Executive Summary

By many measures the 2005 hurricane season was the worst in the Nation's history. Storms striking the Louisiana coast took over 1,800 lives, destroyed billions of dollars of residential, commercial, and public property, and changed the landscape of the Louisiana coast. Across America and around the world people were shocked by the images of destruction along the Gulf Coast in the most active Atlantic hurricane season in recorded history, witnessing the unprecedented formation of three powerful "Category 5" storms in the Gulf of Mexico. In response, the U.S. Congress has directed the Secretary of the Army, through the Chief of the U.S. Army Corps of Engineers to **"conduct a comprehensive hurricane protection analysis and design…to develop and present a full range of flood control, coastal restoration, and hurricane protection measures...[and] the Secretary shall consider providing protection for a storm surge equivalent to a Category 5 hurricane...[and] the analysis shall be conducted in close coordination with the State of Louisiana."**

Flooded Homes in St. Bernard Parish, Louisiana

The Corps of Engineers and the State of Louisiana have assembled a team of expert scientists and engineers from more than 30 organizations including universities, private firms, environmental organizations, State and Federal governmental agencies, and international groups. This integrated team is working to forward the goals and objectives of the Louisiana Coastal Protection and Restoration (LACPR) reports by producing the design and analysis required to enhance hurricane risk reduction in coastal Louisiana. Close coordination has been established with the State of Louisiana's Coastal Protection and Restoration Authority (CPRA). This local authority was established to coordinate hurricane risk reduction and coastal restoration activities in Louisiana. In conducting analysis and developing designs, the LACPR team has made a concerted effort to use the best available scientific and engineering information and to work closely with its partners and the public.

Hurricane Risk Reduction Decision Framework

A decision framework is being developed to present a set of matrices necessary to communicate an array of information for policy makers. The framework will be designed to present information and data that will facilitate analysis and consideration of a range of scaled alternatives that will require further engineering analysis and design before projects can be recommended for authorization. Indeed, a decision framework that can be well understood by the public and decision-makers is the only means by which priorities for particular alternatives may be confirmed. The decision framework will be used by Congress and other laypersons as well as by engineers and trained analysts to consider a vast array of information necessary to make informed decisions.

The framework will present data in layers of matrices that organize the information in a logical sequence, as follows:

- Confirmation of geographic planning units for South Louisiana.
- Description of assets at risk in each of the planning units.
- Identification of screening storms and probability of annual recurrence as they affect planning units.
- Development and evaluation of structural, non-structural, and coastal restoration measures appropriate for each planning unit.
- Integration of component measures into alternative plans.
- Estimation of costs for each of the scaled alternatives identified for the planning units.
- Recommendations for further engineering and design investigations of the most promising specific measures to provide increased levels of risk reduction.

Because of the need to effectively integrate and display different kinds of data to decision-makers development of a decision framework is complicated. It is anticipated that a draft framework that has the utility to begin to inform decisions will be developed by October 2006; it may take longer to produce

relevant information. The framework will develop and display data for a full range of scaled alternatives for measures for a variety of hydrologic areas and storm characteristics.

Decisions on whether to build particular projects, and which projects to build, are inherently policy decisions, and will be beneficially informed by the type of analytical information that the LACPR process will provide. Developing a decision-making framework that is more robust than the normal National Economic Development (NED) framework is a practical necessity that will facilitate more robust, comprehensive decision-making. Moving forward, this report will focus on supplementing the well-established and well-understood NED analysis with risk-based models of storm damage and risk to human life and property, so that decision-makers can more accurately assess the relative merits of potential protective and mitigating actions.

This Preliminary Technical Report provides an outline and schedule for developing a Final Technical Report. Interim Technical Reports are anticipated, and may include information on component parts of the system suitable to support authorization of detailed engineering studies or other construction decisions, consistent with the Administration's intention that any Federal funding for additional analysis or for construction would be subject to annual budget requests and necessary authorizations. Confirmation of any future authorization would be informed through the application of the decision framework. The Final Technical Report will fully respond to the direction provided by Congress to develop and present a full range of flood control, coastal restoration, and hurricane risk reduction measures in a comprehensive system approach. The intention is that any decision for Federal funding of further feasibility analysis or of construction of particular features will be informed and confirmed by the LACPR risk reduction decision framework and will be considered in annual budget requests and subject to necessary authorizations.

Coastal Features: Restoring the First Line of Defense

Protecting Louisiana's citizens, natural resources, and industries from hurricanes, nature's most powerful storms, is an enormous water resources challenge. Prior to the 2005 hurricane season, the Corps of Engineers and State of Louisiana were working together on plans to restore the State's eroding and deteriorating coastline. This joint effort was considered one of the most important ecosystem restoration efforts in the Nation. Hurricanes Katrina and Rita resulted in the destruction of more than 217 square miles of coastal wetlands during their landfalls. This 2-day loss exceeds the wetland losses that had been projected to occur in the State over the next 20 years. Viewed in relation to the New Orleans area, all of the wetlands that were expected to erode over 50 years were lost in a single day during the landfall of Hurricane Katrina.

Continuing losses of wetlands in Louisiana brings the Gulf of Mexico closer to coastal communities and increases the likelihood of damages from storms of all magnitudes. In addition to considering ongoing wetland loss, the LACPR team is faced with engineering a plan in an environment of poor soil foundation conditions, high subsidence rates, and the unknown scale of effects of sea level rise and future storms. Nothing less than the ultimate survival of one of America's great cities is at stake with vital international trade and national energy production hanging in the balance.

The LACPR team has recognized that the first line of defense against storms is Louisiana's coastal ecological features including barrier islands, marshes, ridges, and coastal forests. The people of coastal Louisiana are engaged in a battle against the encroaching Gulf of Mexico. A tenet of efforts to restore and sustain coastal ecosystems dictates that risk reduction measures not destroy these resources. As such, plans to restore coastal features as natural lines of defense are an integral part of an overall storm risk reduction and survival plan for Louisiana. These coastal lines of defense may be especially key during lower intensity but higher frequency storm events. Building a strong structural hurricane risk reduction system of levees and other barrier structures augmented with a restored and sustainable coastal ecosystem offers the best opportunity for success to save and protect coastal Louisiana's citizens and economy. Further, individuals and businesses have many opportunities to incorporate non-structural measures, such as elevating homes and improving evacuation plans, into their own recovery planning and rebuilding efforts.

Consideration of the costs for building an integrated hurricane risk reduction system should recognize the importance of coastal Louisiana to America's economy. Without risk reduction, important economic sectors including oil and gas, international shipping, shipbuilding, agriculture, seafood, tourism, and medical technology face uncertainties about storm risks. Construction of a stronger and integrated hurricane risk reduction system would provide more certainty to these critical industries fostering a more

robust recovery for the economic engines of southern Louisiana.

Across South Louisiana 23 parishes are subject to various levels of inundation by hurricane storm surges. These coastal parishes contain 55% of the State's population or over 2.4 million people whose lives and property are at risk. Coastal Louisiana provides an integral national security function by supporting energy independence, balance of trade, and the efficient and effective transportation of commodities. Even if the populated areas located behind existing hurricane risk reduction systems can be made safer through increasing levels of risk reduction, the losses of coastal wetlands outside of the risk reduction system pose an increasing threat to the economic and environmental sustainability of the region.

Characterizing the Hurricane Threat to Greater New Orleans

The greater New Orleans area flanks the east and west banks of the Mississippi River and is surrounded by a series of large estuarine bays and lakes. Although the city is about 100 river miles inland from the Gulf of Mexico, its location along the shores of these bays and lakes and the rapid loss of coastal wetlands now places the city very close to the open sea. Combined with low-lying topography, in some cases below sea level, the city and surrounding communities face significant flooding risks from rainfall, spring river runoff, and hurricane storm surges. A significant local and Federal investment in levee and drainage systems helps to support and protect residents that work in the area's vital port, energy production, seafood, medical and military manufacturing economic sectors. Each of these business areas produces important goods and services for the region and Nation in turn helping support the unique cultural heritage of the city known for the birth of jazz, vibrant arts, and famous cuisines.

As hurricanes approach the New Orleans area, storms push and carry ocean surges and waves across the surrounding wetlands and into the bays and lakes. In some cases, powerful coastal storms also push surges up the Mississippi River many miles above New Orleans. This scenario leaves greater New Orleans an island surrounded by storm surge and dependent upon levee systems to prevent inundation. Many years of coastal erosion coupled with Hurricane Katrina's damages to the estuaries surrounding New Orleans have reduced the natural storm defenses around the city by more than 500 square miles. The direct physical losses from Hurricane Katrina have been estimated to exceed $90 billion and reverberations have been felt in the energy, agriculture, trade, transportation, seafood, and insurance sectors nationwide.

The Corps of Engineers has completed emergency repairs to 169 miles of levees and floodwalls damaged or destroyed during Hurricane Katrina. This work, carried out by Task Force Guardian, restored the hurricane risk reduction system to pre-storm authorized levels. Additional work approved by Congress and the Administration is being implemented to advance other projects to completion. Other hurricane risk reduction work in Louisiana was recently authorized by Congress in emergency authorization bills for storm recovery. The LACPR team is including all of these emergency repairs as part of the existing conditions to be considered in evaluating needs for upgrading the risk reduction to "Category 5" levels.

The current levee system protecting the New Orleans area is a result of a complex series of decisions regarding locations, designs, environmental impacts, and levels of risk reduction governed by local agreements, court cases, and Congressional authorizations and appropriations. The levee systems in place to protect this population are known to be inadequate because they were not designed to defend against nature's strongest hurricanes. A primary conclusion of the Interagency Performance Task Force (IPET) team and other post-Katrina evaluations has revealed that the area's hurricane risk reduction structures do not function as an integrated system as intended or needed. As a result, the greater New Orleans area continues to face significant risks from powerful Gulf hurricanes.

New Orleans Skyline Fronted by Wetlands on the West Bank of the Mississippi River

Risk Reduction Approach

The widespread use of the Saffir-Simpson Scale, a scale for categorizing hurricane wind damages, for weather forecast warnings and media reporting has established public demand for levels of risk reduction in South Louisiana tied to "Category 5" events. However, Corps of Engineers designs and Congressional project authorizations have historically been centered on composite storms, or Standard Project Hurricanes, that have characteristics that do not fit into a single Saffir-Simpson category but rather have winds, barometric pressures and storm surges falling within several classification categories. The team has been challenged to meet a "Category 5" project standard due to factors including strike probabilities and lack of historical data on storm strengths. The LACPR effort provides an important opportunity to better inform the public of the actions involved in designing, building and maintaining a system capable of protecting South Louisiana from storms with sustained winds greater than 155 miles per hour and storm surge heights exceeding 18 feet.

Analyzing the efficiency of hurricane risk reduction by using the probability of storms and risk reduction instead of Saffir-Simpson damage prediction categories offers a more realistic and understandable approach for engineers, government leaders, and the public. The Corps of Engineers IPET and LACPR teams have identified a new risk-based assessment methodology for developing hurricane risk reduction plans that would include valuation of consequences to populations and assets at risk. This new methodology is emerging from post-Katrina forensic efforts and is being proposed as an improved approach for future engineering work and policy direction.

Development of this risk-based approach is underway and will include expert workshops, test applications, and independent technical review for verification. In short, the methodology seeks to transform development of what has been commonly called hurricane "protection" concepts and plans away from a single event-driven planning approach based upon cost benefit analysis to a more reasoned risk-based assessment. The LACPR final report will support the development of the methodology and incorporate it into a range of information to be presented to decision-makers.

A Vision for Success

A series of expert workshops and public meetings have been hosted by the LACPR team. A vision for success has emerged from the LACPR preliminary efforts. A "Category 5" storm striking Louisiana presents extreme weather conditions requiring planners and designers to develop multiple lines of defense using an integrated system of restored coastal features, strong structural barriers and levees, and non-structural features to protect lives and property.

Coastal ecological features form the outer line of defense against storm waves. Barrier island systems absorb waves from approaching storms and help limit the amount of water that enters estuaries in advance of tropical systems. Back-barrier marshes and coastal fringe wetlands act as tidal and wave buffers protecting inland features. Upper estuary forested systems provide further risk reduction through wind and surge reduction. Forested ridges formed on old river and bayou banks also provide wave and wind reduction during storm events.

The lessons of Hurricane Katrina show the dangers of depending upon a single line of levee defenses located adjacent to densely populated areas. In this case a single overtopping or failure can lead to catastrophic results. A better system approach would involve fighting storm surges on the outer fringe of populated areas with large surge barriers and armored levees fronted by natural coastal features. Also, coastal populations should recognize the extreme storm dangers and plan accordingly by using better construction techniques to withstand storms and efficient evacuation plans to move out of the paths of harmful hurricanes.

Steps to the Final Technical Report

Along with the development of the decision framework and the information within it, the LACPR team will focus on continuing the design and analysis for each plan alternative identified. Work to analyze the alternatives will include more refined hydrodynamic modeling, additional plan formulation, full ecosystem restoration planning and integration, risk and consequences analysis, initial engineering and design, environmental impact analyses, cost estimating, as well as more independent technical reviews and external peer reviews. A full-scale public involvement plan has been outlined to include continued interactive public meetings and events associated with the public comment periods to allow for review of the draft and final versions of the Final Technical Report and the PEIS. Efforts will continue to fully coordinate completion of this effort with other ongoing recovery

planning efforts being conducted in Louisiana. Most importantly the LACPR team will continue to work closely with the State of Louisiana in its development of a Master Plan for hurricane risk reduction and coastal ecosystem restoration and the Final Technical Report.

The work remaining for developing the Final Technical Report is substantial and may result in some modifications and changes to the information presented, as well as substantial new results and findings. The LACPR team is aware of the complexity of the tasks at hand and the difficulties facing communities struggling to recover from the damages experienced in the 2005 hurricane season. Working closely with the assembled expert members, local residents and governments, and independent review panels offers the most effective and comprehensive means of addressing Louisiana's hurricane risk reduction and coastal restoration challenges.

We are seeking innovative concepts for addressing the comprehensive range of risk reduction measures that are the subject of the LACPR reports. This will include a request for interested parties to submit innovative designs and concepts for hurricane risk reduction measures. The public is invited now to propose innovative conceptual approaches so that they may be considered in interim reports or in the Final Technical Report, as appropriate. Once the new decision framework is available, the USACE-Louisiana CPRA team will solicit recommendations from interested parties as how to best consider innovative approaches for hurricane risk reduction strategies for South Louisiana.

Enclosures

This Preliminary Technical Report is informed by a number of documents that have been developed by the LACPR team. While these documents are not incorporated into the findings of this report they are useful for the insight they provide into traditional and alternative planning methodologies. Many of these documents are provided as enclosures to this report. Any findings or recommendations from the Enclosures are intended to provide information about the ongoing process, and should not be construed as recommendations to pursue a particular course of action.

17th Street Canal Breach at Hammond Highway Bridge

House in Road After Flooding in Chalmette, Louisiana (East of New Orleans)

Boats in Road Near Empire Bridge in Plaquemines Parish