DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

REPLY TO
ATTENTION OF

APR 6 2010

CECW-MVD

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

SUBJECT: Louisiana Coastal Protection and Restoration - Final USACE Response to Independent External Peer Review

1. Independent External Peer Review (IEPR) was conducted for the subject project in accordance with Section 2034 of WRDA 2007, EC 1165-2-209, and the Office of Management and Budget's Final Information Quality Bulletin for Peer Review (2004).

2. The IEPR was conducted by the National Research Council (NRC) of the National Academies, which established a committee to review LACPR. The Committee reviewed the LACPR's February 2008 and March 2009 drafts with the purpose of providing the Corps with an external independent technical assessment, including an assessment of the economic, engineering, and environmental methods, models, data, and analyses used in the report. The committee was charged to review two draft reports from the LACPR team and to assess "the hurricane risk reduction framework, alternatives for flood control, storm protection, coastal restoration, and risk analysis". The committee's first report was released in 2008 and the second review dated July 2009 presents the committee's review and advice for improvements of the LACPR March 2009 draft final technical report, which considers the first NRC reports comments.

3. The final written responses to the IEPR report are hereby approved. The enclosed document contains the final written responses of the Chief of Engineers to the issues raised and recommendations contained in the IEPR report. The IEPR report and USACE responses will be posted on the Internet, as required in EC 1165-2-209.

4. If you have any questions on this matter, please contact Joseph Redican, MVD-RIT Planner at 202-761-4523.

FOR THE COMMANDER:

STEVEN L. STOCKTON, P.E.
Director of Civil Works

Encl

Louisiana Coastal Protection and Restoration Program

USACE Response to Independent External Peer Review
April 2010

Independent External Peer Review (IEPR) was conducted for the Louisiana Coastal Protection and Restoration Program in accordance with Department of the Army, the U.S. Army Corps of Engineers (USACE), guidance *Peer Review of Decision Documents* (Engineering Circular (EC) 1105-2-410) dated August 22, 2008 and subsequent updated guidance *Civil Works Review Policy* (EC 1165-2-209) dated December 31, 2009, CECW-CP Memorandum dated March 30, 2007, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

In December 2005, the U.S. Congress directed the Secretary of the Army through Public Laws 109-103 and 109-148 to

"...conduct a comprehensive hurricane protection analysis and design at full federal expense to develop and present a full range of flood control, coastal restoration, and hurricane protection measures exclusive of normal policy considerations for South Louisiana and the Secretary shall submit a preliminary technical report for comprehensive Category 5 protection within 6 months of enactment of this Act and a final technical report for Category 5 protection within 24 months of enactment of this Act: Provided further, That the Secretary shall consider providing protection for a storm surge equivalent to a Category 5 hurricane within the project area and may submit reports on component areas of the larger protection program for authorization as soon as practicable: Provided further, That the analysis shall be conducted in close coordination with the State of Louisiana and its appropriate agencies."

In response to the authorization and appropriations, USACE produced the LACPR Final Technical Report that presents a full range of flood damage risk reduction (referred to in the authorization as flood control), coastal restoration, and hurricane and storm damage risk reduction (referred to in the authorization as hurricane protection) plans exclusive of normal policy considerations for South Louisiana. Included within this report are alternative plans that could provide risk reduction for a range of alternatives, including the Category 5 threshold of storm events. In addition to formulating and developing alternatives to reduce risk, the LACPR report strives to communicate the risks and the range of implications associated with managing those risks. The LACPR Final Technical Report engages leaders and stakeholders in a process of risk-informed decision-making. The report further indicates the types and potential magnitude of the tradeoffs required for implementation of each plan to assist local, regional, and national consideration and decision-making.

The goal of the USACE Civil Works program is always to provide the most scientifically sound, sustainable water resource solutions for the nation. The USACE review processes are essential to ensuring project safety and quality of the products USACE provides to the American people. In June 2007, USACE contracted with National Research Council (NRC) of the National Academies to establish a committee to review the LACPR Program documented in the LACPR Final Technical Report. The Committee first reviewed the February 2008 LACPR Draft Technical Report and provided comments, which were released in 2008, to be addressed in the

March 2009 report. The Committee then reviewed the March 2009 LACPR Draft Technical Reports with the purpose of providing the Corps with a final external independent technical assessment, including an assessment of the economic, engineering, and environmental methods, models, data, and analyses used in the report. The committee was charged to review these two draft reports and assess "the hurricane risk reduction framework, alternatives for flood control, storm protection, coastal restoration, and risk analysis". The second NRC report dated July 2009 presents the committee's final review and advice for improvements of the LACPR March 2009 draft final technical report, which again considers the first NRC report's comments. USACE commends the independent external peer review panel for their grasp and understanding of this complex issue and their comments have been integral in the shaping of LACPR Final Technical Report as well as informing other coastal protection and restoration studies and projects in Louisiana. This document outlines what actions USACE has or will take to address the comments provided.

The following discussions present USACE Response to the IEPR comments.

1. IEPR Comment: The lack of a comprehensive long-term hurricane protection and coastal restoration plan, and the lack of advice on initial high-priority steps and projects, represent substantial shortcomings of the LACPR draft final technical report. Before the end of 2009, the Corps of Engineers and the State of Louisiana should agree on the elements of a single comprehensive plan for long-term hurricane protection and coastal restoration. As part of that plan, the Corps and the state should agree on a number of high-priority projects for immediate implementation.

USACE Response: Adopted

Action Taken. USACE concurs with the need to provide additional advice on initial high priority steps and projects. The LACPR Final Technical Report presents a range of comprehensive long-term hurricane and storm damage risk reduction plans that include structural, non-structural and coastal restoration measures. Inherent in each of these comprehensive plans are tradeoffs that need to be further addressed by USACE and the State of Louisiana prior to identifying a comprehensive plan. The steps to address these tradeoffs are included in the Path Forward section of the Main Report and Summary Report.

Action To Be Taken. USACE has provided the LACPR Final Technical Report to the State of Louisiana and will work with the State to identify tradeoffs and priorities in order to identify initial high-priority steps and projects. The complexity and magnitude of those decisions required to identify these steps and projects preclude resolution on the timeline suggested in the comment.

2. IEPR Comment: The LACPR team should complete a sediment budget for coastal Louisiana. They also should provide a better explanation of potential costs and environmental impacts of dredging alternatives. Rather than focusing energy and resources into trying to maintain the current configuration of southern Louisiana's eroding coastline, the LACPR team is encouraged to focus its protection and restoration plans on high-priority projects.

USACE Response: Adopted

Action Taken: USACE concurs that a more detailed sediment budget needs to be developed. The Preface and Summary Report sections of the LACPR Final Technical Report were revised to include a discussion on sediment availability. The initial findings clarify that adequate sediment resources may be available to implement proposed coastal restoration plans but acquiring those resources would involve significant tradeoffs in terms of cost and potential impacts to the ecosystem.

Action To Be Taken: The goal of maintaining the current shoreline was a starting point for more detailed future analysis. External to the LACPR effort, additional steps related to sediment allocation are being taken. The first step in determining this cost of utilization, will be the development of a sediment budget and a regional sediment input/output model. This budget is currently under development as part of the Corps Regional Sediment Management (RSM) program. This initial investigation is scoped as a two year effort and is contingent on availability of funding.

In order to complete an assessment of the coastal landscape contribution to risk management in a timely manner, a comparison of the existing versus future with no restoration condition was employed. The LACPR evaluation determined that the required amount of sediment necessary for specifically identified restoration measures to offset expected losses is available either in existing sources or through the expected delivery of riverine sediments over the period of construction. This finding was based on the identification of specific sediment sources for maintaining the shoreline and the technical feasibility of using this material. The results of hydrodynamic modeling of the current or existing condition provide indications of those landscape features that are critical relative to management of risk. The implication of these findings for risk management is that it may not be necessary to explicitly offset all expected future landscape loss. Additional analysis may identify specific landscape features and locations, requiring significantly less sediment resources to maximize risk management potential.

At this time, USACE is focusing its restoration plans on projects such as those that were identified in the Louisiana Coastal Area (LCA) near-term plan. The LCA near-term plan, which was incorporated into the LACPR study, was developed through a public involvement process and working closely with other Federal agencies and the State of Louisiana. A Chief of Engineers Report on this near-term plan was signed on 31 January 2005, and was then authorized in the Water Resources Development Act of 2007 (WRDA 2007). The plan emphasizes projects that involve diverting and managing freshwater and the associated sediment for restoration purposes. Wetlands created or sustained in this manner can help restore/sustain nesting, feeding and resting habitats for fish and wildlife, including threatened and endangered species (sturgeon, brown pelican, piping plover). The plan also includes barrier Island restoration, which can favorably impact nesting and resting cover for brown pelican and piping plover. Other high priority projects that are either undergoing additional analysis or being implemented are the: Morganza to the Gulf, LA Hurricane and Storm Damage Risk Reduction Project; Larose to Golden Meadows, LA Hurricane and Storm Damage Risk Reduction Project; Alexandria to the Gulf, LA, Hurricane and Storm Damage Risk Reduction Project; and Mississippi River Gulf Outlet Ecosystem Restoration Project.

3. IEPR Comment: The LACPR report should provide a better and more quantitative explanation of the scientific uncertainty associated with projections of marsh and wetlands restoration (including diversions), surge attenuation by wetlands, numerical modeling efforts, and the implications of Mississippi River diversions. The high level of uncertainty of the effects of proposed river diversions suggests the need for careful monitoring and evaluation of existing diversions. It also suggests the importance of an adaptive strategy that can adjust to and build upon new information as more is learned about the responses of these coastal wetlands systems to human interventions.

USACE Response: Adopted

Action Taken: USACE concurs, that additional project-specific modeling will need to be performed to further quantitatively address the uncertainties for specific project features and any linkages to common elements such as the Mississippi River. As an inherently dynamic system, the coastal landscape, and its restoration, is surrounded by large uncertainties. USACE has attempted to quantify, or qualify, these uncertainties to the extent practical at this level of analysis required for such a complex, large scale planning effort. The Summary Report section of the final LACPR Technical Report was revised to include a section on Key Findings that discusses how uncertainties are amplified in large-scale hurricane risk reduction planning. Some of the large uncertainties associated with relative sea level rise and land use/population growth have been accounted for through the use of scenarios. Uncertainty with water levels has been addressed as part of the development of the storm surge and hydrodynamic data and extrapolated to the performance metrics, however, there are additional uncertainties that cannot be quantified. In addition, the Adaptive Management Section of the report was expanded to address the adjustments that would been to be made as more information if learned about the responses of these coastal wetlands systems to human interventions. An adaptive management strategy will be crucial for ensuring that the program remains true to its basic objectives while also integrating valuable new information and allowing necessary shifts in priorities. The LACPR Final Technical Report discusses how the LCA Science and Technology Program could be modified to not only provide the necessary environmental and engineering science, but also include social and economic science and analyses, to completely and effectively address both coastal restoration and hurricane risk reduction needs. This programmatic approach will enable long-term consistency in application and transfer of knowledge and adaptive management as it also integrates risk reduction elements.

Action To Be Taken: Evaluation of the effect of the existing landscape on storm surge provides valuable insight to the types and configuration of landscape features that aid in managing risk. Additional research and modeling of specific features has been identified as a necessary component of a further plan development. More detailed quantitative assessments are needed and will be undertaken when the priority areas have been identified and the plans are further refined.

The Louisiana Coastal Area (LCA) projects and LCA Science and Technology office also provide the expertise and ability to monitor and evaluate existing diversions and to continue to learn from them. As specific coastal restoration projects are being developed under the LCA authority, the Science and Technology office is being utilized as the resource to develop both program and project specific adaptive management plans and criteria.

4. IEPR Comment: The level of storm surge protection for the City of New Orleans should be designed for a hurricane storm surge event with an expected return interval of 400 to 1,000 years. The 2007 report from the Dutch engineers found that even higher levels of protection are economically justified.

USACE Response: Adopted

Action Taken: The final LACPR Technical Report presents an array of alternatives for achieving 100-year (a one percent annual probability of being equaled or exceeded), 400-year (a 0.25 percent chance of being equaled or exceeded in any given year) to 1000-year (a 0.1 percent chance of being equaled or exceed in any given year) hurricane risk reduction for coastal Louisiana. The technical analysis in the final technical report has provided a clearer picture of the probability of large, storm related surge events that will significantly impact the population, property, and national and regional economy, taking into consideration the 2007 report from the Dutch. Scientists have concluded that the two primary parameters for estimation of maximum storm surges along the coast are storm intensity (related to the Saffir-Simpson scale) and storm size (not related to the Saffir-Simpson). As a representation of "Category 5" risk reduction, the final technical report presents alternatives at the 100-year, 400-year, and 1000-year design levels for all planning units, which include the City of New Orleans. The 400-year flood event is an approximation of Hurricane Katrina.

Action To Be Taken: The array of alternatives will continue to be developed as well as the benefits that are derived by their implementation.

5. IEPR Comment: The LACPR team should perform a quantitative risk assessment of the structural protection systems that includes the probability of system failure of the various components including floodwalls, levees, ring levees, and floodgates.

USACE Response: Adopted

Action To Be Taken. The final LACPR Technical Report qualitatively addresses potential failure of structural measures and acknowledges that more detailed quantitative risk analyses should continue to be performed under in the next phases or under additional project specific authorizations.

USACE concurs that a quantitative risk assessment is critical for a full understanding of a comprehensive risk reduction system. This type of analysis, however, requires a more detailed design than was developed for comparison of the 111 alternatives developed for LACPR across the entire Louisiana coast. An element of the tradeoff comparison presented in the LACPR report is a qualitative assessment of failure potential for both the structural and non-structural components of the alternatives. Structural components were gauged relative to levee length and numbers and sizes of structures, with increasing length and numbers of structures implying greater susceptibility to failure. Non-structural plan performance was tested against the relative level of participation, with diminishing public participation (in ten percent increments) correlating to potential failure of an overall plan. The results of these failure tests were included in the tradeoff analysis of the final array of alternatives. Further development of quantitative risk

assessments will be performed as priorities are established and projects are developed to a feasibility level of detail.

Even for the best performing plans presented in the final array, substantial residual risk remains for the most extreme surge events. In evaluating the performance of alternatives across a wide range of surge events an assumption of continuous resilience has been employed. In other words features designed based on a more frequent event are exceeded but would not fail for less frequent, larger events. This assumption was used to evaluate initial alternatives and would need to be further evaluated in future analyses. All structural measures are capable of providing significant risk reduction, particularly with increasing design levels. However, evaluation results have indicated that some 100-year level structural alignments could potentially provide significant risk reduction for the 400-year to 1000-year surge events if those features remains intact for these higher level events. The technical evaluation has indicated that levee alignments that allow some distance between the levee and the development footprint produce greater, and often significant residual protection above the indicated design level. The assumption of continuous resilience, the design requirements to support such an assumption, and the specific potential for system failure, should be investigated in detail at the planning unit scale.

6. IEPR Comment: Multi-Criteria Decision Analysis is a potentially useful approach to evaluate projects with important environmental, social, and cultural impacts; however, flaws in the application of these methods to the LACPR study have prevented any convincing results. As applied, the methods do not support the identification of a preferred alternative for any of the planning areas. Furthermore, they do not support the rankings of alternative plans as presented in the LACPR report.

USACE Response: Adopted

Action To Be Taken. The multi-criteria decision analysis approach evolved throughout the LACPR effort and will continue to be refined and improved. USACE agrees that the Multi-Criteria Decision Analysis is a potentially useful approach for USACE and its partners to compare projects with important environmental, social, and cultural impacts. The final LACPR report includes a clearer description of the purpose and limitations of the MCDA approach as applied to the LACPR effort. The MCDA tool did not provide fully useable results but the effort does highlight and reinforce the need for USACE to incorporate other factors in the decision besides damage reduction and dollars. In addition, the MCDA approach exposed potential tradeoffs involved in hurricane risk reduction decisions and the need for further dialogue to resolve the issues. Upon further coordination with the State of Louisiana, further comparison of alternatives using multiple criteria may be undertaken as priority plans are collaboratively identified.

7. IEPR Comment: Implementation of a variety of nonstructural measures will be essential in better managing and reducing flood risks in southern Louisiana. The LACPR team and the Corps should take a more aggressive leadership role in promoting a variety of nonstructural measures that are important to reducing flood risks in coastal Louisiana. Examples of these nonstructural measures include limiting development in flood-prone areas and stronger public education efforts regarding flooding risk in different sections of New Orleans.

USACE Response: Adopted

Action To Be Taken. USACE concurs with the importance of nonstructural measures for comprehensive risk reduction and the technical report recognizes them as viable options. Nonstructural measures can be an essential component for risk reduction in Southern Louisiana and nonstructural measures are included in the array of alternatives that are identified as promising alternatives in the LACPR Technical Report. Other types of nonstructural measures such as buyouts and limiting development involve socio-economic tradeoffs, which are discussed in the LACPR report, will need to be further explored. The USACE will work with the State and other Federal agencies to identify and clarify roles and responsibilities in developing and implementing nonstructural measures. Using the information in this technical report, USACE will continue to coordinate with the State of Louisiana and further develop options and priorities in each planning unit. USACE and the State will then jointly coordinate those options and priorities with other Federal agencies, local entities, non-governmental organizations, and the public.

8. IEPR Comment: The LACPR team should more specifically identify and explain the trade-offs between commercial navigation and river diversions for coastal restoration.

USACE Response: Adopted

Action Taken. USACE recognizes the importance of resolving the tradeoffs and management criteria associated with commercial navigation and river diversions. The LACPR Final Technical Report was revised to state that there are tradeoffs between commercial navigation and river diversions. The LACPR Final Technical Report describes alternatives with freshwater diversion features as a means to maintain the current coastal landscape and ecosystem functions. Most of those diversions could be classified as large diversions with high flow design capacities greater than 15,000 cfs with the largest diversion being over 175,000 cfs.

Action To Be Taken. USACE concurs that additional analysis is required to identify trade-offs between commercial navigation and river diversions. The LACPR team has not determined the cumulative impacts that multiple diversions may cause on the system. Nor has the team quantified the impacts on navigation or flood control on the Mississippi River. In addition, technical issues for freshwater diversions persist, particularly for the larger scale diversions. These issues include how well the measures may actually perform, how they should be operated, and the tradeoffs that will be required such as over-freshening of marsh areas and displacement of associated fisheries and wildlife. These proposed measures would be expected to evolve over time and be further studied as the USACE looks to improve its understanding of large-scale diversions. These issues are being addressed through ongoing Louisiana Coastal Area projects

and studies. USACE has continued the process of discussing and documenting these issues in recent forums involving a wide range of navigation and environmental stakeholders. Under the Louisiana Coastal Area authority in WRDA 2007, USACE and the State of Louisiana are initiating the development of a scope for the development of a comprehensive hydrodynamic study of the Mississippi River to support systemic assessment of diversion and navigation management.

9. IEPR Comment: It is encouraging that the LACPR draft final technical report describes the importance of preventing induced development. The report, however, does not adequately demonstrate how these principles will be a prominent part of hurricane protection and coastal restoration actions. Discouraging development in particularly vulnerable areas, whether or not they are protected by levees, is a fundamental principle of flood risk management and reduction. The LACPR should strengthen its cooperation with state and local entities to ensure that the prevention of induced development is accorded a more prominent and meaningful role in future plans.

USACE Response: Adopted

Action Taken: The LACPR Final Technical Report describes the importance of preventing induced development and presents several alternatives for achieving 400-year to 1000-year hurricane risk reduction for coastal Louisiana, which include nonstructural alternatives that could discourage development

Action To Be Taken. USACE will continue to work with the State and other Federal agencies to identify and clarify roles and responsibilities for the State in regulating smart development and managing associated risk.

USACE agrees that the potential for induced development is a concern. Encouraging development in hurricane prone areas may be directly counter to the coastal restoration goals of LACPR and the other Federal and State efforts to restore coastal Louisiana. The destruction of wetlands within levee systems can result in the loss of natural flood attenuation functions, while at the same time putting people and properties at greater risk of flooding during coastal storms, heavy rains and/or in the event of levee overtopping. Federal, State, and local entities have a shared responsibility to prevent induced development. Future increases in vulnerability can only be limited by an integrated set of measures, including land use planning, floodplain management, conservation easements, and strictly enforced zoning regulations. Hurricane and storm damage risk reduction measures should be designed and built in a way that contributes to the long-term sustainability of the region and encourage wise development in flood-prone areas. USACE will continue to work with Federal, State and local entities to strengthen this relationship.

10. IEPR Comment: The multiple authorizations that govern ecosystem restoration and hurricane protection in southern Louisiana represent a piecemeal approach and may hinder integrated, adaptive restoration and protection improvements across the region.

USACE Response: Adopted

Action Taken. The final LACPR Technical Report includes promising comprehensive plans for coastal Louisiana as well as comprehensive plans for each planning unit for hurricane and storm damage risk reduction that include coastal restoration features. A comprehensive authority for protection and restoration is identified as one approach to proceed forward.

Action To Be Taken. Multiple authorizations identified in the LACPR report are pointed to as a means of expediting implementation with minimal requirement for additional authorization. Currently USACE has multiple authorities that exist to address coastal protection and restoration. Examples of these are the Donaldsonville to the Gulf of Mexico, and Southwest Coastal authorities that have ongoing studies that are integrating LACPR findings. The Lake Pontchartrain and Vicinity and Morganza to the Gulf of Mexico authorities currently include or have previously included alternatives found in the LACPR final array. Each of these authorities effectively covers complete planning units. With a base of common storm surge modeling and application of consistent design criteria these authorities can support comprehensive system analysis and design.