – High

Omission of plausible non-historical events and/or significant contemporary historical events from this storm set affects the accuracy and uncertainty of the economic analysis and alternative selection process, including the identification of the Tentatively Selected Plan (TSP).

Recommendations for Resolution

1. Discuss and justify the adequacy of the historical storm sample to represent all plausible future events, and discuss, in terms of uncertainty added, the impact of omitting plausible non-historical storms on the Beach-fx results. References to consider in preparing this discussion are Resio et al. (2009), Niedoroda et al. (2010), Irish et al. (2011), Resio et al. (2012).
2. Discuss and explain the suitability of the historical time periods used to inform storm set selection.
3. Discuss the physical criteria used to select the subset of tropical and extratropical storms selected. For example, if a peaks-over-threshold surge and/or wave criterion or similar was used, provide quantitative information on the parameter ranges employed. If no criteria were used, provide a short discussion on the justification for this approach.
4. Provide more details on selection of storms within a Beach-fx lifecycle. Specifically address whether Beach-fx allows for selection of multiple storms within a season (e.g., back-to-back events), and, if not, discuss implications in terms of potential project failure and Beach-fx uncertainty.
5. Discuss how the number of lifecycle realizations was optimized.

Literature Cited:

Irish, J.L., Resio, D.T., Divoky, D.D. (2011). Statistical properties of hurricane surge along a coast. Journal of Geophysical Research, 116(C10):C10007.

Niedoroda, A.W., Resio, D.T., Toro, G.R., Divoky, D.D., Das, H.S., Reed, C.W. (2010). Analysis of the coastal Mississippi storm surge hazard. Ocean Engineering, 37:82-90.

Resio, D.T., Irish, J., Cialone, M. (2009). A surge response function approach to coastal hazards assessment - part 1: basic concepts. Natural Hazards, 51:163-182.

Resio, D.T., Wamsley, T.V., Cialone, M.A., and Massey, T.C. (2012). The estimation of very-low probability hurricane storm surges for design and licensing of nuclear power plants in coastal areas. NUREG/CR-7134. Nuclear Regulatory Commission. http://pbadupws.nrc.gov/docs/ML1231/ML12310A025.pdf

Final Panel Comment 2

The uncertainties in the coastal engineering numerical modeling inputs and outputs are not presented and do not appear to have been considered in the economic analyses and carried through to the benefit-to-cost ratio.

Basis for Comment

Quantification of uncertainty (i.e., error) in the coastal engineering numerical modeling is essential for developing a robust design and for justifying the selected alternative in the context of both the economic analysis and environmental considerations (namely, impacts related to renourishment interval). However, since the uncertainty associated with the modeling inputs and outputs for the ADCIRC, WIS, SBEACH, PFE, and CMS-WAVE (WABED) analyses is not discussed in the Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS), the Panel does not know whether it was quantified for the simulated estimates of surges, waves, storm erosion, and beach-fill evolution. The Panel also does not know how uncertainty may have been carried through from one engineering numerical modeling component to another. Furthermore, there is no discussion of whether or how this modeling uncertainty was carried through Beach-fx to the economic analysis and into the calculation of the benefit-to-cost ratio. As a result, the relative magnitude of these uncertainties and their implications for the economic analysis and the alternative selection process cannot be determined.

Significance – High

The project results are incomplete and do not provide sufficient basis for the benefit-to-cost analysis and alternative selection process because the magnitude of the uncertainties associated with the coastal engineering numerical modeling was not addressed.

Recommendations for Resolution

1. Clarify whether engineering numerical modeling uncertainty was quantified.
2. Discuss the uncertainty (i.e., error) in the coastal engineering numerical modeled estimates of surges, waves, storm erosion, and beach-fill evolution in the context of impacts on alternative selection and project justification. Specifically, address:
   (a) how uncertainty in one engineering modeling component's outputs, then used as inputs to a second engineering modeling component, affects uncertainty in the second modeling component's outputs;
   (b) how overall uncertainty in the engineering models is carried through the Beach-fx analysis and, if there is an impact, whether it is a significant impact on the benefit-to-cost analysis and alternative selection process.

Final Panel Comment 3

The Planform Evolution Model used to predict beach-fill evolution and renourishment interval does not appear to have been validated for use in the study area.

Basis for Comment

The Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS) states that the Planform Evolution Model is included in the USACE Coastal Engineering Design and Analysis System (CEDAS). However, this model is not presented in the CEDAS documentation (USACE 2013) and there appears to be no peer-reviewed documents demonstrating the validity of this model for estimating renourishment intervals. In order for the Panel to assess the adequacy and acceptability of the model results, the Panel needs documentation that the model is sufficiently accurate, based on appropriate physics or theory, and that it has been used appropriately in this study (i.e., appropriate model setup and assumptions).

The IFR/DEIS provides no information on the governing equations or assumptions of the model, or on model validation for this study area. Without understanding the renourishment intervals proposed by the model, the Panel cannot assess the model's ability to determine if there would be adverse impacts, either environmental (e.g., need for renourishment interval of less than three years) or economic (e.g., change in renourishment quantities).

Significance –High

Reliable estimation of the renourishment interval is critically important to the economic justification and engineering success of the proposed project.

Recommendations for Resolution

1. Provide references for the Planform Evolution Model that demonstrate that the model (a) is an appropriate choice for renourishment interval estimation and (b) is vetted by the coastal engineering community. If insufficient references exist, provide a detailed description of the model's governing equations and assumptions along with a description of other successful applications of the model for beach fill projects.
2. Present model validation/calibration information to demonstrate model accuracy for this study.

Literature Cited:

USACE (2013). CEDAS-Coastal Engineering Design and Analysis System. U.S. Army Corps of Engineers, Coastal and Hydraulics Laboratory.
http://chl.erdc.usace.army.mil/cedas

Final Panel Comment 4

The screening of non-structural alternatives from the areas of highest economic damage has not been presented and it is unknown if the full array of non-structural alternatives was considered.

Basis for Comment

The Economics Appendix states (p. B-41) that the only non-structural alternative considered was the removal of all first row structures and, in that scenario, five of the 117 economic sub-reaches showed positive net benefits. There is no discussion of the screening of other non-structural measures and alternatives, such as barrier walls and partial ring levees.

Table B-3 (Economics Appendix) also indicates that 10 of the 117 reaches (i.e., reaches 15, 70, 78, 87, 89, 92, 93, 106, 114, and 116) have disproportionately high structural/ content damage associated with wave and attendant flooding damage. Details of the disproportionately high without-project damages associated with these economic reaches are not provided.

In addition, the reason given for discarding the non-structural buyout alternative from the five cited reaches (i.e., reaches 78, 89, 93, 106, and 114) is that there would be unsustainable gaps in the contiguous berm/dune system; however, evidence was not provided to support this. Furthermore, the assertion of unsustainability is confusing because, when comparing Table B-3 to Table B-6 (Economics Appendix), the Tentatively Selected Plan (TSP) does not include dune measures for reaches 78, 89, and 114.

Significance – Medium

The Panel cannot assess the adequacy and acceptability of the non-structural screening process based on the level of information provided for this analysis.

Recommendations for Resolution

1. Describe the affected structures in reaches 15, 70, 78, 87, 89, 92, 93, 106, 114, and 116 and the nature of the damages to support the disproportionately high without-project damages.
2. Provide the analysis to support the assertion that non-structural alternatives only for reaches 78, 89, 93, 106, and 114 create engineering unsustainability.
3. Specify if other non-structural measures were considered and screened out and if so, why.
4. Provide the analysis used to determine that non-structural alternatives would create unsustainable gaps.

Final Panel Comment 5

The assumption that non-Federal nourishment would not occur under future without-project conditions contradicts historical activities and adds uncertainty to the economic analysis.

Basis for Comment

The forecast of the future without-project condition presents the circumstances expected during the typical USACE 50-year period of analysis. In addressing the future without-project condition, the Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS) states (p. 49), "Key assumptions regarding beach modifications are that, other than some reshaping of the dune and beach after storms, no other major nourishment project in the study area will be constructed by any non-Federal government agency." This assumption is not supported by recent local projects or by planning initiatives of Carteret County.

The IFR/DEIS itself documents the precedent for local nourishment (p. 132): Bogue Banks has had at least six non-Federal beach nourishment projects along various reaches of the island's seaside shoreline. Additionally, during the winter of 2013, Carteret County placed approximately 913,000 cubic yards of sand onto three sections of beach, one in Pine Knoll Shores and two sites at each end of Emerald Isle to replace sand lost during Hurricane Irene in 2011.

The Panel understands that a comprehensive 30-year $18.2 million local plan for Bogue Banks nourishment was in development in 2010. Furthermore, the IFR/DEIS (p. 49) acknowledges a Carteret County initiative if the proposed Federal plan is not approved.

Adding to the likelihood of non-Federal efforts in the absence of a Federal project is a Federal Emergency Management Agency (FEMA) requirement. In order to remain qualified for FEMA reimbursement to replace sand lost in response to a Federally declared disaster, municipalities have to adopt a maintenance plan whereby nourishment is necessary when one half of the beachfill volume has eroded. Bogue Banks municipalities have created tax districts to finance locally funded nourishment projects to be able to meet FEMA requirements.

Based upon the discussion above the future without-project condition would be a non-Federal effort to nourish the beaches along the entire island. The economic analysis provided in the IFR/DEIS does not reflect a non-Federal beach nourishment effort, which is highly probable to occur, as part of the future without-project conditions.

Significance – Medium

The future-without project condition appears to be incorrectly described, which could lead to an overestimation of project costs.

Recommendations for Resolution

1. Provide a history of nourishment efforts for Bogue Banks.
2. Revise the project cost to reflect any change in the interpretation of the future without-project condition, if necessary.

Final Panel Comment 6

The economic impact on recreational benefits resulting from damage to the first three rows of residential and commercial structures that could occur under modeled storm conditions has not been quantified.

Basis for Comment

The modeled storm conditions have additional costs associated with achieving recreational benefits that have not been quantified. A storm that could damage the front line or first three rows of residential and commercial structures would also flood the remainder of the barrier island, and damage residential and commercial properties as well as considerable infrastructure throughout the barrier island. These are considered residual risks.

Much, if not most, of the barrier island-wide damages (e.g., roads, shops, restaurants, motels, etc.) would have to be repaired before recreational benefits from tourism could be realized. Therefore, although the Tentatively Selected Plan (TSP) would reduce the flood and storm damage risk to the first three rows of residential and commercial structures, the remainder of the island would have to be rehabilitated to realize the recreational benefits associated with the TSP.

Significance – Medium

The stated net benefits associated with recreation may not be representative of post-storm conditions.

Recommendations for Resolution

1. Provide a discussion and quantify the effects of residual risks on project-related recreational benefits.

Final Panel Comment 7

Off Road Vehicle use within the project area has not been factored into the analysis of impacts on protected species.

Basis for Comment

The Panel acknowledges that USACE is required to ensure compliance with Section 7 of the Endangered Species Act (ESA) and amendments. The Panel understands from an email communication provided by USACE via Battelle that USACE does not anticipate that USFWS will initiate formal consultation or issue a new Biological Opinion for this project.

After reviewing the documentation provided, the Panel is not certain if USFWS is aware of the extent of ORV use on Bogue Banks. The Panel did note the Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS) acknowledges that ORVs are used on the beaches of Bogue Banks (p. 39). Appendix F (p. 36) also states the decline of seaside amaranth is caused, in part, by increased ORV use, but does not discuss its potential to affect other listed species. Therefore, the potential exists for unmitigated impacts on sea turtles and their hatchlings, piping plovers, and seaside amaranth from ORV use.

The Panel is aware that USFWS is considering designating a large area of coastline that includes Bogue Banks as a critical habitat for the threatened loggerhead sea turtle (Pippin 2013). This designation was not mentioned in the IFR/DEIS and the potential impact of ORV use on the Tentatively Selected Plan (TSP), if any, is not addressed. While the Panel understands that ORV use will not affect project design, it cannot determine whether USACE has discussed and resolved these issues related to compliance with Section 7 of the ESA with USFWS. The Panel is concerned whether existing and future Off Road Vehicle (ORV) use has been considered by the U.S. Fish and Wildlife Service (USFWS), since these activities may affect nesting sea turtles, piping plovers, and seaside amaranth, which are all Federally listed species.

Significance – Medium

The impacts of existing and future ORV use on Federally listed species cannot be determined without a discussion of compliance with Section 7 of the ESA.

Recommendations for Resolution

1. Include language in the IFR/DEIS clarifying that USACE has discussed the potential impacts of ORV use on listed species occurring in Bogue Banks with USFWS, and that these impacts do not affect USFWS's decision to not issue a new Biological Opinion.

Literature Cited:

Pippin, J. (2013). Turtle Habitat Designation for Bogue Banks Draws Concern. http://www.havenews.com/news/local-news/turtle-habitat-designation-for-bogue-banks-draws-concern-1.184928?page=0

Final Panel Comment 8

It is not clear whether public and governmental agency concerns have been identified and described, or if project benefits and impacts have been communicated to the public.

Basis for Comment

The Panel did not find information in the Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS) describing the level to which the public or governmental agencies have been involved in helping shape the contents of the IFR/DEIS. The Panel understands that a future Appendix N, Public and Agency Review, will describe this involvement. Further, the Panel learned from an email communication provided by USACE via Battelle that the National Marine Fisheries Service (NMFS) intends to approve the Bogue Banks project by means of an existing NMFS Biological Opinion, or a new Biological Opinion that is to be completed in the near future. This email communication also states that USACE does not anticipate that the U.S. Fish and Wildlife Service (USFWS) will initiate formal consultation or issue a new Biological Opinion for this project. However, this information was not reflected in the IFR/DEIS.

It is reasonable to assume that the majority of stakeholders are in favor of the beach nourishment program. However, without the opportunity to review pubic and governmental agency comments, or be informed of the potential designation of Bogue Banks as a critical habitat for nesting loggerhead turtles, the Panel cannot determine whether the issue of public and governmental agency comments has been adequately incorporated into the IFR/DEIS.

Significance – Medium

Understanding of the project benefits and impacts is incomplete without incorporating input from the public and/or commenting governmental agencies into the IFR/DEIS.

Recommendations for Resolution

1. Incorporate public and governmental agency comments into the IFR/DEIS and revise them as necessary.
2. Discuss whether the designation of Bogue Banks beaches as critical habitat for nesting loggerhead turtles may generate a new or revised Biological Opinion from USFWS concerning the impacts of the Tentatively Selected Plan (TSP) on this species.

Final Panel Comment 9

The IFR/DEIS does not include a discussion of how the TSP will provide increased accessibility for low-income segments of the population, as discussed in ER-1105-2-100 and to be fully compliant with Executive Order 12898.

Basis for Comment

Engineer Regulation (ER) 1105-2-100 (USACE 2000) requires USACE to consider being "sensitive to public concerns and identify interested and affected parties including those who might be unaware of an action that could be of concern to them." Appendix B (p. B-4) lists low-income segments of the population as being among those who should be contacted and informed of the proposed action resulting from implementation of the Tentatively Selected Plan (TSP). The Panel did not find this information in the Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS).

Table 9.1 (IFR/DEIS, p. 159) states that the proposed action is in "partial compliance" with Executive Order 12898 (EO 12898), Environmental Justice and Minority and Low Income Populations (February 11, 1994) and that full compliance will be attained after the National Environmental Policy Act (NEPA) process is complete. However, the IFR/DEIS does not specify the remaining information required to be in full compliance with EO 12898, or the process for obtaining this information.

Without the information described above, the Panel cannot determine if the IFR/DEIS complies with ER 1105-2-100 or will come into full compliance with EO 12898.

Significance – Low

Consideration of low-income populations has not been sufficiently documented and explained in the IFR/DEIS to be considered compliant with ER-1105-2-100 and Executive Order 12898.

Recommendations for Resolution

1. Provide additional explanation of how the TSP has addressed low-income populations relative to ER 1105-2-100.
2. Provide additional explanation of how the TSP will be in compliance with EO 12898 once the NEPA process is complete and if any changes will result in modification of or special conditions to the TSP.

Literature Cited:

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

Executive Order No. 12,898, 59 Fed. Reg. 7629 (Feb. 11, 1994). Environmental Justice and Minority and Low Income Populations.

APPENDIX B

Final Charge to the Independent External Peer Review Panel as Submitted to USACE on September 30, 2013

on the

Bogue Banks IEPR

This page is intentionally left blank.

Charge Questions and Guidance to the Panel Members for the Independent External Peer Review of the Bogue Banks IEPR

BACKGROUND

The Bogue Banks study is being pursued under the Corps of Engineers' General Investigation (GI) Program. The Integrated Feasibility Report and Draft Environmental Impact Statement is being conducted in response to the following resolution adopted July 23, 1998:

> Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives that the Secretary of the Army is requested to review the report of the Chief of Engineers dated November 27, 1984, on Bogue Banks and Bogue Inlet, North Carolina, and other pertinent reports, to determine whether any modifications of the recommendations contained therein are advisable at the present time in the interest of shore protection and related purposes for Bogue Banks, North Carolina.

The area known as Bogue Banks is a barrier island located entirely within Carteret County on the central North Carolina coast. The island faces the Atlantic Ocean on the south and extends approximately 25.4 miles from Beaufort Inlet on the east to Bogue Inlet on the west. Bogue Sound separates Bogue Banks from the mainland to the northern communities of the island, from east to west, include Fort Macon State Park, Atlantic Beach, Pine Knoll Shores, Salter Path, Indian Beach, and Emerald Isle. The sponsors' interest is in developing a plan for reducing storm damages. The study area extends landward approximately 500 feet from the shoreline. Seaward the study area extends from the shoreline approximately 1 mile. The study area also includes offshore borrow areas lying 1 to 8 miles from the shoreline and borrow areas in Beaufort Inlet and Bogue Inlet.

The Bogue Banks feasibility study is investigating measures and plans for coastal storm damage reduction. The study is also documenting incidental recreation benefits. Located between Cape Lookout and Cape Fear, Bogue Banks is a frequent target for hurricanes and tropical storms tracking along the mid-Atlantic coast. In addition to these direct landfalling storms, many storms that have passed offshore without making landfall have also impacted the study area. Local impacts on the study area have varied depending on the landfall location and strength of the storm.

Typical solutions considered for this study area are berm and dune beachfills using material dredged from offshore borrow sites, and in some cases building relocations, or coastal structures such as groins or breakwaters.

The estimated range of initial construction cost for the various alternatives varies between $100 million and $200 million, and estimated annual renourishment costs are approximately $5 million. Renourishment would continue through 50 years if the project is authorized.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) for the Integrated Feasibility Report and Draft Environmental Impact Statement (IFR/DEIS) for Bogue Banks, Carteret County, North Carolina (hereinafter: Bogue Banks IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review* (EC 1165-2-214, December 15, 2012), and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. Peer review typically evaluates the clarity of hypotheses, validity of the research design, quality of data collection procedures, robustness of the methods employed, appropriateness of the methods for the hypotheses being tested, extent to which the conclusions follow from the analysis, and strengths and limitations of the overall product.

The purpose of the IEPR is to assess the "adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-214; p. D-4) for the Bogue Banks documents. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in coastal engineering, economics/Civil Works Planning, biologist/ecologist issues relevant to the project. They will also have experience applying their subject matter expertise to coastal storm damage reduction.

The Panel will be "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-214, Appendix D, review panels should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The panel members may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The following is a list of documents, supporting information, and reference materials that will be provided for the review.

Documents for Review
The following documents are to be reviewed by designated discipline:

Title	Approx. No. of Pages
Integrated Feasibility Report and Draft Environmental Impact Statement Bogue Banks, Carteret County, North Carolina	200
Appendix A - Coastal Engineering	100
Appendix B - Economics	77
Appendix C - Geotechnical Engineering	25
Appendix D - Cost Engineering	72
Appendix E - Archaeological Survey	76
Appendix F - Biological Assessment	72
Appendix G - Environmental Commitments	9
Appendix H - Real Estate	33
Appendix I - Parking and Access	35
Appendix J - Cumulative Impact Assessment	27
Appendix K - 404b1 Analysis	8
Appendix L - Draft Fish and Wildlife Coordination Act Report	184
Total Page Count	**918**

Documents for Reference

- USACE guidance Civil Works Review, (EC 1165-2-214, 15 December 2012)
- Office of Management and Budget's Final Information Quality Bulletin for Peer Review (December 16, 2004).

SCHEDULE

This final schedule is based on the October 11, 2013 receipt of the final review documents by the Panel. The schedule will be revised upon receipt of final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	10/11/2013
	Battelle convenes kick-off meeting with panel members	10/15/2013
	Battelle convenes kick-off meeting with USACE and panel members	10/15/2013
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	10/23/2013
	Panel members complete their individual reviews	10/29/2013
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Tele-conference	11/4/2013
	Battelle convenes Panel Review Teleconference	11/5/2013
	Battelle provides Final Panel Comment templates and instructions to panel members	11/6/2013
	Panel members provide draft Final Panel Comments to Battelle	11/13/2013
	Battelle provides feedback to panel members on draft Final Panel Com-ments; panel members revise Final Panel Comments	11/14-11/21/2013
	Battelle finalizes Final Panel Comments	11/22/2013
	Battelle provides Final IEPR Report to panel members for review	11/26/2013
	Panel members provide comments on Final IEPR Report	12/2/2013
	*Battelle submits Final IEPR Report to USACE	12/4/2013
Comment/ Response Process	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	12/6/2013
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	12/6/2013
	USACE provides draft PDT Evaluator Responses to Battelle	12/13/2013
	Battelle provides the panel members the draft PDT Evaluator Responses	12/16/2013
	Panel members provide Battelle with draft BackCheck Responses	12/19/2013
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	12/19/2013
	Battelle convenes Comment-Response Teleconference with panel mem-bers and USACE	12/20/2013
	USACE inputs final PDT Evaluator Responses to DrChecks	12/31/2013
	Battelle provides final PDT Evaluator Responses to panel members	1/6/2014

Task	Action	Due Date
Comment/ Response Process	Panel members provide Battelle with final BackCheck Responses	1/9/2014
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	1/10/2014
	*Battelle submits pdf printout of DrChecks project file	1/13/2014
Civil Works Review Board (CWRB)	Panel prepares and/or reviews slides for CWRB	2/3/2014
	Civil Works Review Board	4/2014 Tentative

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Bogue Banks documents 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 Bogue Banks documents. Please focus your review on the review materials assigned to your discipline/area of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note 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 1165-2-214; 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 evaluating economic or environmental impacts of the proposed project.

4. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation.
5. Identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods.
6. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable
7. Please focus the review on assumptions, data, methods, and models.

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

1. If desired, panel members can contact one another. However, panel members **should not** contact anyone who is or was involved in the project, prepared the subject documents, or was part of the USACE Agency Technical Review (ATR).
2. Please contact the Battelle Project Manager (Julian DiGialleonardo, digialleonardoj@battelle.org) or Program Manager (Karen Johnson-Young (johnson-youngk@battelle.org) for requests or additional information.
3. In case of media contact, notify the Battelle Program Manager, Karen Johnson-Young (johnson-youngk@battelle.org) immediately.
4. Your name will appear as one of the panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Julian DiGialleonardo, digialleonardoj@battelle.org, no later than October 29, 2013, 5 pm ET.

Independent External Peer Review for the Integrated Feasibility Report and Draft Environmental Impact Statement for Bogue Banks, Carteret County, North Carolina

Charge Questions and Relevant Sections as Supplied by USACE

General Questions

1. To what extent has it been shown that the project is technically sound?
2. Are the assumptions that underlie the engineering and environmental analyses sound?
3. Are the engineering and environmental methods, models, and analyses used adequate and acceptable?
4. Were all models used in the analyses used in an appropriate manner with assumptions appropriately documented and explained?
5. Were risk and uncertainty sufficiently considered?
6. Was the process used to select the recommended alternative rational and was the process implemented in a reasonable manner given the project constraints?
7. Does the EIS satisfy the requirements of NEPA? Were adequate considerations given to significant resources by the project?
8. Assess the recommended alternatives from the perspective of systems. It should also include systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

Safety Assurance Review Questions

9. Were the methods used to evaluate the condition of the structures (berms, dunes) adequate and appropriate given the circumstances?
10. Have the appropriate alternatives been considered and adequately described for this project and do they appear reasonable?
11. Do the project features adequately address redundancy, resiliency, or robustness with an emphasis on interfaces between structures, materials, members, and project phases?
12. Are the quality and quantity of the surveys, investigations, and engineering sufficient to assess expected risk reduction?
13. Have the hazards that affect the structures been adequately documented and described?

14. Are the models used to assess hazards appropriate?

15. Are the assumptions made for the impacts appropriately documented and explained?

16. Is there sufficient information presented to identify, explain, and comment on the assumptions that underlie the engineering analyses?

17. Are there any additional analyses or information available or readily obtainable that would affect decisions regarding the structures?

18. Does the physical data and observed data provide adequate information to characterize the structures and their performance?

19. Have all characteristics, conditions, and scenarios leading to potential failure, along with the potential impacts and consequences, been clearly identified and described? Have all pertinent factors, including but not necessarily limited to population-at-risk been considered?

20. Does the analysis adequately address the uncertainty given the consequences associated with the potential loss of life for this type of project?

21. From a public safety perspective, is the proposed alternative reasonably appropriate or are there other alternatives that should be considered?

22. Has anything significant been overlooked in the development of the assessment of the project or the alternatives?

23. Do the alternatives and their associated costs appear reasonable? Do the benefits and consequences appear reasonable?

Objectives

24. Is the purpose of the project adequately defined? If not, why?

25. Has the project need been clearly described?

26. Have the public concerns been identified and adequately described?

27. Are the specific objectives adequately described?

28. In your opinion, are there any other issues, resources, or concerns that have not been identified and/or addressed?

Alternatives

29. Have the criteria to eliminate plans from further study been clearly described?

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

31. Were the assumptions made for use in developing the future with-project conditions for each engineering alternative reasonable? Were adequate scenarios considered? Were the assumptions reasonably consistent across the range of alternatives and/or adequately justified where different?

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

33. Have comparative impacts been clearly and adequately described?

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

35. Are there any unmitigated environmental impacts not identified and, if so, could they impact project designs?

36. Please comment on the likelihood the recommended engineering alternative will achieve the expected outputs.

37. Are residual risks adequately described and is there a sufficient plan for communicating the residual risk to affected populations?

38. Have the impacts on the existing infrastructure, including the existing flood risk management project, utilities, and transportation infrastructure, been adequately addressed?

Affected Environment

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

40. Is the description of wetland resources in the project area complete and accurate?

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

42. Is the description of threatened and endangered species resources in the study area complete and accurate?

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

44. Is the description of the cultural resources in the study area complete and accurate?

45. Is the description of the historical and existing socioeconomic resources in the study area complete and accurate? Were specific socioeconomic issues not addressed?

Environmental Consequences

46. Have impacts on significant resources been adequately and clearly described?

47. To what extent have the potential impacts of the alternatives on significant resources been addressed and supported?

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

Cumulative Impacts

49. Are cumulative impacts adequately described and discussed? If not, please explain.

Hydrology and Hydraulics (Coastal)

50. Was the Coastal Engineering modeling performed technically sound?

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

52. Were the geotechnical analyses adequate and appropriate for the current level of design as presented in the report documentation?

Design

53. Are the assumptions used to determine the cost of operations and maintenance for the proposed project adequately documented and explained?

Cost Estimates and Economics

54. Were the benefit categories used in the economic analysis adequate to calculate a benefit-to-cost ratio for each of the project alternatives?

55. Was the methodology used to determine the characteristics and corresponding value of the structure inventory for the study area adequate?

56. Were the methods used to develop the content-to-structure value ratios appropriate and were the generated results applicable to the study area?

57. Were the methods to develop the depth-damage relationships appropriate and were the generated results applicable to the study area?

58. To what extent have significant project construction costs been adequately identified and described?

59. Are the costs adequately justified?

Public Involvement and Correspondence

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

Summary Questions*

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

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

***Two additional charge questions were added by Battelle to elicit summary responses from the IEPR Panel.**