The U.S. Army Corps of Engineers submits the following information per requirements in the Water Resources Reform and Development Act of 2014, Section 1044(c)(4)(B).

**Entity Conducting the Review**

Outside Eligible Organization: Battelle

505 King Avenue

Columbus, OH 43201

**Dates of Review**

Review Initiation: 31 October 2017

Anticipated Type I IEPR Final Report Submittal: 6 February 2018

**Reviewer Names and Qualifications**

David Luckie

Civil Works Planner/Economist

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

Mr. Luckie is familiar with the evaluation of alternative plans for both CSRM and flood risk management (FRM) studies, and has conducted, supervised, or reviewed several water resource studies featuring numerous alternative plans constructed from an array of different management measures. Over the last three decades, Mr. Luckie has been involved in numerous CSRM studies. Two examples are the Panama City Beach, Florida, study, a multipurpose project that included structural, non-structural, and recreation outputs, and the Mississippi Coastal Improvements Program following Hurricanes Katrina and Rita. He has also served as a panel member on the IEPRs of the Hereford Inlet CSRM Study in New Jersey and the Encinitas – Solana Beach CSRM Study in California. He applied his knowledge of ER-1105-2-100 and the 6-Step Planning Process in each of these high-profile efforts. Least cost analysis, also known as cost-effectiveness analysis, has been a very important aspect of Mr. Luckie’s decades of work. He is familiar with the evaluation of alternative plans. As a Regional Economist with the USACE Mobile District (1988-2006), Mr. Luckie conducted, supervised, or reviewed benefit-cost analyses for a variety of water resource projects, both single-purpose and multi-purpose projects covering the full range of USACE missions. Relevant studies include the Apalachicola-
Chattahoochee-Flint River and the Alabama-Coosa-Tallapoosa Comprehensive Studies and the draft Programmatic Environmental Impact Statements covering the states of Alabama, Florida, and Georgia; and the Hunting Bayou General Reevaluation Report (GRR) in Houston, Texas. Mr. Luckie is very familiar with USACE standards and procedures. He has extensive experience in performing National Economic Development (NED) analyses, specifically as they relate to flood and coastal risk management. For more than 25 years, he has performed, supervised, or reviewed NED procedures for technical accuracy and compliance with policy and guidance and accepted planning principles. Such studies as Panama City Beaches and Mississippi Coastal Improvements reflect this expertise. Mr. Luckie has been using the Hydrologic Engineering Center’s Flood Damage Reduction Analysis (HECFDA) software since its inception in the 1990s. He has also performed, reviewed, or trouble-shot scores of HEC-FDA analyses for federal, non-Federal, and private sector clients. In addition, he has mentored interns and junior economists in USACE methodologies for coastal flood risk management, requiring them to calculate without- and with-project condition damages, either by hand or with a Microsoft Excel spreadsheet, before allowing them to use HEC-FDA. He is also very familiar with the USACE Regional Economic System (RECONS) model and the estimation of Regional Economic Development benefits, and has used the model for both Federal and non-Federal project proponents since its inception.

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<th>Kay Crouch</th>
<th>Biological and Environmental Law Compliance Specialist</th>
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| Ms. Crouch is board chair of Crouch Environmental Services, Inc., a company specializing in National Environmental Policy Act (NEPA) analysis, environmental site assessment, permitting, and mitigation for projects with high public and interagency interests. She earned her M.S. in biology/ecology in 1978 from Steven F. Austin State University, and has received additional academic training in the NEPA process from the Duke University Nicholas School of Environmental and Earth Sciences (2004-05). Ms. Crouch has more than 37 years of nationwide experience in conducting environmental site assessments and NEPA impact assessments for complex multi-objective public works projects with competing trade-offs. She has performed numerous environmental evaluations throughout the coastal ecosystems of Louisiana and Texas in support of Federal Energy Regulatory Commission (FERC) filings and NEPA documentation. For the first 10 years of her consulting career, Ms. Crouch worked predominantly in Louisiana performing NEPA analyses for oil and gas pipelines crossing the Louisiana Coastal Zone and has prepared over 100 NEPA documents since 1978. Ms. Crouch has experience working with NEPA impact assessment in marsh and urban areas and related ecosystem species and habitats. She has done extensive work in the coastal marsh habitats that span the Gulf Coast. She has experience in high and low tidal marsh restoration and evaluation, as well as inland wetlands. Additionally, she has worked on projects in Louisiana involving evaluation of chenieres and inland swamps. In the mid-1990s, Crouch Environmental Services designed and constructed the Baytown Nature Center, Texas, a large coastal marsh creation project for which the company received the 1998 Award of Excellence from the National Association of Landscape Architects. Ms. Crouch is familiar with USACE calculations of environmental benefits and routinely performs cumulative effects analyses on high-visibility public works projects as part of her extensive NEPA practice. This type of modeling has been required on every flood damage reduction and ecosystem restoration
project she has worked on relating to USACE, including the Clear Creek Flood Damage Reduction Project and the Addicks and Barker Dams and Reservoirs system in Harris County, Texas. Other NEPA projects have consisted of flood damage reduction projects, dams, ports, parks, offshore activities, linear transportation corridors, and power plants and other types of projects involving Federal funding. Ms. Crouch has 38 years of experience with endangered species. She has completed several projects that involve compliance with the Endangered Species Act (ESA), specifically with the listed species found in Southern Louisiana (including state-listed species), through her work in the Louisiana coastal zone. The evaluation of the presence or absence of listed species is required for almost every project she has been involved in. These include USACE 404 permit applications requiring field investigations for listed species in numerous states; she also has completed the Section 7 consultation process for several species. Ms. Crouch also has demonstrated experience with cultural resource surveys. Almost every project she works on requires an investigation and evaluation of cultural resource issues. She is intimately familiar with the record search step as well as field survey techniques for cultural resources. Her experience is supervisory and relates to USACE 404 permits and NEPA documentation. She also has experience with Section 106 for the analysis of historical issues. She has demonstrated knowledge of conducting biological assessments, including wetlands delineation, compilation of Biological Assessments for Section 404 permitting, and NEPA documentation. She has dealt with numerous types of habitats in many locations nationwide. Ms. Crouch is familiar with USACE’s calculation and application of environmental impacts and benefits. She routinely performs cumulative effects analyses on high-visibility public works projects as part of her extensive NEPA practice. She is well versed in various modeling types and in the performance of incremental cost analysis for mitigation evaluation for dam repair and restoration. She has experience reviewing the application of Wetland Value Assessment (WVA) methodology and has calculated the environmental losses and benefits of USACE projects using the hydrogeomorphic (HGM) approach, habitat evaluation procedures (HEP), and WVA, as well as other models. Most recently, she performed WVA analysis for the Addicks and Barker Dams environmental assessment in Harris County, Texas, for the Galveston District. Additionally, she has experience serving as an environmental expert in previous IEPRs of USACE Louisiana Water Resources Council (LWRC) projects. Ms. Crouch is a member of the Society of Wetland Scientists.

Christopher Bender
Coastal/Hydrology and Hydraulic Engineer

Dr. Bender is a senior engineer in the coastal engineering group at Taylor Engineering, Inc. He earned a Ph.D. in coastal engineering from the University of Florida in 2003 and is a registered professional engineer in Florida and Mississippi. He leads much of Taylor Engineering’s simulations and evaluations of hurricane surges, wave mechanics and loading, littoral processes, shoreline stability and protection, beach renourishment, and sediment transport. He has also served as an adjunct professor at the University of North Florida since 2009, teaching coastal engineering and processes classes. His experience includes large urban coastal risk reduction engineering projects and shore protection projects and designs in Florida and coastal storm surge studies in the southeastern United States, New York, New Jersey, and the Gulf of Mexico. Studies include the Federal Emergency Management Agency (FEMA) Region IV Coastal Storm Surge Update Studies.
in South Carolina, Georgia, Northeast Florida, and East Coast Central Florida and the Nuclear Regulatory Commission (NRC) Evaluation of Coastal Storm Surge for Nuclear Power Plants. Dr. Bender has also served on USACE IEPR panels as the coastal engineering discipline expert for coastal storm damage reduction studies for the Hereford Inlet to Cape May Inlet, New Jersey, Hurricane and Coastal Storm Damage Risk Reduction Project Draft Feasibility Report and Environmental Assessment; the Surf City and North Topsail Beach, North Carolina, Integrated Feasibility Report and Environmental Impact Statement; the South Shore of Staten Island Coastal Storm Damage Reduction Feasibility Study; and the Fire Island to Montauk Point Coastal Storm Risk Management Hurricane Sandy General Reformulation Report. Dr. Bender is familiar with USACE coastal, hydrologic and hydraulic computer models and has extensive experience setting up, executing, and post-processing results in USACE coastal models, including Coastal Modeling System (CMS), Steady State Spectral WAVE (STWAVE), Advanced Circulation (ADCIRC), Storm-induced Beach Change Model (SBEACH), Beach-fx, Simulating Waves Nearshore model (SWAN), Generalized Model for Simulating Shoreline Change (GENESIS), and Coastal Engineering Design and Analysis System (CEDAS) for several projects. He has worked with the CMS system and models and the Surface-water Modeling System (SMS) software. During recent studies, he has applied STWAVE for nearshore and offshore spectral wave modeling and ADCIRC to simulate storm surge levels, with efforts during the entire modeling process: grid development, model validation, storm simulation, and processing of model results. Dr. Bender has applied spreadsheet models for wave growth, wave runup, and wave overtopping along Louisiana coastal levees and during evaluation of storm surge hazard at NRC nuclear sites. He is also familiar with the Generalized Risk and Uncertainty Coastal Plan (GRANDUC model) and has successfully applied these models to many locations from Florida to Texas. Dr. Bender is familiar with risk and uncertainty analyses for coastal storm risk management projects, participating in such studies as the development of GRR and limited reevaluation report (LRR) documents for the Ft. Pierce, Florida, Shore Protection Project; GRR document for the Panama City Beaches, Florida, Shore Protection Project; and Feasibility Study for the Walton County, Florida, Project. The projects applied USACE models to define damages and benefits and NED aspects of project alternatives. Efforts on the various projects included storm damage modeling, alternative development, alternative analysis, and NED plan selection. He also worked with a team of experts to develop a risk-based methodology to calculate revised coastal storm surge and wave estimates for the Joint USACE/FEMA Coastal Storm Surge Studies along the Louisiana and Texas coasts. He also participated in projects to develop revised coastal storm surge and wave estimates for FEMA coastal storm surge studies along the South Carolina, Georgia, and east Florida coasts. Dr. Bender is capable of addressing the USACE Safety Assurance Review (SAR) requirements and has conducted SARs in support of such studies as the Shore Protection Projects (SPP) in Martin County and St. Lucie County, Florida. He has also authored or co-authored numerous publications on nearshore wave transformation, coastal processes, and simulation of nearshore waves. His involvement on the Fort Pierce, Florida, LRR and GRR projects, the Nassau County, Florida, GRR, and the Panama City Beaches, Florida, GRR project included working with the USACE application of risk and uncertainty analyses in coastal storm damage reduction studies.

Jay Jani  Structural Engineer
Dr. Jay Jani, P.E., has more than 32 years of experience as a structural engineer working on a variety of projects including offshore and coastal structures, flood protection, subsea pipelines, and industrial structures. He earned his Ph.D. in ocean engineering with a major in structural engineering and an emphasis on offshore and coastal structures from Florida Atlantic University in 1990. Dr. Jani founded his firm, Engineering Consulting Services, Inc. (ECS) in 2000 and has been ECS’s president/CEO and senior structural engineer since the firm’s founding. He also served as an adjunct faculty member in the Department of Civil Engineering at the University of New Orleans. Dr. Jani has served on previous post-Katrina IEPR panels for the USACE New Orleans District’s Hurricane and Storm Damage Risk Reduction System (HSDRRS) projects. These projects’ structures (specifically, the Lake Pontchartrain and Vicinity 144 project) included T-walls, I-walls, L-walls, T-wall sheetpiles, levees, steel gates, levee tie-ins, temporary retaining structures, transition and scour protection, barge/boat impact loads, and flood protection structures. He also has participated in other IEPR panels, reviewing documents such as the New Orleans District’s “New Post-Katrina HSDRRS Design Guidelines,” “Aberrant Barge Impact Loads on HSDRRS Floodwalls,” and “Spiral Welded Pipe (SWP) Piles.” Dr. Jani has extensive experience in the structural design of steel-reinforced concrete structures, pile foundations, construction, and rehabilitation projects in soft Louisiana soils. He also has extensive experience designing and assessing the structural integrity of all phases of offshore platform design for various projects, including a floating tension-leg platform in the Gulf of Mexico, in-place analysis of fixed offshore platforms, installation engineering (load-out, transportation analysis, lift analysis, lift rigging design, etc.), pile foundation design, subsea pipelines, and steel catenary risers (SCR) and SCR hook design and earthquake analysis. Dr. Jani also performed structural inspections of USACE New Orleans District’s Bayou Dupre and Bayou Bienvenue control structures to assess their post-Katrina structural integrity and condition. In addition, he participated in the structural integrity assessment of many residential buildings in metro New Orleans and vicinity following Hurricane Katrina. In 2008-2009, Dr. Jani served as Chairman of the American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) Structures Committee (New Orleans chapter).

Dr. Charles Aubeny, Geotechnical Engineer

Charles Aubeny is currently employed at Texas A&M University teaching soil mechanics, geotechnical design, geotechnical testing, and numerical methods. His academic experience includes 18 years of teaching, conducting research, and consulting on topics involving slope stability, earth-retaining structures, geotechnical site characterization, numerical analysis, offshore foundations and pipelines, and unsaturated soils. Prior experience includes eight years with the Embankment Dams Branch of the U.S. Bureau of Reclamation and seven years in private consulting in geotechnical engineering, offshore engineering, dam engineering, levees and flood control, and geo-environmental engineering. He has had direct personal involvement in a wide range of geotechnical practice, including field investigations, laboratory testing, analysis, design, construction quality control and assurance, and performance monitoring of structures during operation. Dr. Aubeny has 34 years of experience in the planning, analysis, design and construction of earthen embankments and floodwalls. His background on earthen embankment includes design and analysis for slope stability, settlement, seepage control, wave run-up protection, and overtopping. He has teamed with structural engineers in the design of
traditional floodwalls and has extensive knowledge of earth-retaining structures, including sheetpile walls, drilled shafts, and mechanically stabilized earthfill. His design experience also includes the planning and implementation of instrumentation programs that monitor the performance of embankments and retaining walls. He has been involved in the construction aspects of geotechnical practice throughout his career, including serving as resident engineer for Pacific Gas & Electric during construction of the seismic retrofit of Butt Valley Dam (1997) and as chief of geotechnical monitoring for the East Bay Municipal Utility District for the upgrade of the Mokelumne Aqueduct (1998). Dr. Aubeny's prior service as an external peer reviewer on coastal engineering projects includes the USACE Mississippi Coastal Improvement Study (2009), which considered a wide range of both structural and nonstructural risk management measures, and the USACE Freeport Harbor Navigation Improvement Project (2008). He also was an external peer reviewer on other USACE projects involving flood risk management in the Lower San Joaquin River in California (2015), the Dallas Floodway (2013), the Santa Maria levees in California (2012), and the Kansas City levees (2012). He served as Project Manager on a number of flood control projects governed by USACE geotechnical standards, including the Sacramento Area Flood Control Levee Upgrades (1996) and multiple levee systems throughout the Sacramento-San Joaquin River Delta (1992-1998). His annual graduate course on slope stability and retaining walls presents USACE practice for the analysis, design, and construction of levees, earth dams, sheetpile walls, flood walls, and retaining walls. He has served on prior IEPR panels for USACE projects involving SARs for flood management, including the Santa Maria and Bradley Canyon levee system, the Kansas City Flood Risk Management Project, and the Dallas Floodway Feasibility Report and Environmental Impact Statement. Dr. Aubeny actively participates in professional engineering and scientific societies, including service as an Editorial Board Member for the ASCE Journal of Geotechnical and Geoenvironmental Engineering and the American Society for Testing and Materials ASTM Geotechnical Testing Journal. He is frequently called as an expert witness on forensic cases involving distressed slopes, retaining walls, and underwater lifelines. He authored a textbook titled *Geomechanics of Marine Anchors* outlining the state of practice on offshore site soil characterization and on anchor and pile design for coastal and ocean engineering projects. He regularly performs service activities to the profession and currently supervises three Texas A&M doctoral students performing site inspections and data collection for the Geotechnical Extreme Events Reconnaissance study of coastal Texas following Hurricane Harvey in 2017. He received the ASCE Middlebrooks Award and is an ASCE Fellow.

Phillip Brozek
Civil Engineer/Risk Reviewer

Mr. Brozek, a principal with Brozek & Associates, has 35 years of experience as a practicing engineer. He earned his B.S. in civil engineering in 1979 from California State University, Sacramento, and is a registered P.E. in California and Oregon. In addition to additional academic coursework in water resources engineering, Mr. Brozek holds a Certificate in Hazardous Material Management from the University of California Extension, Davis, and an Associates Certificate in Project Management from George Washington University. He also was a founding member of the Practitioner Advisory Committee at the Department of Civil Engineering, California State University, Sacramento. Mr. Brozek's familiarity with large, complex Civil Works projects with high public and interagency interest includes work on projects both as an employee of USACE and as a private
consultant. Project objectives for this work included flood risk management, levee and dam safety risk management, and watershed restoration. Mr. Brozek’s review capability is enhanced by significant experience in construction management and the practical operation and maintenance, repair, replacement, and rehabilitation (OMRR&R) implementation for projects focusing on project resiliency. Mr. Brozek served as a Civil Works Senior Project Manager for 11 years with the USACE Sacramento District, overseeing large multi-objective projects. He was also project and program manager for the interagency restoration of the Lake Tahoe watershed, which included multi-objective planning and implementation as part of a long-term $3.5 billion watershed restoration plan. His USACE experience featured structural and nonstructural elements, including levee embankments, stability berms, dam removal, reinforced concrete channels and floodwalls on top of embankments, box culverts, bridge appurtenances, pump stations, sheetpiles, off-stream detention basins and on-stream overbank storage, and control features to maximize storage while attenuating and reducing peak discharge. Environmental restoration project features included vegetated basins to provide incremental water quality improvements, aquatic ecosystem improvements, and recreation access and opportunities when areas are not inundated. Typical projects included the San Lorenzo River (with coastal outlet), South Sacramento Streams group, Yuba River, Magpie Creek, Sacramento River Gradient Structure, multiple stream restoration projects (e.g., Mill Creek, Blackwood Creek, Upper Truckee River) in the Lake Tahoe watershed, and oversight as senior project manager of an entire portfolio of other projects. For nearly eight years, Mr. Brozek has worked as a consultant on large Civil Works projects that include levee vegetation management risk waivers; training of USACE project managers in risk management and practical application of risk and uncertainty principles in actual projects; risk register updates for feasibility study; dam design and construction; reservoir land use planning; dam modification design-dam safety; risk assessment integration; safety review of the new construction and demolition of concrete flood walls, flood gates, and other appurtenances; review of slope stabilization during demolition of existing structures; work around historic, archeological and environmentally sensitive areas; and the planning, design, and review of material management plans for projects that involve the removal, separation, storage, and disposal of large amounts of excess material, including concrete and soil.