Final Independent External Peer Review Report of the Rio Grande de Arecibo, Puerto Rico Post Authorization Change Limited Reevaluation Report

Prepared by
Battelle Memorial Institute

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

Contract No. W912HQ-10-D-0002
Task Order: 0058

March 9, 2015

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Executive Summary

PROJECT BACKGROUND AND PURPOSE

This Post Authorization Change (PAC) Report for the Rio Grande de Arecibo flood control project in Arecibo, Puerto Rico is being prepared to seek a Section 902 limit of the Water Resources Development Act (WRDA) of 1986 to request the required authorization and appropriations for additional construction funds. The current authority provides funds for the completion of Contract 1 and Contract 2A, requiring additional authority and appropriations to complete Contract 2B and Contract 3. There are no changes to the scope of the authorized project or features; therefore, this PAC report is a Limited Reevaluation Report (LRR). The LRR evaluates the authorized project within the context of the current socioeconomic conditions of the study area, unit cost data from completed and ongoing construction contracts, and current property value and detailed design estimates established during Preconstruction Engineering and Design (PED).

In general, the lapsed years of escalation, the development of detailed design during PED, and differing or constraining site conditions encountered during construction are the main contributing factors for the increase in total project cost. The LRR will outline revised cost, updated economic analysis, and National Environmental Policy Act (NEPA) and resource agency coordination.

The authorized purpose of the Rio Grande de Arecibo flood control project is to address flood damages caused by the overflow of the Tanama, Santiago, and Arecibo rivers into the municipality of Arecibo, Puerto Rico. The project is designed to reduce the flood risk of a 100-year flood event for the areas adjacent to Rio Grande de Arecibo and its tributaries. In general, the authorized project consists of the channelization of the developed portions of Rio Santiago located north of Highway 22, the construction of a drainage structure for the diversion channel, the construction of earthen levees along the north bank of Rio Tanama, the construction of an earthen levee and floodwall along the developed west bank of Rio Grande de Arecibo, the construction of one rock jetty, recreational features, and wetland and archaeological mitigation. The project was contracted in increments. Each construction increment of the project provides standalone benefits for a 100-year storm event. Contract 1 provides 25% of the total benefits, Contract 2 provides 25% of the total benefits and is subdivided into parts 2a and 2b, and Contract 3 provides 50% of the total benefits. The construction of Contract 1 and design of Contract 2A have been completed.

Independent External Peer Review Process

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The U.S. Army Corps of Engineers (USACE) is conducting an Independent External Peer

Review (IEPR) of the Rio Grande de Arecibo, Puerto Rico Post Authorization Change Limited Reevaluation Report (hereinafter: Rio Grande de Arecibo IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, is free from conflicts of interest (COIs), 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 Rio Grande de Arecibo IEPR. 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 presents the Final Panel Comments of the IEPR Panel (the Panel). Details regarding the IEPR (including the process for selecting panel members, the panel members' biographical information and expertise, and the charge submitted to the Panel to guide its review) are presented in appendices.

Based on the technical content of the Rio Grande de Arecibo IEPR review documents and the overall scope of the project, Battelle identified potential candidates for the Panel in the following key technical areas: planning/economics, environmental review, hydrologic and hydraulic engineering/risk analysis, and cost engineering. Battelle screened the candidates to identify those most closely meeting the selection criteria and evaluated them for COIs and availability. USACE was given the list of final candidates to confirm that they had no COIs, but Battelle made the final selection of the four-person Panel.

The Panel received an electronic version of the Rio Grande de Arecibo IEPR review documents (211 pages in total), along with a charge that solicited comments on specific sections of the documents to be reviewed. Following guidance provided in USACE (2012) and OMB (2004), USACE prepared the charge questions, which were included in the draft and final Work Plans.

The USACE Project Delivery Team briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review 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 Rio Grande de Arecibo IEPR documents individually. The panel members then met via teleconference with Battelle to review key technical comments and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of: (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium/high, medium, medium/low, or low); and (4) recommendations on how to resolve the comment. Overall, 12 Final Panel Comments were identified and documented. Of these, three were identified as having high significance, one had medium/high significance, two had medium significance, five had medium/low significance, and one had low significance.

Results of the Independent External Peer Review

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Rio Grande de Arecibo IEPR review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Planning/Economics: Of primary concern was that the updated economic benefit calculations provided in the LRR are based on incomplete, undocumented, or outdated information and methodologies that cannot be used to validate the National Economic Development benefits and the benefit-cost ratio. USACE can resolve this issue by (1) providing a complete explanation of survey methods and results for the structure inventory by node in the study area and describe how the impacted area has changed; (2) defining and fully describing all categories of with- and without-project damages and how these damages were aggregated across the study area; (3) providing survey, prior claim, or other supporting documentation to estimate flood insurance participation rates in the study area; and (4) providing updated information about without-project recreation activities in the study area and justification for the baseline estimate of recreation user days both with- and without-project. Another key issue of concern is that the risk and uncertainty analysis, as presented, is not consistent with ER1105-2-101. This issue can be addressed by providing results of the risk-based analysis consistent with ER 1105-2-101 and including information about the use of risk and uncertainty parameters in the expected with- and without-project damages and residual risks in the with-project condition. Additionally, and of significant concern to the Panel, was that the description of the without-project conditions does not include, or account for, the planned upgrade of the storm water management system agreed to by the Puerto Rico Department of Natural and Environmental Resources and the U.S. EPA in 2012. This deficiency can be addressed by providing an updated hydrologic and hydraulic evaluation that integrates expected changes in public storm water management infrastructure into the without-project conditions, as well as including an updated analysis of expected annual damages in the without-project conditions. In addition, an updated analysis of the benefit-cost ratio for the project should be provided.

Engineering: Based on their review, the Panel found that the Cost and Schedule Risk Analysis report has appropriately identified priority risks and that the amounts for resulting contingencies have been included in the project cost estimate and schedule. However, the Panel was concerned that the project, as currently designed, does not incorporate rainfall data per National Oceanic and Atmospheric Administration (NOAA) Atlas 14 or consider the potential for increases in rainfall in the study area, and as a result may not provide flood damage reduction for the 100-year design storm. This issue can be addressed by updating the hydrologic and hydraulic analysis using current criteria and rainfall data and integrating any design modifications that have occurred since the project was originally authorized. The Panel also noted that an assessment of the construction modifications and cost engineering cannot be made because the engineering assumptions and data that underlie the study analyses have not been provided. USACE can resolve this matter by including a discussion of the substantial increase in channel hardening and erosion control measures compared to the project authorized in 1996 and whether these modifications are anticipated to have cost, construction, or schedule implications. USACE should also clarify whether the project adheres to the most recent design standards and construction engineering methods and practices.

Environmental: The Panel also found that modifications to the project design are not expected to have a significantly different environmental impact than those previously assessed for the 1996 authorized project. However, the Panel noted that between 2005 and 2011, project construction activities have impacted wetlands, however, the original mitigation site is no longer available, and the location of a wetland mitigation site is not yet determined. USACE can address this issue by identifying and evaluating potential wetland mitigation sites and by selecting a suitable wetland mitigation site and constructing wetland mitigation features.

Table ES-1. Overview of 12 Final Panel Comments Identified by the Rio Grande de Arecibo IEPR Panel

No.	Final Panel Comment
Significance – High	
1	The updated economic benefit calculations provided in the LRR are based on incomplete, undocumented, or outdated information and methodologies that cannot be used to validate the National Economic Development benefits and the benefit-cost ratio.
2	The risk and uncertainty analysis, as presented, is not consistent with ER1105-2-101.
3	The description of the without-project conditions does not include, or account for, the planned upgrade of the storm water management system agreed to by the Puerto Rico Department of Natural and Environmental Resources and the U.S. EPA in 2012.
Significance – Medium/High	
4	The project as currently designed does not incorporate rainfall data per NOAA Atlas 14 or consider the potential for increases in rainfall in the study area, and as a result may not provide flood damage reduction for the 100-year design storm.
Significance – Medium	
5	The construction modifications and cost engineering cannot be assessed because the engineering assumptions and data that underlie the study analyses have not been provided.
6	Between 2005 and 2011, project construction activities have impacted wetlands, however, the original mitigation site is no longer available, and the location of a wetland mitigation site is not yet determined.
Significance – Medium/Low	
7	Public involvement and coordination activities with the limited English proficiency population and the Non-Federal Sponsor that have occurred since the approval of the 1993 Feasibility Study are not documented.
8	The socioeconomic analysis is incomplete since impacts on the population and structures in the study area from Hurricane Georges in 1998 and the housing/financial crisis in 2007-2010 are not addressed.
9	A detailed breakdown of the Operation, Maintenance, Repair, Replacement, and Rehabilitation cost estimate is not provided, so the accuracy and reasonableness of the cost estimate cannot be verified.

Table ES-1. Overview of 12 Final Panel Comments Identified by the Rio Grande de Arecibo IEPR Panel (continued)

No.	Final Panel Comment
10	Lessons learned from the significant cost and schedule overruns during the Contract 1 project phase are not defined, and it could not be determined how these lessons were incorporated into project design changes or future project planning and management activities.
11	The LRR does not confirm a commitment to developing and executing risk management during continued preconstruction engineering and design (PED) and construction activities as recommended in the Cost Schedule Risk Analysis.
Significance – Low	
12	Measures to avoid potential impacts on threatened and endangered species that have been listed post authorization are not discussed in the LRR.

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LIST OF ACRONYMS

ATR	Agency Technical Review
BMP	Best Management Practice
COI	Conflict of Interest
CSRA	Cost and Schedule Risk Analysis
DrChecks	Design Review and Checking System
EC	Engineer Circular
EO	Executive Order
ER	Engineer Regulation
H&H	Hydrology and Hydraulics
IEPR	Independent External Peer Review
LEP	Limited English Proficiency
LRR	Limited Reevaluation Report
NED	National Economic Development
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
OMRR&R	Operation, Maintenance, Repair, Restoration, and Rehabilitation
PAC	Post Authorization Change
PED	Preconstruction Engineering and Design
PDT	Project Delivery Team
SAR	Safety Assurance Review
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Services
WRDA	Water Resources Development Act

1. INTRODUCTION

This Post Authorization Change (PAC) Report for the Rio Grande de Arecibo flood control project in Arecibo, Puerto Rico is being prepared to seek a Section 902 limit of the Water Resources Development Act (WRDA) of 1986 to request the required authorization and appropriations for additional construction funds. The current authority provides funds for the completion of Contract 1 and Contract 2A, requiring additional authority and appropriations to complete Contract 2B and Contract 3. There are no changes to the scope of the authorized project or features; therefore, this PAC report is a Limited Reevaluation Report (LRR). The LRR evaluates the authorized project within the context of the current socioeconomic conditions of the study area, unit cost data from completed and ongoing construction contracts, and current property value and detailed design estimates established during Preconstruction Engineering and Design (PED).

In general, the lapsed years of escalation, the development of detailed design during PED, and differing or constraining site conditions encountered during construction are the main contributing factors for the increase in total project cost. The LRR will outline revised cost, updated economic analysis, and National Environmental Policy Act (NEPA) and resource agency coordination.

The authorized purpose of the Rio Grande de Arecibo flood control project is to address flood damages caused by the overflow of the Tanama, Santiago, and Arecibo rivers into the municipality of Arecibo, Puerto Rico. The project is designed to reduce the flood risk of a 100-year flood event for the areas adjacent to Rio Grande de Arecibo and its tributaries. In general, the authorized project consists of the channelization of the developed portions of Rio Santiago located north of Highway 22, the construction of a drainage structure for the diversion channel, the construction of earthen levees along the north bank of Rio Tanama, the construction of an earthen levee and floodwall along the developed west bank of Rio Grande de Arecibo, the construction of one rock jetty, recreational features, and wetland and archaeological mitigation. The project was contracted in increments. Each construction increment of the project provides standalone benefits for a 100-year storm event. Contract 1 provides 25% of the total benefits, Contract 2 provides 25% of the total benefits and is subdivided into parts 2a and 2b, and Contract 3 provides 50% of the total benefits. The construction of Contract 1 and design of Contract 2A have been completed.

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Rio Grande de Arecibo, Puerto Rico Post Authorization Change Limited Reevaluation Report (hereinafter: Rio Grande de Arecibo 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 the Office of Management and Budget (OMB) *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Supplemental guidance on evaluation for conflicts of interest (COIs) was obtained from the *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

This final report presents the Final Panel Comments of the IEPR Panel (the Panel) on the existing engineering, economic, environmental, and plan formulation analyses contained in the Rio Grande de Arecibo IEPR documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted. Appendix B provides biographical information on the IEPR panel members and describes the

method Battelle followed to select them. Appendix C presents the final charge to the IEPR panel members for their use during the review; the final charge was submitted to USACE on January 7, 2015.

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 engineering, economic, environmental, and plan formulation analyses of the project study. In particular, the IEPR addresses the technical soundness of the project study's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the Rio Grande de Arecibo IEPR 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 FOR CONDUCTING THE IEPR

The methods used to conduct the IEPR are briefly described in this section; a detailed description can be found in Appendix A. Table 1 presents the major milestones and deliverables of the Rio Grande de Arecibo IEPR. Due dates for milestones and deliverables are based on the December 12, 2014 date for receipt of the modification award and modified project work statement. Note that the work items listed under Task 6 occur after the submission of this report. Battelle anticipates submitting the pdf printout of the USACE's Design Review and Checking System (DrChecks) project file (the final deliverable) on April 30, 2015. The actual date for contract end will depend on the date that all activities for this IEPR are conducted.

Table 1. Major Milestones and Deliverables of the Rio Grande de Arecibo IEPR

Task	Action	Due Date
1	Award/Effective Date	2/27/2014
	Project Restart Based on Award of Contract Modification	12/12/2014
	Review documents available	10/14/2014
2	Battelle submits list of selected panel members	1/5/2015
	USACE confirms the panel members have no COI	1/7/2015
3	Battelle convenes kick-off meeting with USACE	3/6/2014
	Battelle convenes kick-off meeting with USACE and panel members	1/20/2015

Table 2. Major Milestones and Deliverables of the Rio Grande de Arecibo IEPR (continued)

Task	Action	Due Date
4	Panel members complete their individual reviews	2/5/2015
	Panel members provide draft Final Panel Comments to Battelle	2/18/2015
5	Battelle submits Final IEPR Report to USACE	3/9/2015
6[a]	Battelle convenes Comment-Response Teleconference with panel members and USACE	4/10/2015
	Battelle submits pdf printout of DrChecks project file to USACE	4/30/2015
	Contract End/Delivery Date	8/31/2015

[a] *Task 6 occurs after the submission of this report.*

Battelle identified, screened, and selected four panel members to participate in the IEPR based on their expertise in the following disciplines: planning/economics, environmental review, hydrologic and hydraulic engineering/risk analysis, and cost engineering. The Panel reviewed the Rio Grande de Arecibo IEPR document and produced 12 Final Panel Comments in response to 27 charge questions provided by USACE for the review. This charge included two questions added by Battelle that sought summary information from the IEPR Panel. Battelle instructed the Panel to develop the Final Panel Comments using a standardized four-part structure:

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

Battelle reviewed all Final Panel Comments for accuracy, adherence to USACE guidance (EC 1165-2-214, Appendix D), and completeness prior to determining that they were final and suitable for inclusion in the Final IEPR Report. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Panel's findings are summarized in Section 4.1; the Final Panel Comments are presented in full in Section 4.2.

4. RESULTS OF THE IEPR

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

4.1 Summary of Final Panel Comments

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Rio Grande de Arecibo IEPR review document. The following summarizes the Panel's findings.

Planning/Economics: Of primary concern was that the updated economic benefit calculations provided in the LRR are based on incomplete, undocumented, or outdated information and methodologies that cannot be used to validate the National Economic Development benefits and the benefit-cost ratio. USACE can resolve this issue by (1) providing a complete explanation of survey methods and results for the structure inventory by node in the study area and describe how the impacted area has changed; (2) defining and fully describing all categories of with- and without-project damages and how these damages were aggregated across the study area; (3) providing survey, prior claim, or other supporting documentation to estimate flood insurance participation rates in the study area; and (4) providing updated information about without-project recreation activities in the study area and justification for the baseline estimate of recreation user days both with- and without-project. Another key issue of concern is that the risk and uncertainty analysis, as presented, is not consistent with ER1105-2-101. This issue can be addressed by providing results of the risk-based analysis consistent with ER 1105-2-101 and including information about the use of risk and uncertainty parameters in the expected with- and without-project damages and residual risks in the with-project condition. Additionally and of significant concern to the Panel was that the description of the without-project conditions does not include, or account for, the planned upgrade of the storm water management system agreed to by the Puerto Rico Department of Natural and Environmental Resources and the U.S. EPA in 2012. This deficiency can be addressed by providing an updated hydrologic and hydraulic evaluation that integrates expected changes in public storm water management infrastructure into the without-project conditions, as well as including an updated analysis of expected annual damages in the without-project conditions. In addition, an updated analysis of the benefit-cost ratio for the project should be provided.

Engineering: Based on their review, the Panel found that the Cost and Schedule Risk Analysis report has appropriately identified priority risks and that the amounts for resulting contingencies have been included in the project cost estimate and schedule. However, the Panel was concerned that the project, as currently designed, does not incorporate rainfall data per National Oceanic and Atmospheric Administration (NOAA) Atlas 14 or consider the potential for increases in rainfall in the study area, and as a result may not provide flood damage reduction for the 100-year design storm. This issue can be addressed by updating the hydrologic and hydraulic analysis using current criteria and rainfall data and integrating any design modifications that have occurred since the project was originally authorized. The Panel also noted that an assessment of the construction modifications and cost engineering cannot be made because the engineering assumptions and data that underlie the study analyses have not been provided. USACE can resolve this matter by including a discussion of the substantial increase in channel hardening and erosion control measures compared to the project authorized in 1996 and whether these modifications are anticipated to have cost, construction, or schedule implications. USACE should also clarify whether the project adheres to the most recent design standards and construction engineering methods and practices.

Environmental: The Panel found that modifications to the project design are not expected to have a significantly different environmental impact than those previously assessed for the 1996 authorized project. However, the Panel noted that between 2005 and 2011, project construction activities have impacted wetlands, however, the original mitigation site is no longer available, and the location of a wetland mitigation site is not yet determined. USACE can address this issue by identifying and evaluating potential wetland mitigation sites and by selecting a suitable wetland mitigation site and constructing wetland mitigation features.

4.2 Final Panel Comments

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

Final Panel Comment 1

The updated economic benefit calculations provided in the LRR are based on incomplete, undocumented, or outdated information and methodologies that cannot be used to validate the National Economic Development benefits and the benefit-cost ratio.

Basis for Comment

The Panel identified several concerns about the information and methodologies used to estimate National Economic Development (NED) benefits. In many cases, the supporting documentation presented is incomplete or inconsistent and cannot be used to validate the NED calculations for each category of project benefits. Concerns about each project benefit category are as follows:

1. **Inundation Benefits**
   a. No data are presented in the Limited Reevaluation Report (LRR) or Appendix D (Economics) on the condition of structures in each node of the impacted area, and the LRR only references IWR Report 95-R-9 (USACE, 1995) (p. D-8) to describe how condition could be determined.
   b. No information on occupancy rates across residential and commercial structures is provided and survey information was only completed in 2008.
   c. The justification for using the maximum permissible (50%) content-to-structure value due to "increases in real income and consumerism since 1998" (p. D-9) is not consistent with the decline in population (p. D-5) and high unemployment (p. D-15) in the study area.
   d. Residential benefit estimates are shown in Table 5 (p. D-12) for nodes that do not have residential structures (Table 1, D-8), and the estimated structure and content damages in Tables 2 to 4 (pp. D-11 to D-12) do not add up to the total damages in these tables.
   e. No vehicle damages are discussed or estimates provided in the LRR or Appendix D.
   f. No detailed explanation of the calculations and results for changes in annual expected damages and residual risk by node is presented (p. D-14).
2. **Employment Benefits**
   a. The calculations to estimate employment benefits during the construction period are not provided.
   b. There is no project timeline to determine whether the employment benefits are annualized to the 50-year life of the project or only apply to the construction period.
3. **Advanced Bridge Replacement**
   a. The calculations to estimate bridge replacement benefits are not provided.
   b. The guidance document (USACE, 1988) cited to warrant including these benefits is out of date and this type of benefit is not included in more recent guidance manuals (USACE, 2000; USACE, 2013).
   c. The assumption that the remaining life of the existing bridges is zero fails to account for the fact that the existing bridges are still in use and are incurring maintenance costs and benefit estimates should be based on differences in maintenance costs (USACE, 1988).
4. **Flood Insurance**
   a. The methodology uses aggregate flood insurance participation rates for Puerto Rico rather than data specifically for the study area.
   b. The estimated national participation rate applied to all residences in Arecibo indicates that 916 (p. D-17) of the approximately 1,135 housing units (p. D-3), or 81%, are covered by flood insurance, which is not consistent with flood insurance participation rates in low income housing areas.

5. **Recreation**
   a. The update results in a significant increase in annual recreation benefits ($530K), but no details are provided to support the increase in estimated user days.
   b. The current LRR states that the 1998 LRR did not provide details on how without-project use was derived (p. 24; p. D-18), but the Recreation Plan (Appendix F) does not provide current information to establish a baseline for actual recreation activities in the study area.

Significance – High

The inability to validate the NED benefits affects the estimated benefit-cost ratio and economic feasibility of the project.

Recommendation for Resolution

1. Provide a complete explanation of survey methods and results for the structure inventory by node in the study area and describe how the impacted area has changed since the 1998 LRR, Hurricane Georges, and the 2007-2010 housing/financial crisis.
2. Provide the basis and inventory data for estimating structure age, depreciation factors, and occupancy rates.
3. Provide a rationale for estimating content-to-structure values that is consistent with the current socioeconomic character of the study area;
4. Ensure consistency between structure inventory data within the study area and corresponding estimates of expected benefits.
5. Define and fully describe all categories of with- and without-project damages and how these damages were aggregated across the study area.
6. Provide details on the methodology and assumptions used to estimate employment benefits during the construction period, as an annual benefit, and the duration of these benefits.
7. Describe and justify the methods and assumptions used to calculate advanced bridge replacement benefits based on recent USACE guidelines.
8. Provide survey, prior claim, or other supporting documentation to estimate flood insurance participation rates in the study area.
9. Provide updated information about without-project recreation activities in the study area and justification for the baseline estimate of recreation user days both with- and without-project.

Literature Cited:

USACE (1988). National Economic Development Procedures Manual, Urban Flood Damage. Institute of Water Resources (IWR) Report 88-R-2. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. March. Available online at: http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/IWR88-R-2.pdf.

USACE (1995). Procedural Guidelines for Estimating Residential and Business Structure Value for Use in Flood Damage Estimations. Institute of Water Resources (IWR) Report 95-R-9. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. April. Available online at: http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/95-R-91.pdf

USACE (2000). Planning Guidance Notebook. Engineering Regulation (ER) 1105-2-100. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. April 22. Available online at: http://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1105-2-100.pdf.

USACE (2013). Flood Risk Management National Economic Development Manual. Institute of Water Resources Report 2013-R-05, Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. June. Available online at: http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/2013-R-05.pdf.

Final Panel Comment 2

The risk and uncertainty analysis, as presented, is not consistent with ER1105-2-101.

Basis for Comment

The original 1993 Feasibility Report was completed before more through evaluations of risk and uncertainty in flood damage reduction studies were required under USACE guidance such as ER 1105-2-101 (USACE, 2006). The 2014 LRR follows the risk and uncertainty protocols of the original 1993 Feasibility Report (as noted in the LRR, p. 35) and as such reports NED benefits and the benefit-cost ratio as point estimates. Since 2006, however, USACE has required risk distributions for with- and without-project annual expected damages, NED benefits, and benefit-cost ratios to capture and quantify the effect of risk and uncertainty on the design and economic viability of water resources projects.

In addition, very little narrative information is provided on residual risks and inundation maps to fully describe the impacts of the project and inform the public.

Significance – High

Risk and uncertainty analysis is an integral part of flood damage reduction evaluations and is necessary to validate NED benefits under current USACE planning guidelines.

Recommendation for Resolution

1. Provide information about the use of risk and uncertainty parameters in the expected with- and without-project damages.
2. Provide results of the risk-based analysis consistent with ER 1105-2-101.
3. Provide more detailed information about residual risks in the with-project condition.

Literature Cited:

USACE (2006). Planning – Risk Analysis for Flood Damage Reduction Studies. Engineer Regulation (ER) 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. January 3. Available online at: http://planning.usace.army.mil/toolbox/library/ERs/er1105-2-101.pdf

Final Panel Comment 3

The description of the without-project conditions does not include, or account for, the planned upgrade of the storm water management system agreed to by the Puerto Rico Department of Natural and Environmental Resources and the U.S. EPA in 2012.

Basis for Comment

The U.S. Department of Justice (2012) announced in June 2012 a settlement agreement with the municipality of Arecibo, Puerto Rico for violations of the Clean Water Act related to releases into the Rio Grande de Arecibo. Under the consent decree, Arecibo is expected to invest an estimated $56 million to improve its storm water management program and build a new pump station with three retention basins.

This settlement agreement is not discussed as part of the without-project conditions in the study area, and the potential impacts this storm water management program may have on the Rio Grande de Arecibo Flood Risk Management project are unknown. The planned upgrades to key components of the storm water management infrastructure within the study area would be expected to impact the hydrologic and hydraulic evaluation, expected damages, and the benefit-cost ratio for the project.

Significance – High

The without-project description does not fully account for expected changes in the public infrastructure and storm water systems within the study area that may impact the expected damages and benefit-cost ratio.

Recommendation for Resolution

1. Provide an updated hydrologic and hydraulic evaluation that integrates expected changes in public storm water management infrastructure into the without-project conditions.
2. Provide an updated analysis of expected annual damages in the without-project conditions and an updated analysis of the benefit-cost ratio for the project.

Literature Cited:

U.S. Department of Justice (2012). Arecibo, Puerto Rico, to Upgrade Sewer Systems to Resolve Clean Water Act Violations. Justice News, Office of Public Affairs, June 4, 2012. Available online at: http://www.justice.gov/opa/pr/arecibo-puerto-rico-upgrade-sewer-system-resolve-clean-water-act-violations

Final Panel Comment 4

The project as currently designed does not incorporate rainfall data per NOAA Atlas 14 or consider the potential for increases in rainfall in the study area, and as a result may not provide flood damage reduction for the 100-year design storm.

Basis for Comment

Depth, duration, frequency, and distribution of rainfall are key data factors of the hydrologic and hydraulic models used in project engineering design for:

- Determining 100-year floodplain surface water elevations,
- Hydraulic design of the channel improvements including diversion channels,
- Establishing levee heights and performing overtopping analysis, and
- Channel sedimentation and locations vulnerable to scour potential, which determine the type and extent of channel protection measures.

In the initial 1993 Feasibility Report, Appendix A, Hydrologic and Hydraulics, rainfall data from the U.S. Weather Service Technical Paper No. 42 (NWS, 1961) were used to determine 100-year floodplain impacts, damages, and risk. Because of changes to the authorized project and design criteria, such as the change in rainfall depths, the project may not meet the stated goals for flood risk reduction due to a 100-year flood. The 2014 Limited Reevaluation Report (LRR) acknowledges rainfall data have since been updated in the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 (NOAA, 2006), and that the project as designed may not provide the level of protection anticipated during a 100-year storm event.

An updated hydrologic and hydraulic analysis that integrates post authorization design changes (e.g., addition of scour and channel protection, channel widening, and levee realignment) has occurred, but this analysis did not include updated rainfall data. Rainfall data are a key component of hydrology and hydraulic analysis leading to the determination of floodplain impacts, which influence the final engineering design, costs, benefits, and risks of the authorized project.

Significance - Medium/High

The inclusion of model parameter updates, such as rainfall in the hydrologic and hydraulic analyses, is necessary to validate that the post-authorized project design will continue to meet the goals stated in the LRR for protection during a 100-year flood event.

Recommendation for Resolution

1. Update the hydrologic and hydraulic analysis using current criteria and rainfall data and integrate any design modifications that have occurred since the project was originally authorized.

Literature Cited:

NOAA Atlas 14 (2006). Precipitation-Frequency Atlas of the United States, Volume 3 Version 4.0: Puerto Rico and the U.S. Virgin Islands. Bonnin, G.M., D. Martin, B. Lin, T. Parzybok, M. Yekta, D. Riley, D. Brewer, L. Hiner. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Silver Spring, Maryland. Available online at: http://nws.noaa.gov/oh/hdsc/PF_documents/Atlas14_Volume3.pdf

NWS (1961). Technical Paper No. 42, Generalized Estimates of Probable Maximum Precipitation and Rainfall-Frequency Data for Puerto Rico and Virgin Islands for Areas to 400 Square Mlles, Durations to 24 Hours, and Return Periods from 1 to 100 Years. U.S. Department of Commerce, U.S. Weather Bureau. Available online at:
http://nws.noaa.gov/oh/hdsc/PMP_documents/TP42.pdf

Final Panel Comment 5

The construction modifications and cost engineering cannot be assessed because the engineering assumptions and data that underlie the study analyses have not been provided.

Basis for Comment

The LRR states there is no change to the location, purpose, or scope of the authorized project, and due to limited changes in the Arecibo basin, the engineering data developed to support the authorized plan remains valid. The Panel is concerned the LRR and its appendices, as provided, do not contain sufficient information to permit a reasonable review of the assumptions and analyses used to support the project cost engineering and construction modifications, therefore additional background information is warranted. The Panel requested engineering reports and documentation to review the assumptions and analyses for these project modifications during the mid-review teleconference on January 30, 2015, but USACE indicated this information is not currently available for review.

For example, the project as currently designed and described in Appendix B of the LRR includes a substantial increase in channel hardening and erosion control measures as compared to the project authorized in 1996. These modifications are likely the result of lessons learned from Hurricane Georges, but the Panel could not confirm this.

Design modifications made to address channel hardening and erosion control may have cost engineering, construction management, and even schedule implications. Even when documentation is provided, it appears to be missing key engineering details. For example, the Hydrologic and Hydraulic (H&H) Appendix A of the 1993 Feasibility Report that was provided to the Panel for reference does not include requisite H&H engineering information such as data on scour analysis, or design changes made as a result of value engineering conducted since the approval of the initial Feasibility Report and authorization of the project.

Finally, the Panel is concerned about the design maturity of the project and whether there may be cost engineering implications for features whose designs are dated and not yet constructed, or for features that have neither been designed nor constructed yet (e.g., bridges, floodwalls, levees, etc.). Safety provisions for these features may have changed as well. From a construction management and Safety Assurance Review (SAR) perspective, it will be difficult to assess the implications for these design features, but future reviews could identify them. These project features may contribute to an increase in project cost.

Significance – Medium

A review of engineering data and analyses would confirm that the project will perform as designed, allow for an evaluation of the benefits of increased channel hardening and erosion control, and validate the need for that particular increased project cost.

Recommendation for Resolution

1. Discuss the substantial increase in channel hardening and erosion control measures compared to the project authorized in 1996 and whether these modifications are anticipated to have cost, construction, or schedule implications.
2. Clarify whether the project adheres to the most recent design standards and construction engineering methods and practices.

Final Panel Comment 6

Between 2005 and 2011, project construction activities have impacted wetlands, however, the original mitigation site is no longer available, and the location of a wetland mitigation site is not yet determined.

Basis for Comment

The authorized project had identified an 8.2 acre parcel to use for wetland mitigation (LRR, p. 28). It included an existing white mangrove stand and 7.2 acres where additional mangrove forest could be created to offset project impacts. Between 1996 when the project was authorized and the preparation of the LRR in 2014, a radio tower and related infrastructure were constructed (2003-2004) on the authorized project wetland mitigation site. This compromised the ability of this site to be used for wetland mitigation as previously planned and authorized. Although some area may still be available at the authorized project wetland mitigation site for use in the project, additional area will also be needed for wetland mitigation.

The LRR considers and evaluates seven other potential sites for wetland mitigation. One of these, located within the buffer zone of the Caño Tiburones Natural Preserve, was excluded early, as it is being rehydrated and reverting back to wetland. Some of the other potential sites are also near the preserve and may revert to wetland over time.

In a letter dated 15 June 2011, in response to the USACE letter notifying them of the post authorization changes (Appendix E, Environmental), the U.S. Fish and Wildlife Service expresses concern over the loss of the previously authorized mitigation site. They recommend that USACE expedite the search for suitable mitigation sites because wetland impacts have already occurred and not wait for the initiation of Contract 3. The number of potential sites suitable for mitigation is likely to become fewer in future years as suitable sites continue to be developed for other uses.

Significance – Medium

Locating and obtaining a wetland mitigation site with the capacity to offset impacts due to project implementation is a required component of the project.

Recommendation for Resolution

1. Identify and evaluate potential wetland mitigation sites.
2. Select a suitable wetland mitigation site and construct wetland mitigation features.

Final Panel Comment 7

Public involvement and coordination activities with the limited English proficiency population and the Non-Federal Sponsor that have occurred since the approval of the 1993 Feasibility Study are not documented.

Basis for Comment

The LRR (p. 9) notes that a Project Cooperation Agreement was executed in 2001 with the Puerto Rico Department of Environmental and Natural Resources (Non-Federal Sponsor), but provides no evidence of subsequent cooperation, coordination, and funding support for the project. In light of the significant increases in project cost, reduced benefits, and increased local cost-sharing responsibilities, direct evidence of continuing public involvement and coordination and funding support for this project is warranted. The LRR provides no evidence of Non-Federal Sponsor funding capabilities.

In addition, efforts to document and communicate with persons with limited English proficiency (LEP) within the study area, as required by Executive Order 13166 (EO 13166, 2000), are not described, and any impacts the project may have on this population are unknown.

Significance – Medium/Low

Participation and support from the Non-Federal Sponsor is necessary for project design, funding, and execution. The effects of the project on LEP communities should be communicated consistent with EO 13166.

Recommendation for Resolution

1. Describe and document recent public involvement with the redesign of the project.
2. Provide evidence of Non-Federal Sponsor support and funding capabilities.
3. Describe and document LEP communities in the socioeconomic profile of study area.
4. Describe efforts to ensure compliance with EO 13166.

Literature Cited:

EO 13166 (2000). Improving Access to Services for Persons with Limited English Proficiency. Executive Order (EO) 13166. The White House, Office of the Press Secretary, August 11. 65 Fed. Reg. 50121 (August 16, 2000).

Final Panel Comment 8

The socioeconomic analysis is incomplete since impacts on the population and structures in the study area from Hurricane Georges in 1998 and the housing/financial crisis in 2007-2010 are not addressed.

Basis for Comment

Accurate and current socioeconomic information is necessary to determine the population and resources at risk from flood events. Appendix D (Economics) indicates that most of the field work to inventory property in the study area was completed in 2008 and then subsequently updated to October 2013 price levels (p. D-6). This appendix also notes relatively large declines in the population in the municipality of Arecibo from 1998 to 2010 (p. D-5), but does not focus on population, housing stock, and occupancy rates in the study area under with- and without-project conditions. Both Hurricane Georges in 1998 and the housing/financial crisis in 2007-2010 would be expected to have major impacts on the population and housing in the study area, but these impacts are not addressed.

In addition, the housing stock inventory information that is presented (e.g. Table 1, Appendix D) is inconsistent with the expected without-project conditions. For example, Table 1 lists that there are no residential structures in Nodes 2 and 9 of the study area, yet Table 5 (Appendix D, p. D-12) presents expected annual without-project residential damages of $426,000 and $1,127,000 respectively, for these nodes. These estimates are 27.6% of the total damages presented in Table 5.

Significance – Medium/Low

Current and complete socioeconomic information is necessary to accurately describe the socioeconomic impacts of the project on the local population and housing within the study area.

Recommendation for Resolution

1. Update socioeconomic data within the area directly impacted by the project using the most recent data sources.
2. Describe ongoing trends within the study area in terms of housing counts, occupancy rates, and new commercial/public investment.
3. Identify the population at risk in the impacted area and surrounding floodplains under with- and without-project conditions.
4. Eliminate inconsistencies between built structure inventory data and expected annual without-project damages.

Final Panel Comment 9

A detailed breakdown of the Operation, Maintenance, Repair, Replacement, and Rehabilitation cost estimate is not provided, so the accuracy and reasonableness of the cost estimate cannot be verified.

Basis for Comment

The Limited Evaluation Report and appendices do not provide information on how the Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) cost estimate was developed. A figure of $80,000 in additional annual OMRR&R costs is given in Table 13 (p. D-21) in Appendix D (Economics); however, there is no explanation or detail regarding how this amount was estimated.

OMRR&R costs are an essential component of project National Economic Development (NED) cost development, and documenting the assumptions and analyses used for estimating these costs is required to review and understand their formulation.

Significance – Medium/Low

The LRR and stated need for a Post Authorization Change would be strengthened by the inclusion of a discussion and detailed breakdown of the estimated OMRR&R costs.

Recommendation for Resolution

1. Provide a breakdown of the estimated OMRR&R costs in Appendix D (Economics).

Final Panel Comment 10

Lessons learned from the significant cost and schedule overruns during the Contract 1 project phase are not defined, and it could not be determined how these lessons were incorporated into project design changes or future project planning and management activities.

Basis for Comment

The LRR contains several references (pp. ES-4, ES-7, 11, 16, 17) to lessons learned from the previously completed Contract 1 phase of the project, which included the Rio Arecibo and Tamana levees and the Rio Santiago diversion channel. For example, lessons were reportedly learned from the effects of Hurricane Georges and various encountered site conditions. However, there is no specific description of what these lessons are, and no discussion of how these lessons have influenced modifications to the remaining project work. Since there were significant cost and schedule challenges with the Contract 1 phase, there would appear to be important lessons to learn; however, a detailed discussion of these lessons is not included in the LRR.

Significance – Medium/Low

Providing a more detailed discussion of the lessons learned would strengthen the understanding of what has been learned from the Contract 1 phase and the resulting improvements to be expected in the remaining project phases.

Recommendation for Resolution

1. Provide a detailed discussion of the lessons learned from the Contract 1 phase that specifically addresses how that knowledge has influenced planning and design of the remaining project phases.

Final Panel Comment 11

The LRR does not confirm a commitment to developing and executing risk management during continued preconstruction engineering and design (PED) and construction activities as recommended in the Cost Schedule Risk Analysis

Basis for Comment

The Cost and Schedule Risk Analysis (CSRA) performed for the Rio Grande Arecibo project recommends (p. 16) that risk response plans be developed for priority risks such as Differing Site Conditions. However, the Limited Reevaluation Report does not confirm a commitment to adopting risk management plans, and it is not clear if risk management plans will be developed and implemented during the PED or construction phases.

Risk management activities are generally accepted as fundamental components of best management practices and are essential for project success. For instance, the adverse consequences of risk events can be significantly reduced by risk monitoring and contingency planning.

Significance – Medium/Low

A confirmation of commitment to risk management would facilitate appropriate attention to risk in project delivery and associated project management activities.

Recommendation for Resolution

1. Develop risk response plans for priority risks listed in the CSRA risk register.
2. Implement risk management during the project delivery activity to design and construct the remaining uncompleted portions of the project.

Final Panel Comment 12

Measures to avoid potential impacts on threatened and endangered species that have been listed post authorization are not discussed in the LRR.

Basis for Comment

It has been almost 30 years since the Rio Grande de Arecibo was authorized by the Water Resources Development Act of 1996, and changes to the project design have been made post authorization. Since that time, as pointed out in a 23 May 2011 e-mail from the National Marine Fisheries Service (NMFS) Protected Resource Division to USACE, the NMFS has listed additional species and designated new critical habitats that may be present in or near the study area.

Appendix E, Environmental, provides evidence that USACE and NMFS entered into a Section 7 consultation, as required by the Endangered Species Act, to address potential impacts on sea turtles, corals, and coral critical habitat (see letter from NMFS to USACE dated 9 November 2012). The NMFS reached concurrence with the USACE position that the project "may effect, not likely to effect" position with regard to impacts on sea turtles, corals, and coral habitat only after USACE committed to the use of sedimentation and erosion control Best Management Practices (BMPs) and monitoring to prevent adverse impacts on sea turtles, corals, and coral habitat. The LRR includes a summary of the consultation (Section 9, Environmental Considerations, p. 28), but does not include documentation describing the commitment to use erosion control and sedimentation BMPs with monitoring to avoid adverse impacts on sea turtles, corals, and coral habitat.

Significance – Low

The LRR will be strengthened by documenting the commitment of USACE to use erosion control and sedimentation BMPs and monitoring to avoid impacts on listed species and critical habitat.

Recommendation for Resolution

1. Revise Section 9, Environmental Consideration, p. 28, paragraph 2 of the LRR to include reference to the use of erosion and sediment control BMPs and monitoring to avoid impacts on sea turtles, corals, coral habitats.

5. REFERENCES

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APPENDIX A

IEPR Process for the Rio Grande de Arecibo Project

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

Table A-1 presents the schedule followed in executing the Rio Grande de Arecibo, Puerto Rico Post Authorization Change Limited Reevaluation Report Independent External Peer Review (hereinafter: Rio Grande de Arecibo IEPR). Due dates for milestones and deliverables are based on the December 12, 2014 date for receipt of the modification award and modified project work statement. The review documents were provided by U.S. Army Corps of Engineers (USACE) on October 14, 2014. Note that the work items listed under Task 6 occur after the submission of this report. Battelle will enter the 12 Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle. Battelle will provide USACE and the Panel a pdf printout of all DrChecks entries, through comment closeout, as a final deliverable and record of the IEPR results.

Table A-1. Rio Grande de Arecibo IEPR Complete IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	2/27/2014
	Project Restart Based on Award of Contract Modification	12/12/2014
	Review documents available	10/14/2014
	Battelle submits draft Work Plan[a]	1/5/2015
	USACE provides comments on draft Work Plan	1/6/2015
	Battelle submits final Work Plan[a]	1/7/2015
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	12/16/2014
	USACE provides comments on COI questionnaire	12/19/2014
	Battelle submits list of selected panel members[a]	1/5/2015
	USACE confirms the panel members have no COI	1/7/2015
	Battelle completes subcontracts for panel members	1/14/2015
3	Battelle convenes kick-off meeting with USACE	3/6/2014
	Battelle sends review documents to panel members	1/15/2015
	Battelle convenes kick-off meeting with panel members	1/20/2015
	Battelle convenes kick-off meeting with USACE and panel members	1/20/2015
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	1/29/2015

Table A-1. Rio Grande de Arecibo IEPR Complete IEPR Schedule (cont.)

Task	Action	Due Date
4	Panel members complete their individual reviews	2/5/2015
	Battelle provides panel members with talking points for Panel Review Teleconference	2/9/2015
	Battelle convenes Panel Review Teleconference	2/9/2015
	Battelle provides Final Panel Comment templates and instructions to panel members	2/10/2015
	Panel members provide draft Final Panel Comments to Battelle	2/18/2015
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	2/19-2/26/2015
	Panel finalizes Final Panel Comments	2/27/2015
5	Battelle provides Final IEPR Report to panel members for review	3/3/2015
	Panel members provide comments on Final IEPR Report	3/5/2015
	Battelle submits Final IEPR Report to USACE[a]	3/9/2015
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	3/11/2015
	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	3/11/2015
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	3/11/2015
	USACE Project Delivery Team (PDT) provides draft Evaluator Responses to Planning Center of Expertise (PCX) for review.	3/25/2015
	USACE PCX provides draft PDT Evaluator Responses to Battelle	4/1/2015
	Battelle provides the panel members the draft PDT Evaluator Responses	4/3/2015
	Panel members provide Battelle with draft BackCheck Responses	4/8/2015
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	4/9/2015
	Battelle convenes Comment-Response Teleconference with panel members and USACE	4/10/2015
	USACE inputs final PDT Evaluator Responses to DrChecks	4/17/2015
	Battelle provides final PDT Evaluator Responses to panel members	4/22/2015

Table A-1. Rio Grande de Arecibo IEPR Complete IEPR Schedule (cont.)

Task	Action	Due Date
6[b]	Panel members provide Battelle with final BackCheck Responses	4/27/2015
	Battelle inputs the Panel's final BackCheck Responses in DrChecks	4/29/2015
	Battelle submits pdf printout of DrChecks project file[a]	4/30/2015
	Contract End/Delivery Date	8/31/2015

a Deliverable.

b Task 6 occurs after the submission of this report

At the beginning of the Period of Performance for the Rio Grande de Arecibo IEPR, Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan. In addition, 27 charge questions were provided by USACE and included in the draft and final Work Plans. Battelle added two questions that seek 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 C of this final report).

Prior to beginning their review and within one day of their subcontracts being finalized, all the members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge, as well as the Rio Grande de Arecibo 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.

- **Main Report (50 pages)**
- **Appendix A Authorized Proj Description (4 pages)**
- **Appendix B Post Auth Proj Description (5 pages)**
- **Appendix C Cost Estimate (35 pages)**
- **Appendix D Economics (21 pages)**
- **Appendix E Environmental (61 pages)**
- **Appendix F Recreation (18 pages)**
- **Appendix G Real Estate (17 pages)**
- NEPA (pages 104-350 of Final Feasibility Report) (249 pages)
- 1993 Hydraulics Report (pages 356-415 of Final Feasibility Report) (59 pages)
- USACE guidance Civil Works Review, (EC 1165-2-214) dated 15 December 2012
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

About halfway through the review of the Rio Grande de Arecibo IEPR 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 four panel member questions to USACE. USACE provided responses to all of the questions, but was unable to locate all materials and information requested by the Panel.

In addition, throughout the review period, USACE provided documents at the request of panel members. The following documents were provided to Battelle and then sent to the Panel as additional information only and were not part of the official review.

- Arecibo Cost Appendix
- Arecibo Depth Damage Curves
- Arecibo Structure Inventory.

A.2 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. At the end of the review, Battelle summarized the individual comments in a preliminary list of 13 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

A.3 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 significant importance to the findings, and merged any related individual comments. At the conclusion of the teleconference, Battelle reviewed each Final Panel Comment with the Panel, including the associated level of significance, and confirmed the lead author for each comment.

At the end of these discussions, the Panel identified 13 comments and discussion points that should be brought forward as Final Panel Comments.

A.4 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 Rio Grande de Arecibo 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 member as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.

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

  1. Comment Statement (succinct summary statement of concern)

  2. Basis for Comment (details regarding the concern)

  3. Significance (high, medium/high, medium, medium/low, and low; see description below)

  4. Recommendation(s) for Resolution (see description below).

- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:
  1. **High:** Describes a fundamental issue with the project that affects the current recommendation or justification of the project, and which will affect its future success, if the project moves forward without the issue being addressed. Comments rated as high indicate that the Panel determined that the current methods, models, and/or analyses contain a “showstopper” issue.

  2. **Medium/High:** Describes a potential fundamental issue with the project, which has not been evaluated at a level appropriate to this stage in the Planning process. Comments rated as medium/high indicate that the Panel analyzed or assessed the methods, models, and/or analyses available at this stage in the Planning process and has determined that if the issue is not addressed, it could lead to a “showstopper” issue.

  3. **Medium:** Describes an issue with the project, which does not align with the currently assessed level of risk assigned at this stage in the Planning process. Comments rated as medium indicate that, based on the information provided, the Panel identified an issue that would raise the risk level if the issue is not appropriately addressed.

  4. **Medium/Low:** Affects the completeness of the report at this time in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium/low indicate that the Panel does not currently have sufficient information to analyze or assess the methods, models, or analyses.

  5. **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 that was mislabeled or incorrect or that certain data or report section(s) were not clearly described or presented.

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

Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. During the Final Panel Comment development process, the Panel determined that one of the Final Panel Comments could be merged with another Final Panel Comment; therefore, at the end of this process, 12 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 the main report.

APPENDIX B

Identification and Selection of IEPR Panel Members
for the Rio Grande de Arecibo Project

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B.1 Panel Identification

The candidates for the Rio Grande de Arecibo, Puerto Rico Post Authorization Change Limited Reevaluation Report IEPR (hereinafter: Rio Grande de Arecibo IEPR) Panel were evaluated based on their technical expertise in the following key areas: planning/economics, environmental review, hydrologic and hydraulic engineering/risk analysis, and cost engineering. These areas correspond to the technical content of the Rio Grande de Arecibo IEPR review documents and overall scope of the Rio Grande de Arecibo project.

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

The candidates were screened for the following potential exclusion criteria or COIs.[1] These COI questions 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.

1. Previous and/or current involvement by you or your firm[2] in the Rio Grande de Arecibo, Puerto Rico, Post Authorization Change Limited Reevaluation Report (hereinafter: Rio Grande de Arecibo PAC LRR) and technical appendices

2. Previous and/or current involvement by you or your firm[2] in flood control projects in or near Arecibo, Puerto Rico or the Rio Grande de Arecibo and its tributaries

3. Previous and/or current involvement by you or your firm[2] in the Rio Grande de Arecibo, Puerto Rico, PAC LRR related projects.

[1] Battelle evaluated whether scientists in universities and consulting firms that are receiving USACE-funding have sufficient independence from USACE to be appropriate peer reviewers. See OMB (2004, p. 18), "….when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

[2] Includes any joint ventures in which your firm is involved and if your firm serves as a prime or as a subcontractor to a prime. Please clarify which relationship exists in the rows above.

4. Previous and/or current involvement by you or your firm[2] in the conceptual or actual design, construction, or operation and maintenance of any projects in the Rio Grande de Arecibo, Puerto Rico, PAC LRR related projects.

5. Current employment by the U.S. Army Corps of Engineers (USACE).

6. Previous and/or current involvement with paid or unpaid expert testimony related to Rio Grande de Arecibo, Puerto Rico, PAC LRR.

7. Previous and/or current employment or affiliation with [members of the cooperating agencies or local sponsors:] Municipality of Arecibo, Puerto Rico (for pay or pro bono).

8. Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to Arecibo, Puerto Rico.

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

10. Previous or current involvement with the development or testing of models that will be used for or in support of the Rio Grande de Arecibo, Puerto Rico, PAC LRR project.

11. Current firm[2] involvement with other USACE projects, specifically those projects/contracts that are with the Jacksonville 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 Jacksonville District. Please explain.

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

13. Any previous employment by USACE as a contractor (either as an individual or through your firm[2]) within the last 10 years, notably if those projects/contracts are with the Jacksonville District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.

14. Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning flood management and include the client/agency and duration of review (approximate dates).

15. Pending, current, or future financial interests in Rio Grande de Arecibo, Puerto Rico, PAC LRR related contracts/awards from USACE.

16. A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years came from USACE contracts.

17. A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years from contracts with the non-Federal sponsor (Municipality of Arecibo, Puerto Rico).

18. Any publicly documented statement (including, for example, advocating for or discouraging against) related to Rio Grande de Arecibo, Puerto Rico, PAC LRR.

19. Participation in relevant prior and/or current Federal studies relevant to this project and/or Rio Grande de Arecibo, Puerto Rico, PAC LRR.

20. Previous and/or current participation in prior non-Federal studies relevant to this project and/or Rio Grande de Arecibo, Puerto Rico, PAC LRR.

21. Is there any past, present, or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe:

Other considerations:

- Participation in previous USACE technical review panels
- Other technical review panel experience.

B.2 Panel Selection

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. One of the four final reviewers is affiliated with a consulting company, one is an independent consultant, and two are affiliated with universities. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. USACE was given the list of candidate panel members, but Battelle selected the final Panel.

An overview of the credentials of the final four members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table B-1. More detailed biographical information regarding each panel member and his area of technical expertise is presented in Section B.3.

Table B-1. Rio Grande de Arecibo IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Milon	Churchill	Fluty	Ellis
Planner/Economist				
Minimum 10 years of demonstrated experience in economics	X			
Expertise in flood risk management evaluating and conducting complex multi-objective public works projects with high public and interagency interest	X			
Familiarity with USACE flood risk management analysis and economic benefit calculations	X			
Familiarity with standard USACE computer programs including HEC-FDA	X			
Experience with the National Economic Development analysis procedures as they relate to flood risk management	X			
Direct experience working for or with USACE, highly preferred but not required	X			
Experience in Civil Works real estate laws, policies, and coastal property rights preferred	X			
Familiarity with USACE plan formulation process, procedures, and standards as they relate to flood risk management.	X			
Minimum 5 years of experience with the USACE six-step planning process (governed by ER 1105-2-100) Planning Guidance Notebook	X			
Active participation in related professional societies	X			
M.S. degree or higher in economics	X			
Environmental Reviewer				
Minimum 5 years of demonstrated experience in evaluating and conducting ecological evaluations		X		
Minimum 5 years of demonstrated experience conducting NEPA impact assessments for complex public works projects with competing trade-offs.		X		
Experience with high public and interagency interests, preferably those that may have effects on sensitive habitats		X		
Experience in study area (Puerto Rico) preferred		X		

Table B-1. Rio Grande de Arecibo IEPR Panel: Technical Criteria and Areas of Expertise (cont.)

Technical Criterion	Milon	Churchill	Fluty	Ellis
Hydrology and Hydraulic (H&H) Engineering/Risk Analysis				
Registered P.E. with a minimum 10 years of experience in hydrologic and hydraulic engineering			X	
Demonstrated experience in flood risk management projects			X	
Ability to address the USACE SAR aspects of all projects			X	
Experience with performing and presenting risk analyses in accordance with ER 1105-2-101 and other related guidance			X	
Familiarity with risks, primarily, but not limited to, flood risk and related life/safety risk			X	
Active participation in related professional societies			X	
Cost Engineering				
Registered P.E. with a minimum 5 years of experience in cost engineering and construction management				X
Experience in performing cost engineering/construction management for all phases of the project, including safety assurance				X
Familiarity with the construction industry and practices used in Florida, the Southeastern United States, and the Caribbean				X
Experience with performing and presenting risk analyses in accordance with ER 1105-2-101 and other related guidance				X
Active participation in related professional societies				X

B.3 Panel Member Qualifications

Walter Milon, Ph.D.

Role: Planning and economics experience and expertise.
Affiliation: University of Central Florida

Dr. Milon is the Provost's Distinguished Research Professor in the Department of Economics at the University of Central Florida's College of Business Administration. He has 36 years of experience in research, teaching, and publishing related to water resource economics and ecosystem restoration. He earned a Ph.D. in economics from Florida State University in 1978, and for the past 25 years has been teaching graduate-level courses on benefit-cost and social impact analyses, economic theory, and natural resource and environmental economics.

Dr. Milon is familiar with large, complex Civil Works projects with high public and interagency interests, having served as a consultant for the planning and technical advisory on the USACE Florida Everglades Restudy (1995-1999). He has taught graduate courses and conducted research in benefit-cost analysis, risk management, and flood damage assessment modeling, which includes the use of HEC-FDA. He was the principal investigator on the Socioeconomic Evaluation of Hurricane Evacuation Response project for the Florida Hurricane Research Alliance, and co-principal investigator on Florida's Coastal Environmental Resources: Economic Valuation and Analysis project.

Dr. Milon is experienced in evaluating National Economic Development (NED) for flood risk management projects, as well as National Ecosystem Restoration (NER) plan benefits. He is also experienced in Civil Works real estate laws, policies, and coastal property rights, and has conducted research on coastal property valuation. Dr. Milon has served as the lead economist on recent USACE IEPRs involving flood risk management, ecosystem restoration, and coastal storm damage reduction, namely, the White Oak Bayou, Texas, Federal Flood Damage Reduction Plan; Caño Martín Peña Ecosystem Restoration Project, San Juan, Puerto Rico; and the Walton County, Florida, Hurricane and Storm Damage Reduction Project.

Dr. Milon has worked directly for, or with USACE in applying Principles and Guidelines (P&G) to Civil Works projects, including flood risk management projects, and as such has over 5 years of experience working with the USACE six-step planning formulation process. He also teaches graduate courses and conducts research in benefit-cost and Cost Effectiveness and Incremental Cost Analyses (CE/ICA) methods.

Dr. Milon is a former member of the National Research Council Committee on USACE Water Resources Science, Engineering, and Planning; the Committee on Water Resources Science, Engineering and Policy; the Association of Environmental and Resource Economists; the American Economic Association; and the Southern Economics Association.

Jeff Churchill, M.S.

Role: Environmental experience and expertise.
Affiliation: George F. Young, Inc.

Mr. Churchill is an ecological consultant for Environmental Analysis and Permitting, Inc. in St. Petersburg, Florida. He earned his M.S. in zoology from the University of South Florida in 1983. Mr. Churchill has more than 34 years of ecological consulting experience in both government and private sectors, with a focus on wetlands and wildlife issues, wetland mitigation, environmental permitting, and water use permitting assistance. He has experience in preliminary ecological surveying, environmental permitting, NEPA assessments, mitigation design, Development of Regional Impact (DRI) preparation, habitat restoration, avian ecology, vegetation surveys, wildlife surveys, and protected species permitting, and has served as an expert witness.

Mr. Churchill is experienced in conducting NEPA impact assessments for complex Civil Works projects with competing trade-offs. He provided his expertise for mitigation and restoration studies for Federal, state, local, and private entities on such studies as the SWIM Habitat Restoration in Tampa Bay and the Florida Department of Environmental Protection Rainbow Springs State Park Wetlands in Marion County, Florida. He was lead ecologist on the Northwest Hillsborough County Expressway project through the Draft Environmental Impact Statement/Environmental Impact Statement (DEIS/EIS) process and was involved in public meetings, wetland mitigation, design, and implementation. The project involved coordination with all Federal, state, and local environmental agency staff, including, but not limited to, National Marine Fisheries Service, U.S. Fish and Wildlife Service, USACE, Environmental Protection Agency, Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, and U.S. Department of State.

Mr. Churchill has a strong understanding of environmental impacts associated with dredging and placement of contaminated debris and sediment. He has worked on a number of dredging projects where the disposal of the dredge spoils was assessed to ensure it was completed in an ecologically sound fashion, avoiding unintended impacts on natural systems in the vicinity of the project area. Example studies are Port Redwing, Florida Coastal Energy Impact Program and numerous City of St. Petersburg Arterial Channel dredging projects. He has experience working with wetlands and estuarine ecosystems, with the majority of the projects of the last 30 years involving wetlands impacts/avoidance of impacts and mitigation/restoration. Approximately one third of these projects have involved estuarine wetlands including mangrove forests, salt marsh, and salt flats communities. Relevant studies are assessments of Rocky Point and Tower Properties, both in Tampa, Florida. Additionally, he has worked on a Navy project assessing the impacts on mangrove forests on the Island of Vieques, Puerto Rico and developing an environmental management plan. Through his work in Vieques, as well as many other restoration projects in the last 30+ years, Mr. Churchill has an understanding of how structural improvements such as channels dredging and overback improvements affect the ecology/hydrology and embayment and riparian wetlands.

Mr. Churchill is knowledgeable in the standard methods used for evaluating ecological benefits in tropical coastal and estuarine ecosystems, including functional analysis (Uniform Mitigation Assessment Method [UMAM] and Wetland Rapid Assessment Protocol [WRAP]). He is also able to evaluate ecological benefits by assessing community components such as productivity, diversity, and resources.

He has been involved in numerous studies of sensitive habitats such as benthic invertebrate communities in Tampa Bay and South Florida and during his master's research on the effect of infaunal populations on larval colonization in soft bottom benthic communities. He previously worked for Mangrove Systems, which specialized in restoration and impact assessment on mangrove of mangrove forest areas. Most studies often included a faunal component assessing both epifauna and infauna associated with mangrove forests. He is familiar with the development of ecological models, evaluation of assumptions, and verification of models. He has worked with a variety of hydrologic models that intend to mimic naturally occurring events to predict ecological outcome.

Mr. Churchill is familiar with the USACE plan formulation process, procedures, and standards that are related to flood risk management, and has reviewed flood control projects in Florida, including the Herbert Hoover Dike Dam Safety Modification Study, Florida; the Tampa ByPass Canal, Florida; and more recently, many of the Everglades restoration projects to restore hydrology in the Picayune Strand. In addition, Mr. Churchill has been involved in the review of a number of harbor deepening projects located throughout Florida that have been formulated using the USACE six-step planning process and Planning Guidance notebook, namely, Palm Beach Harbor and Port Tampa Bay, as well as numerous beach nourishment projects along the coasts of Florida.

Larry Fluty, Ph.D., P.E.

Role: Hydrology and hydraulic (H&H) engineering/risk analysis experience and expertise.
Affiliation: Independent Consultant

Dr. Fluty has more than 34 years of experience managing and designing civil engineering facilities involving solutions for water resources, flood control, stormwater drainage, reservoir design, and water supply surface water planning. He earned his Ph.D. in civil engineering/water resources from Grant University in 2012 and is a registered professional engineer in the states of Florida, Kentucky, Ohio, Virginia, and West Virginia. Additionally, he is an Association of State Floodplain Managers Certified Floodplain Manager (ASFPM-CFM), and an American Academy of Water Resource Engineers – Diplomate, Water Resources Engineer (AAWRE- D.WRE).

In his previous role as the Director for Water Resources for Cardno, Dr. Fluty was responsible for all water resources and drainage discipline projects. He was also responsible for the planning, design, permitting and construction administration for water resource projects, as well as hydrologic and hydraulic modeling. As such, he is experienced with the USACE HEC model series, FEMA floodplain mapping master drainage plans, watershed management plans, water quality improvement plans, and geographical information systems (GIS) for water resources. Dr. Fluty has extensive background in the design and construction of erosion control, environmental compliance and restoration, hydraulic studies, levee and water supply reservoir design, flood control, stream stabilization, waterway and wetland permitting, dam design and inspections, and hydraulic safety audits and studies.

Dr. Fluty has more than 30 years of experience performing USACE flood risk management projects, as well as FEMA flood hazard mapping, and the preparation of Digital Flood Insurance Rate Maps (DFIRM) and a Flood Insurance Rate Study (FIS). His experience with flood risk management and mapping has evolved into the development of automated GIS parameterization coupled with automated modeling and production of flood risk assessments and mapping. While working for various cooperating technical partners (CTPs), he has produced more than 1000 FEMA Map Panels, and completed six countywide

DFIRM studies and the hydrologic and hydraulic modeling and mapping of more than 25,000 miles of streams.

Specific project experience includes serving as project manager for the Southwest Florida Water Management District's (SWFMD's) Watershed Management Program. While working on this contract, Dr. Fluty was responsible for managing and conducting watershed flood modelling and flood risk management projects for the Blue Sink, Weeki Wachee Prairie, Chassahowitzka River, City of Dunedin, City of Bushnell, and City of Safety Harbour watersheds. Dr. Fluty has also served as the project manager for the Hernando County, Florida, FEMA Map Modernization Project, where he assisted Hernando County with the update of outdated flood maps to meet the requirements for Risk Map and DFIRM formats.

Dr. Fluty is highly capable and experienced in addressing the requirements necessary for performing USACE Safety Assurance Reviews (SAR), and completing and presenting risk management requirements per ER 105-2-101 and related guidance. This experience includes performing SAR reviews for the Gardiner Dam, Ft. Meade, Florida, and the L-40 Levee Conveyance Reconnaissance Study for SFWMD and USACE Jacksonville District.

Dr. Fluty is very familiar with the impact of other disciplines on the outcome on flood risk management and flood reduction projects. He has worked with environmental professionals on impacts on natural systems, and has collaborated with planners to evaluate future land use and with geotechnical engineers to evaluate potential constraints on hydraulic structures. Dr. Fluty has worked with interdisciplinary project teams, serving as project manager on the SFWMD Everglades Protection Area Bc87(3) Project, West Palm Beach, Florida, and the Curlew Creek Restoration and Flood/Erosion Protection Project, Pinellas County, Florida.

Dr. Fluty is very familiar with evaluating risk for flood, damages, and life/safety aspects. Working with the USACE Jacksonville District and the SFWMD, he participated in peer design conferences, evaluated the hydrologic and hydraulic models developed by the project team, and reviewed and modified the proposed Operating Manuals to ensure consistent and compatible performance of the project components with the existing Central and Southern Florida Flood Control Project. Dr. Fluty also conducted risk management assessment of the alternatives and final project for flood risk impact, life and safety, and other criteria as specified by ER 105-2-101.

Dr. Fluty is a member of the American Water Resources Association, the American Society of Civil Engineers, the Association of State Floodplain Managers, and the Society of American Military Engineers.

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

Role: Cost engineering experience and expertise.
Affiliation: University of Florida

Dr. Ellis is an Associate Professor in the Department of Civil and Coastal Engineering at the University of Florida specializing in civil engineering and construction engineering. He earned his Ph.D. in civil engineering from the University of Florida in 1989 and is a registered professional engineer in Florida. Dr. Ellis has 40 years of experience in industry and academia. He has worked on large-scale civil engineering projects both regionally and internationally, including the Caribbean and Central America.

He has direct experience in the management and cost engineering of a wide variety of heavy civil-type projects including flood control projects. His experience in industry (1973-1989) encompasses the design and construction of levees, pumping stations, piping, and other structures related to water control; construction of temporary and permanent sheet pile walls; and dewatering operations. Many of the projects involved floodwalls, retaining walls, gatewell structures, interior drainage systems and structures, and the application of stoplog, sandbag, and other closure techniques.

Before joining the University of Florida, Dr. Ellis was president of the Hammer Corporation construction firm and Director of Projects for the FMI-Hammer Joint Venture. From 1975 to 1985, he directed Joint Venture operations in South Florida and Central America for U.S. government agencies, USACE, the U.S. Navy, and the Panama Canal Commission. Many of these projects involved significant earthwork structures (including flood control structures) and marine construction activities. He was also responsible for many projects involving utility relocations and penetrations and conducted national research on utility relocations.

Currently, as a professor of construction engineering, he teaches courses in advanced construction project management and cost engineering. Dr. Ellis has maintained up-to-date knowledge of USACE risk and uncertainty analyses as they apply to hurricane storm damage and risk reduction studies, HSDRRS design criteria requirements and storm drainage system and design, the full range of non-structural measures available for flood risk reduction, and SAR aspects of USACE projects.

Dr. Ellis also teaches cost and schedule risk analysis techniques, including Monte Carlo simulation applications, and is familiar with current practice in risk analysis and the provisions of ER 105-2-101. As a result, he was selected to participate in several Louisiana coastal storm damage reduction and ecosystem restoration project IEPRs for USACE, assessing analyses associated with cost engineering and construction management. He has also participated in an IEPR for a SAR of an impoundment project in Palm Beach County, Florida.

Dr. Ellis is an active member of the American Society of Civil Engineers (ASCE). He was an appointed member of the ASCE Committee on Critical Infrastructure, providing input on national infrastructure renewal issues (2009-2012), and was a director of the ASCE Education and Research Directorate (2003-2007).

APPENDIX C

Final Charge to the IEPR Submitted to USACE on January 7, 2015 for the Rio Grande de Arecibo Project

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CHARGE QUESTIONS AND GUIDANCE TO THE PANEL MEMBERS FOR THE IEPR OF THE RIO GRANDE DE ARECIBO, PUERTO RICO POST AUTHORIZATION CHANGE LIMITED REEVALUATION REPORT

BACKGROUND

This Post Authorization Change (PAC) Report for the Rio Grande de Arecibo flood control project in Arecibo, Puerto Rico is being prepared to seek a Section 902 of the Water Resources Development Act (WRDA) of 1986 limit increase to request the required authorization and appropriations for additional construction funds. The current authority provides funds for the completion of Contract 1 and Contract 2A, requiring additional authority and appropriations to complete Contract 2B and Contract 3. There are no changes to the scope of the authorized project or features; therefore this PAC report is a Limited Reevaluation Report (LRR). The LRR evaluates the authorized project within the context of the current socioeconomic conditions of the study area, unit cost data from completed and ongoing construction contracts, and current property value and detailed design estimates established during Preconstruction Engineering and Design (PED).

In general, the lapsed years of escalation, the development of detailed design during PED, and differing or constraining site conditions encountered during construction are the main contributing factors for the increase in total project cost. The LRR will outline revised cost, updated economic analysis, and National Environmental Policy Act (NEPA) and resource agency coordination.

The authorized purpose of the Rio Grande de Arecibo flood control project is to address flood damages caused by the overflow of the Tanama, Santiago, and Arecibo rivers into the municipality of Arecibo, Puerto Rico. The project is designed to reduce the flood risk of a 100-year flood event for the areas adjacent to Rio Grande de Arecibo and its tributaries. In general, the authorized project consists of the channelization of the developed portions of Rio Santiago located north of Highway 22, the construction of a drainage structure for the diversion channel, the construction of earthen levees along the north bank of Rio Tanama, the construction of an earthen levee and floodwall along the developed west bank of Rio Grande de Arecibo, the construction of one rock jetty, recreational features, and wetland and archaeological mitigation. The project was contracted in increments. Each construction increment of the project provides stand-alone benefits for a 100-year storm event. Phase 1 provides 25% of the total benefits, phase 2 provides 25% of the total benefits and is subdivided into parts 2a and 2b, and phase 3 provides 50% of the total benefits. The construction of phase 1 is complete.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Rio Grande de Arecibo, Puerto Rico Post Authorization Change Limited Reevaluation Report (hereinafter: Rio Grande de Arecibo IEPR) in accordance with the Department of the Army, U.S. Army Corps of Engineers (USACE), Water Resources Policies and Authorities' Civil Works Review (Engineer Circular [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 Rio Grande de Arecibo IEPR 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 planning/economics, environmental review, hydrologic and hydraulic engineering/risk analysis, and cost engineering issues relevant to the project. They will also have experience applying their subject matter expertise to flood risk management.

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:

Review Documents	
Title	**Number of Pages**
Main Report	50
Appendix A Authorized Proj Description	4
Appendix B Post Auth Proj Description	5
Appendix C Cost Estimate	35
Appendix D Economics	21
Appendix E Environmental	61
Appendix F Recreation	18
Appendix G Real Estate	17
Review Document Total Page Count	**211**
Supporting Documentation (for Panel reference only)	
NEPA (pages 104-350 of Final Feasibility Report)	249
1993 Hydraulics Report (pages 356-415 of Final Feasibility Report)	59
Supporting Document Total Page Count	**308**
Total Page Count	**519**

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 December 12, 2014 date for receipt of the modification award and modified project work statement.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	1/15/2015
	Battelle convenes kick-off meeting with panel members	1/20/2015
	Battelle convenes kick-off meeting with USACE and panel members	1/20/2015
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	1/29/2015
	Panel members complete their individual reviews	2/5/2015
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference	2/9/2015
	Battelle convenes Panel Review Teleconference	2/9/2015
	Battelle provides Final Panel Comment templates and instructions to panel members	2/10/2015
	Panel members provide draft Final Panel Comments to Battelle	2/18/2015
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	2/19-2/26/2015
	Panel finalizes Final Panel Comments	2/27/2015
	Battelle provides Final IEPR Report to panel members for review	3/3/2015
	Panel members provide comments on Final IEPR Report	3/5/2015
	Battelle submits Final IEPR Report to USACE	3/9/2015
Comment/ Response Process	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	3/11/2015
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	3/11/2015
	USACE provides draft PDT Evaluator Responses to Battelle	3/25/2015
	Battelle provides the panel members the draft PDT Evaluator Responses	4/3/2015
	Panel members provide Battelle with draft BackCheck Responses	4/8/2015
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	4/9/2015

Task	Action	Due Date
	Battelle convenes Comment-Response Teleconference with panel members and USACE	4/10/2015
	USACE inputs final PDT Evaluator Responses to DrChecks	4/17/2015
	Battelle provides PDT Evaluator Responses to panel members	4/22/2015
	Panel members provide Battelle with final BackCheck Responses	4/27/2015
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	4/29/2015
	Battelle submits pdf printout of DrChecks project file	4/30/2015

CHARGE FOR PEER REVIEW

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

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

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Rio Grande de Arecibo 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 February 5, 2015, 10 pm ET.

IEPR of the Rio Grande de Arecibo, Puerto Rico Post Authorization Change Limited Reevaluation Report

CHARGE QUESTIONS AND RELEVANT SECTIONS AS SUPPLIED BY USACE

1. Is the need for and intent of the decision document clearly described?
2. Does the decision document adequately address the stated need and intent?

For the decision document:

3. Assess the adequacy and acceptability of the project evaluation data used in the study analyses.
4. Assess the adequacy and acceptability of the economic, environmental, and engineering assumptions that underlie the study analyses.
5. Assess the adequacy and acceptability of the economic, environmental, and engineering methodologies, analyses, and projections.
6. Assess the adequacy and acceptability of the models used in the evaluation of the updated economic benefits.
7. Assess the adequacy and acceptability of the quality and quantity of the surveys, investigations, and engineering sufficient for the project design and cost estimate.
8. Assess the adequacy and acceptability of the overall assessment of significant environmental impacts.
9. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable.
10. Assess the changes in the authorized plan from the perspective of systems, including systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

For the revised authorized plan:

11. Are the assumptions made for the life safety hazards appropriate?
12. Are the quality and quantity of the surveys, investigations, and engineering sufficient for the project design and cost estimate considering the life safety hazards and to support the assumptions made for determining the hazards?
13. Does the analysis adequately address the uncertainty and residual risk given the consequences associated with the potential for loss of life for this type of project?
14. From a public safety perspective, are the changes in the authorized plan reasonably appropriate?

15. Do the project features adequately address redundancy, resiliency, or robustness with an emphasis on interfaces between structures, materials, members, and project phases?

Specific Technical and Scientific Charge Questions

16. Is the authorized project clearly described in terms of location, function, size, and land requirements?
17. Are the changes to the authorized plan clearly described and is the rationale for the changes clear?
18. Are the location, sizing, and design of the changes to the authorized plan features appropriate?
19. Are the changes to the project cost clearly described and is the rationale for the changes clear?
20. Are the updated economic analyses and benefits clearly described and do they appear reasonable?
21. Are the uncertainties inherent in our evaluation of benefits, costs, and impacts, and any risk associated with those uncertainties, adequately addressed and described?
22. Are future Operation, Maintenance, Repair, Replacement, and Rehabilitation efforts adequately described and are the estimated costs of those efforts reasonable?
23. Do the analyses and documentation reasonably demonstrate that the revised authorized project will achieve the expected outputs/benefits, or will any additional measures be needed to realize the outputs/benefits?
24. Does the environmental analysis reasonably support the decision that existing NEPA documentation is adequate?
25. Does the available hydrologic and hydraulic information reasonably support the changes to the authorized project and the updated project cost and benefits?

Summary Questions

26. Please identify the most critical concerns (up to five) you have with the project and/or review documents.
27. Please provide positive feedback on the project and/or review documents

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