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INDIVIDUAL ENVIRONMENTAL REPORT #11

IMPROVED PROTECTION ON THE INNER HARBOR NAVIGATION CANAL

ORLEANS AND ST. BERNARD PARISHES, LOUISIANA

US Army Corps of Engineers®

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1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN), has prepared this Individual Environmental Report (IER) #11 to evaluate the potential impacts associated with the proposed improved hurricane protection on the Inner Harbor Navigation Canal (IHNC). The study area is located in Orleans and St. Bernard Parishes, Louisiana, and encompasses three sub-basins: Orleans East Bank, New Orleans East, and Chalmette Loop (figure 1).

IER #11 has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality's (CEQ's) Regulations (40 Code of Federal Regulations [CFR] §1500-1508), as reflected in the USACE Engineering Regulation, (ER) 200-2-2. The execution of an IER, in lieu of a traditional Environmental Assessment (EA) or Environmental Impact Statement (EIS), is provided for in ER 200-2-2, Paragraph 8, USACE Procedures for Implementing NEPA 33 CFR 230 and pursuant to the CEQ NEPA Regulation 40 CFR 1506.11. The Alternative Arrangements can be found at www.nolaenvironmental.gov and are herein incorporated by reference.

CEMVN implemented Alternative Arrangements on 13 March 2007 under the provisions of the CEQ's Regulations for Implementing NEPA (40 CFR §1506.11). This process was implemented in order to expeditiously complete the environmental analysis for the 100-year level of the Hurricane Protection System (HPS), which is also known as the Hurricane and Storm Damage Reduction System. The HPS was authorized and funded by Congress and the Administration. The proposed actions are located in southeastern Louisiana and are part of the Federal effort to rebuild and improve the HPS in the New Orleans Metropolitan Area as a result of Hurricanes Katrina and Rita.

Because of the paramount importance of providing improved hurricane protection to the recovery of communities and the need for a timely response, as well as the need to capitalize upon innovative solutions to solve this complex engineering and design problem, CEMVN is proposing to use a design-build delivery approach for the project analyzed in this IER. In contrast to the more traditional "Design-Bid-Build" delivery method in which two separate entities design and build a project, under the design-build method the same contractor is responsible for both the design and construction phases of the project. This joint responsibility allows for the overlap of the design and construction phases, thereby potentially streamlining the project and reducing the overall project duration. The primary objective of utilizing the design-build contract method for this project would be to provide an innovative solution for providing the 100-year level of protection no later than 1 June 2011, the onset of the hurricane season.

Inasmuch as achieving the goals of the design-build delivery method depends upon not limiting innovative processes, CEMVN anticipates achieving NEPA compliance in a two-step, or tiered, process. In order for CEMVN to achieve the purpose and need of the project, and to leave room for optimization of technology, construction methods and exact location, this first tier document does not analyze the impacts of an exact alignment, construction materials, or other such design details. Although a Request for Proposals for this project has been released to a previously selected list of qualified firms, and these proposals have been

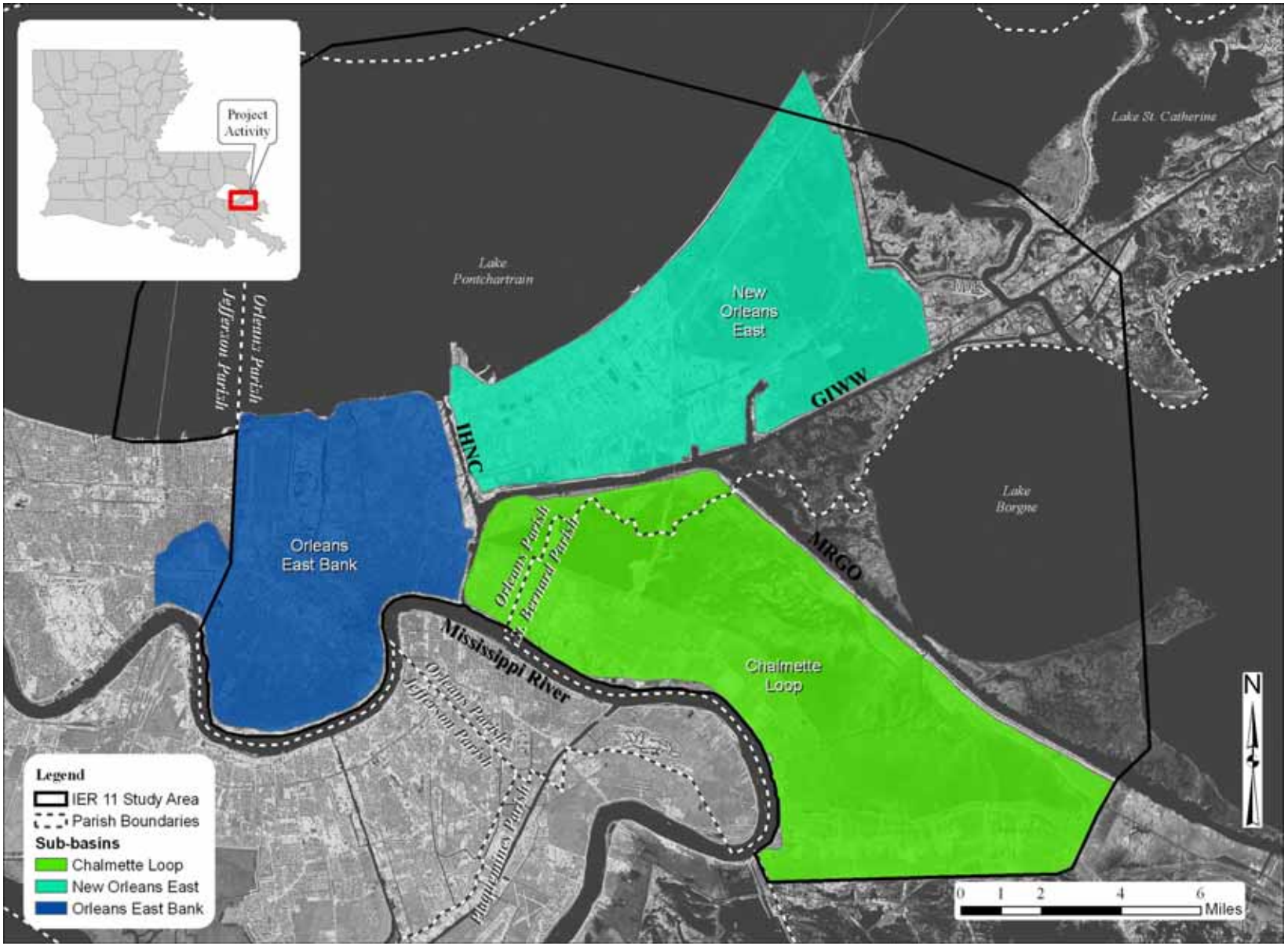


Figure 1 –IER #11 Study Area. The three sub-basins that would gain further hurricane protection from this project are highlighted, and the IER #11 study area is outlined in black.

received by CEMVN, the contents of these proposals have not been disclosed outside of the Source Selection Board, nor has a design-build firm or proposal been selected for award. Because of the timing of this NEPA document relative to the award of the design-build contract, the exact footprints and technologies to be used in the final design cannot be disclosed nor analyzed in this initial document. The alternative selected in this initial Tier 1 document will be a general location range within which further analysis, under a Tier 2 document, would be conducted to arrive at the final solution that could be designed and constructed. After award of the design-build contract, this Tier 2 NEPA analysis would be conducted which investigates a range of alternatives within the location range selected in the Tier 1 document. The Tier 2 NEPA document would provide detailed description and analysis of exact footprints and alignments, construction materials and methods, and other design details to provide a more precise impact analysis.

For the purpose of impacts analysis in this Tier 1 document, within each alternative the greatest possible conceptual project footprint was considered. In other words, any future structures under the alternatives would be expected to have adverse impacts equal to or less than the impacts described for that alternative in this analysis.

Secondly, the solicitation package for procuring the design-build proposals for this project included a number of design considerations intended to avoid or minimize the potential impacts of any proposed solution. These design parameters, listed below, were also considered for the purposes of this document's impacts analysis. These include:

- Minimize the overall project footprint.
- Minimize impacts to wetlands and natural hydrological regime.
- Maintain a water flow capacity that is comparable to the waterway's capacity prior to construction.
- Minimize the creation of steep environmental gradients (i.e., changes in salinity regimes, changes in physical slope of channel).
- Minimize potential adverse impacts to fisheries.
- Accommodate vertical and horizontal fishery distribution patterns within interior marsh tidal pathways and coastal passage.
- Minimize the migratory distance from opening in any flood protection feature to enclosed wetland habitats.
- Do not exceed a 2.6-foot-per-second (fps) water flow during peak flood or ebb tides to avoid or minimize impacts to migrating aquatic species.
- Design structures to remain open except during storm events of sufficient magnitude that flooding is expected.
- Provide for rapid reopening of structure even if electricity is unavailable.
- Minimize potential for turbidity-causing sediment erosion during construction and throughout the project life.

- Avoid or minimize disturbance of contaminated sediments and other hazardous, toxic, or radioactive waste (HTRW) in the study area if they are found to be present.

The tiered NEPA process by which CEMVN intends to comply with all applicable environmental laws and regulations will fully analyze and disclose the impacts of the proposed actions and all reasonable alternatives before a decision on a constructible alternative is made. Every effort has been made to carefully coordinate the design-build and NEPA processes with each other to ensure that the design-build process does not drive the NEPA decision in any way so that CEMVN does not act in a "pre-decisional" manner. For example, the design-build solicitation was designed to allow the firms to propose a solution that falls anywhere within the range of alternatives in this NEPA document and did not restrict them to the limits of the proposed action. Moreover, CEMVN retains the right not to award any design-build contract if the no-action alternative is chosen. No irreversible or irrevocable commitment of resources will be made prior to completion of both tiers of this NEPA analysis.

1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action is to improve hurricane protection on the IHNC, which is a critical component of the Lake Pontchartrain and Vicinity (LPV) Hurricane Protection Project in Orleans and St. Bernard Parishes, Louisiana. The overall purpose of the project is to provide a comprehensive, integrated protection system that would reduce the imminent and continuing threat to life, health, and property posed by flooding from hurricanes and other tropical storm events. This purpose would be achieved by providing a 100-year level of hurricane protection. In addition, these measures are vital to the recovery of the area and need to be addressed in a timely and comprehensive manner.

The term "100-year level of protection," as it is used throughout this document, refers to a level of protection that reduces the risk of hurricane surge and wave-driven flooding that the New Orleans Metropolitan Area has a 1 percent chance of experiencing each year.

1.2 AUTHORITY FOR THE PROPOSED ACTION

The authority for the proposed action was originally provided by the Flood Control Act of 1965. Congress and the Administration granted a series of supplemental appropriations acts following Hurricanes Katrina and Rita to repair and upgrade the project systems damaged by the storms. These supplemental appropriation acts gave additional authority to the USACE to construct 100-year HPS projects in the New Orleans metropolitan area.

The LPV Hurricane Protection Project was authorized under the Flood Control Act of 1965 (Public Law [P.L.] 89-298, Title II, Sec. 204) which, amended, authorized a "project for hurricane protection on Lake Pontchartrain, Louisiana … substantially in accordance with the recommendations of the Chief of Engineers in House Document 231, Eighty-ninth

Congress." The original statutory authorization for the LPV Hurricane Protection Project was amended by the Water Resources Development Acts (WRDA) of 1974 (P.L. 93-251, Title I, Sec. 92); 1986 (P.L. 99-662, Title VIII, Sec. 805); 1990 (P.L. 101-640, Sec. 116); 1992 (P.L. 102-580, Sec. 102); 1996 (P.L. 104-303, Sec. 325); 1999 (P.L. 106-53, Sec. 324); and 2000 (P.L. 106-541, Sec. 432).

The Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery of 2006 (4th Supplemental - P.L. 109-234, Title II, Chapter 3, Construction, and Flood Control and Coastal Emergencies) authorized construction of a 100-year level of protection; the replacement or reinforcement of floodwalls; the construction of permanent closures at the outfall canals; the improvement of the IHNC; and the construction of levee armoring at critical locations. Additional supplemental appropriations include P.L. 110-28, U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007 (5th Supplemental).

1.3 PRIOR REPORTS

A number of studies and reports on water resources development in the proposed project area have been prepared by the USACE, other Federal, state, and local agencies, research institutes, and individuals. The pertinent studies, reports, and projects are summarized below and are herein incorporated by reference:

- Integrated Final Report and Legislative Environmental Impact Statement for the Mississippi River Gulf Outlet Deep-Draft De-Authorization Study, 2007, investigates alternatives for de-authorizing a portion of the MRGO from Mile 60 to the Gulf of Mexico to deep-draft navigation and proposes the construction of a total closure structure made of rock near Bayou La Loutre.

- In July 2006, CEMVN signed a Finding of No Significant Impact (FONSI) on EA #433 entitled "USACE Response to Hurricanes Katrina & Rita in Louisiana." The document was prepared to evaluate the potential impacts associated with the actions taken by the USACE as a result of Hurricanes Katrina and Rita.

- Ecosystem Restoration Study and Programmatic EIS, 2004, Louisiana Coastal Area.

- Evaluation Report and Environmental Impact Statement, March 1997, entitled "Mississippi River – Gulf Outlet, New Lock and Connecting Channels." This document addresses the feasibility of improving navigation between the Mississippi River in New Orleans, Louisiana, and the Gulf Intracoastal Waterway (GIWW) and the Mississippi River Gulf Outlet (MRGO) on the east side of the river.

- On 4 August 1989, CEMVN signed a FONSI on EA #89 entitled "LPV Hurricane Protection, High Level Plan - Alternate Borrow Site 1C-2B." The report addresses the impacts associated with the excavation of a borrow area along Chef Menteur Highway,

Orleans Parish for LPV Hurricane Protection Project construction. The material was used in the construction of a levee west of the IHNC.

- Supplemental Information Report (SIR) #25 entitled "LPV Hurricane Protection – Chalmette Area Plan, Alternate Borrow Area 1C-2A" was signed by CEMVN on 12 June 1987. The report addresses the use of an alternate contractor-furnished borrow area for LPV Hurricane Protection Project construction.

- SIR #27 entitled "LPV Hurricane Protection – Alternate Borrow Site for Chalmette Area Plan" was signed by CEMVN on 12 June 1987. The report addresses the use of an alternate contractor-furnished borrow area for LPV Hurricane Protection Project construction.

- SIR #28 entitled "LPV Hurricane Protection – Alternate Borrow Site, Mayfield Pit" was signed by CEMVN on 12 June 1987. The report addresses the use of an alternate contractor-furnished borrow area for LPV Hurricane Protection Project construction.

- SIR #29 entitled "LPV Hurricane Protection – South Point to GIWW Levee Enlargement" was signed by CEMVN on 12 June 1987. The report discusses the impacts associated with the enlargement of levees along the GIWW.

- SIR #17 entitled "LPV Hurricane Protection – New Orleans East Alternative Borrow, North of Chef Menteur Highway" was signed by CEMVN on 30 April 1986. The report addresses the use of an alternate contractor-furnished borrow area for LPV Hurricane Protection Project construction.

- SIR #22 entitled "LPV Hurricane Protection – Use of 17th Street Pumping Station Material for Lake Pontchartrain Hurricane Protection Levee" was signed by CEMVN on 5 August 1986. The report investigated the impacts of moving suitable borrow material from a levee at the 17th Street Canal in the construction of a stretch of levee from the IHNC to the London Avenue Canal.

- SIR #10 entitled "LPV Hurricane Protection, Bonnet Carré Spillway Borrow" was signed by CEMVN on 3 September 1985. The report evaluated the impacts associated with using the Bonnet Carré Spillway as a borrow source for LPV Hurricane Protection Project construction and found "no significant adverse effect on the human environment."

- In December 1984 an SIR to complement the Supplement to Final EIS on the LPV Hurricane Protection Project was filed with the U.S. Environmental Protection Agency (USEPA).

- EA #411, entitled "MR-GO, Installation of Articulated Concrete Mattressing, Miles 37.4 to 36.5, St. Bernard Parish, Louisiana" with a FONSI signed on October 19, 2004.

- EA #403, entitled "MR-GO, Hopper Dredging Miles 27.0 to 66.0" with a FONSI signed on March 22, 2004.

- EA #402, entitled “Lake Borgne - MR-GO, Shoreline Protection Project, St. Bernard Parish, LA” with a FONSI signed on December 16, 2004.

- EA #361, entitled “MR-GO, LA, Test Installation of Articulated Concrete Mattressing, Miles 39.0 to 38.0” with a FONSI signed on January 29, 2003.

- EA #355, entitled “MR-GO Mile 27.0 to 0” with a FONSI signed on June 30, 2003.

- EA #354, entitled “MR-GO, Additional Disposal Area Designation Miles 66.0 to 49.0, St. Bernard Parish, LA” with a FONSI signed February 9, 2004.

- EA #349, entitled “MR-GO, Miles 32-27, Additional Disposal Areas-Hopedale Marshes, St. Bernard Parish, LA” with a FONSI signed on August 15, 2002.

- EA #288, entitled “MR-GO Mile 43 to Mile 41 North Bank Stabilization, St. Bernard Parish, LA” with a FONSI signed on November 8, 1999.

- EA #277, entitled “MR-GO, LA, Shell Beach Disposal Areas, St. Bernard Parish, LA” with a FONSI signed on September 6, 2001.

- EA #277-A, entitled “MR-GO, LA, Construction of Flotation Channels Miles 49.0 to 38.0, St. Bernard Parish, LA” with a FONSI signed on October 2, 2001.

- EA #274, entitled “MR-GO, Additional Disposal Areas, Hopedale Marshes” with a FONSI signed on July 10, 1998.

- EA #269, entitled “MR-GO, LA, South of Lake Borgne Additional Disposal Areas, St. Bernard Parish, LA” with a FONSI signed on March 24, 1998.

- EA #269-B, entitled “MR-GO, South of Lake Borgne Additional Disposal Areas plus Deflection Dike and Flotation Channels, St. Bernard Parish, LA” with a FONSI signed June 2000.

- EA #269C, entitled “MR-GO, LA, Construction of Flotation Channels Miles 51.0 to 48.0, St. Bernard Parish, LA” with a FONSI signed on October 2, 2001.

- EA #255, entitled “MR-GO, LA, Wetland Creation, Miles 15.0 to 23.0, St. Bernard and Plaquemines Parish, LA” with a FONSI signed on February 12, 1997.

- EA #247, entitled “MR-GO St. Bernard Parish, LA, Bank Stabilization Miles 55.0 to 56.1” with a FONSI signed on September 24, 1996.

- EA #244, entitled “MR-GO Back Dike (CWPPRA), Disposal Area Marsh Protection, Back Dike” with a FONSI signed on July 30, 1996.

- EA #162, entitled "Mississippi River – Gulf Outlet, St. Bernard and Plaquemines Parishes, LA – Marsh Enhancement/Creation and Berm Construction" with a FONSI signed on July 10, 1992.

- EA #152, entitled "MR-GO St. Bernard Parish, LA, Bank Stabilization, Miles 50.5 to 55.0" with a FONSI signed on November 21, 1991.

- EA #143, entitled "Mississippi River – Gulf Outlet – New Canal, Remedial Dredging" with a FONSI signed on September 11, 1991. EA #72, entitled "MR-GO Breton Sound Jetty Repairs" with a FONSI signed on May 26, 1988.

- EA #54, entitled "South Bank Mississippi River – Gulf Outlet – Borrow Site" with a FONSI signed on April 1, 1986.

- EA #47, entitled "MR-GO Foreshore Protection" with a FONSI signed on January 23, 1985.

- EA #38, entitled "MR-GO, Foreshore Protection Test Section" with a FONSI signed on August 15, 1983.

- EA #15, entitled "Transfer of Land Along Mississippi River – Gulf Outlet Jourdan Road Terminal to Inner Harbor Navigation Canal" with a FONSI signed on December 15, 1980.

- EIS, 1973-74, Lake Pontchartrain, LA and Vicinity Hurricane Protection Project, Riprap Shore Protection With Openings at Bayous Bienvenue and Dupre.

- EIS, March 1976, MR-GO Bayous La Loutre, St. Malo, and Dupre.

- EIS, May 1989, MR-GO Ocean Dredged Material.

- EIS, June 1973, MR-GO, Michoud Canal.

- A Statement of Findings for the Final EIS for the LPV Hurricane Protection Project, dated August 1974, was signed by CEMVN on 2 December 1974. Final Supplement I to the EIS, dated July 1984, was followed by a Record of Decision (ROD), signed by CEMVN on 7 February 1985. Final Supplement II to the EIS, dated August 1994, was followed by a ROD signed by CEMVN on 3 November 1994.

- A report entitled "Flood Control, Mississippi River and Tributaries," published as House Document No. 90, 70th Congress, 1st Session, submitted 18 December 1927 resulted in authorization of a project by the Flood Control Act of 1928. The project provided comprehensive flood control for the lower Mississippi Valley below Cairo, Illinois. The Flood Control Act of 1944 authorized the USACE to construct, operate, and maintain water resources development projects. The Flood Control Acts have had an important impact on water and land resources in the study area.

1.4 INTEGRATION WITH OTHER INTERIM ENVIRONMENTAL REPORTS

In addition to this IER, CEMVN is preparing a draft Comprehensive Environmental Document (CED) that will describe the 100-year level of protection HPS work completed and remaining to be constructed. The purpose of the CED will be to document the work completed by the CEMVN on a system-wide scale. The CED will describe the integration of IERs into a systematic planning effort. Overall cumulative impacts, a finalized mitigation plan, and future operations and maintenance requirements will also be included. Additionally, the CED will contain updated information for any IER that had incomplete or unavailable data at the time it was posted for public review.

The CED will be available for a 60-day public review period. The document will be posted on www.nolaenvironmental.gov. Additionally, interested parties can request a copy by contacting CEMVN. A notice of availability will be mailed/e-mailed to interested parties advising them of the availability of the CED for review. Further, a notice will be placed in national and local newspapers. Upon completion of the 60-day review period, all comments will be compiled and appropriately addressed. Upon resolution of any comments received, a Final Comprehensive Environmental Document will be prepared, signed by the District Commander, and made available to any stakeholders requesting a copy.

1.5 PUBLIC CONCERNS

Several public concerns were raised during public meetings held in March 2007 through January 2008 regarding improved protection on the IHNC.

Citizens in both Orleans and St. Bernard Parishes expressed concern over inadequate hurricane protection and difficulty in insuring private property during the planning and execution of the proposed project, as well as potential human environmental impacts that could be experienced during construction such as increased noise, damage to transportation infrastructure, and disruption of historical and cultural resources. Concern was also expressed over possible land use restrictions or "takings" of private property for the sake of hurricane protection and possible impacts to the natural environment, such as wetland loss and impacts to threatened and endangered species. Furthermore, citizens also asked CEMVN to consider any impacts the project could have on the water table, and warned that groundwater could be contaminated if pipelines carrying chemicals were damaged during construction.

St. Bernard Parish residents communicated an urgent desire to see the MRGO closed, and recommended that any hurricane protection project built to protect the IHNC should not protect Orleans Parish at the expense of St. Bernard Parish's protection.

1.6 DATA GAPS AND UNCERTAINTIES

The following data gaps exist at this time. However, these gaps will be addressed in the Tier 2 NEPA document:

- Results from the Engineer Research and Development Center (ERDC) hydrologic modeling efforts which are currently underway for the project area. The results of these studies would be disclosed in the Tier 2 NEPA document, and would be used to optimize the design of the final solution.

- Phase II Cultural Resource Investigations of suspected high potential sites for cultural resources. Additional cultural resources investigations and consultation with the State Historic Preservation Officer (SHPO) and Indian Tribes will occur during the Tier 2NEPA phase, once a more exact project location is determined and design details are available. Appropriate measures will be initiated to ensure that impacts to significant cultural resources are avoided, minimized, or mitigated prior to project construction.

2. ALTERNATIVES

2.1 ALTERNATIVES DEVELOPMENT AND PRELIMINARY SCREENING CRITERIA

NEPA requires that a "No-action" alternative be analyzed to determine the environmental consequences of not undertaking the action(s) or project(s) proposed, and thereby providing a framework for measuring the benefits and adverse effects of other alternatives. Despite its name, the no-action alternative for this project is comprised of actions necessary to raise the existing levees and floodwalls in the project area to their originally authorized level of protection. Similarly, Section 73 of the WRDA of 1974 (P.L. 93-251) requires Federal agencies to consider nonstructural measures to reduce or prevent flood damage. The nonstructural measures evaluated in this analysis are raising structures in place and the relocation of residents or structures subject to flooding through a property acquisition and relocation assistance program.

In addition to the no-action and nonstructural alternatives, a range of reasonable structural alternatives to meet the purpose of achieving the 100-year level of protection were formulated through input by the CEMVN Project Delivery Team, Value Engineering Team, engineering and design consultants, as well as local government, the public, and resource agencies. These "action" alternatives are comprised of raising existing levees and floodwalls, providing storm surge protection across waterways, and creating wetlands.

All reasonable alternatives considered for this IER are described in detail in section 2.2. From this alternative array, a preliminary screening was conducted to identify alternatives to carry though further detailed analysis. The criteria used to make this determination included

engineering effectiveness, economic efficiency, and environmental and social acceptability. Those alternatives that did not adequately meet these criteria were considered unreasonable and were eliminated from further study in this IER.

2.2 DESCRIPTION OF THE ALTERNATIVES

2.2.1 Proposed Actions: Storm Surge Protection Structures

These proposed actions would provide structural barriers to prevent damaging storm surges from entering the IHNC from Lake Pontchartrain and/or the Gulf Intracoastal Waterway (GIWW)-Mississippi River Gulf Outlet (MRGO)-Lake Borgne complex ("Lake Borgne complex"). The first proposed action, referred to throughout this document as "Borgne 1," encompasses a location range within which a barrier could be built to address storm surge from the Lake Borgne complex. The second proposed action, referred to as "Pontchartrain 2," encompasses a location range within which a barrier could be built to address storm surge from the Lake Pontchartrain.

Any storm surge protection structure built within the proposed action location ranges would include static barriers across non-navigable portions of the location range, and gated or otherwise navigable structures across authorized channels, such as the IHNC or GIWW. Additionally, gates would be provided across any channel or portion thereof designated as a Natural and Scenic River under the Louisiana Natural and Scenic River Act.

2.2.1.1 Borgne 1

The Borgne 1 location range extends from the vicinity of the Paris Road Bridge east along the GIWW to the Maxent Canal and south to the MRGO approximately four miles south of the Bayou Bienvenue Floodgate (figure 2).

Any gated structure built on the GIWW west of the Michoud Canal would be of a size and depth to allow deep draft navigation. Any gated structure built east of Michoud Canal would be of a size and depth to allow shallow draft navigation. This gate would be designed according to the design considerations outlined in section 1.1, and would remain open except during extreme storm events.

Figure 2 – Proposed Action, Storm Surge Protection Structures, Borgne 1 Location Range

Because the Water Resources Development Act of 2007 (WRDA 07) provided for the deauthorization of the MRGO, and CEMVN has proposed the construction of a rock dike or "plug" on the channel at Bayou La Loutre, any structure built on the MRGO under IER #11 would be a permanent closure rather than a gate. A Legislative EIS has been completed for this proposed project, and its construction has been authorized in the WRDA 07, although a final Record of Decision has not yet been signed. The MRGO will be officially deauthorized upon the submittal of the MRGO Deauthorization Chief's Report to Congress. To differentiate between the Bayou La Loutre "plug" and the closure structure proposed under this IER, the Bayou La Loutre "plug" will be referred to as the "deauthorization closure structure" and the closure proposed under this IER will be referred to simply as a "closure" throughout this document.

For the purposes of impact analysis, previous conceptual studies (Arcadis 2006a, 2006b) for this project were used to estimate the largest possible footprint for any structure or closure to be built in the GIWW and MRGO channels: 1,000 feet wide and 3,000 feet long, including any necessary tie-in features to existing hurricane protection features such as adjacent levees or floodwalls.

If a gate is built on the GIWW and a closure is built on the MRGO, there would likely be a need for a barrier connecting these two structures. The length of this barrier could vary, depending upon the location of the MRGO closure and GIWW gate. For the purposes of

impacts analysis, the largest conceptual barrier footprint within this proposed action is estimated to be 1,000 feet wide and 22,000 feet long.

If the barrier is aligned such that it crosses that portion of Bayou Bienvenue between the GIWW and MRGO, a gate would be provided at the intersection of the barrier and bayou as to maintain the bayou's current cross section and provide passage for recreational and commercial fishing vessels. Similar to any gate built on the GIWW, this gate would remain open except during extreme storm events.

Construction associated with the proposed action could include activities such as dredging, pile-driving, and placement of fill material, all of which would be disclosed and analyzed in the Tier 2 NEPA document.

2.2.1.2 Pontchartrain 2

The Pontchartrain 2 location range encompasses the northernmost portion of the IHNC, from the Senator Ted Hickey Bridge to approximately 2,500 feet south of the bridge (figure 3).

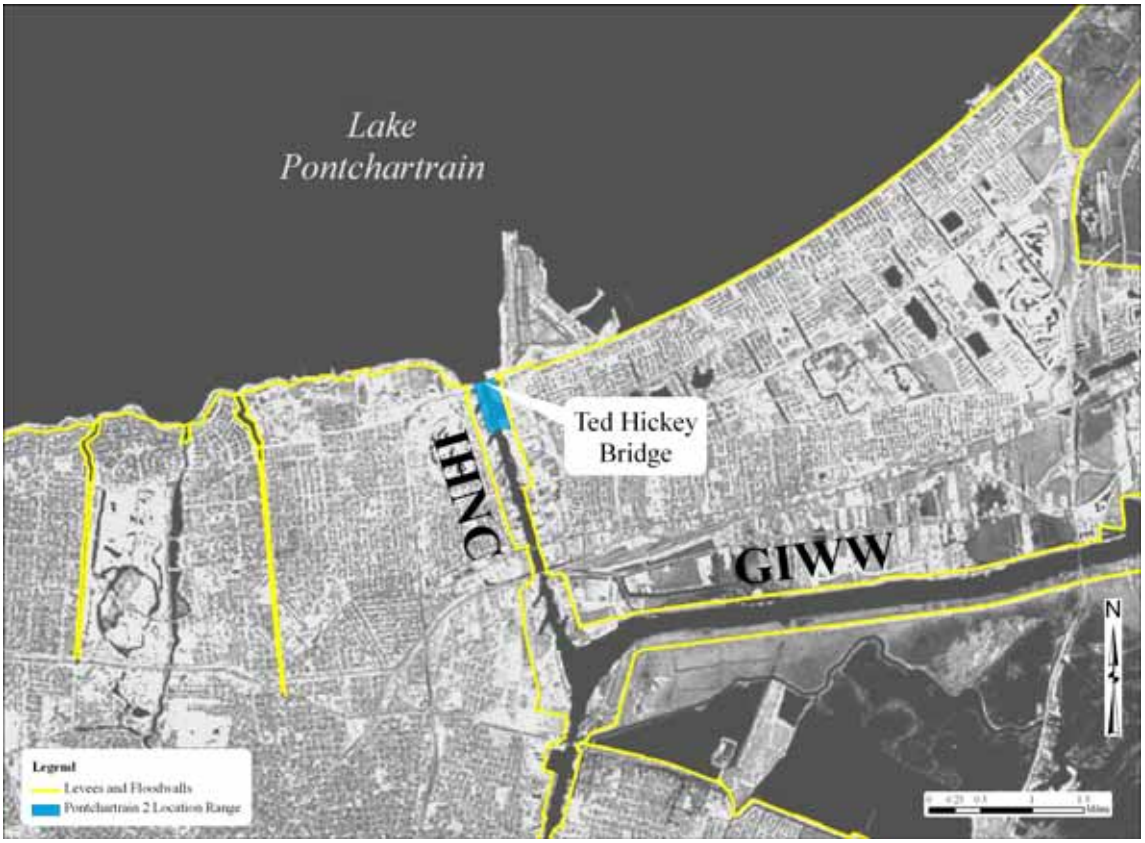


Figure 3 – Proposed Action, Storm Surge Protection Structure, Pontchartrain 2 Location Range

Any gate built within this location range would be designed to allow shallow draft navigation, and would remain open except during extreme storm events. For the purposes of impact analysis, previous conceptual studies for this project were used to estimate the largest possible footprint for any structure built in this channel: 500 feet long and 1,400 feet wide, including any necessary tie-in features to existing hurricane protection features such as adjacent levees or floodwalls.

As in Borgne 1, construction associated with the proposed action could include activities such as dredging, pile-driving, and placement of fill material, all of which would be disclosed and analyzed in the Tier 2 NEPA document.

2.2.2 Alternatives to the Proposed Action

2.2.2.1 No-Action Alternative (Raise Existing HPS to Previously Authorized Level of Protection)

Since the LPV Hurricane Protection Project was originally constructed, parts of the network of levees and floodwalls that make up the HPS have settled and subsided. The no-action alternative consists of raising the height of all the HPS along the IHNC and, to a limited extent, the GIWW and MRGO (as shown in figure 4), to the level of protection originally authorized in the 1984 Supplement to the Environmental Impact Statement for the LPV HPS while incorporating the new engineering design criteria that are now standard for all levee and floodwall construction and improvements (USACE 2007a). These elevations, which would range from 15 to 18 feet, were originally designed to protect against the "Standard Project Hurricane (SPH)." The SPH was defined as the "most severe hurricane that can be reasonably expected to occur from a combination of meteorological and hydrological events reasonably characteristic of the area" (USACE 1984).

Figure 4 illustrates the locations of the areas that are at or below the authorized grade which would be raised under this alternative. The levee/floodwall network that bounds the GIWW between the IHNC and MRGO is predominantly at or above authorized grade with the exception of the north side near the Paris Road Bridge and the east bank of the Michoud Canal, which are up to 5 feet below authorized grade. The system between the bridge and the canal is approximately 2 feet below grade as is the system located along the IHNC. Only very small areas on the east bank of the IHNC are up to 5 feet below grade.

This alternative would replace all HPS features in kind except in those areas where an existing levee could not be expanded due to space restrictions. Very few levee reaches would need to be raised under this alternative, as most of them are at or above the originally authorized level of protection. However, to raise the top of a levee, the base must be widened. In the areas where space restrictions would not permit expansion of the base, a floodwall would be installed on the levee, or the height of the existing floodwall would be increased. Where space is available, the preference would be to raise the existing hurricane protection system, in kind, to the required height.

Typical T-wall and L-wall cross sections that would be built under the no-action alternative are shown in figures 5 and 6.

Figure 4 – Locations of Areas of the HPS At or Below the Authorized Level of Protection against the Standard Project Hurricane. Areas indicated by red or yellow are deficient and would be raised under the no-action.

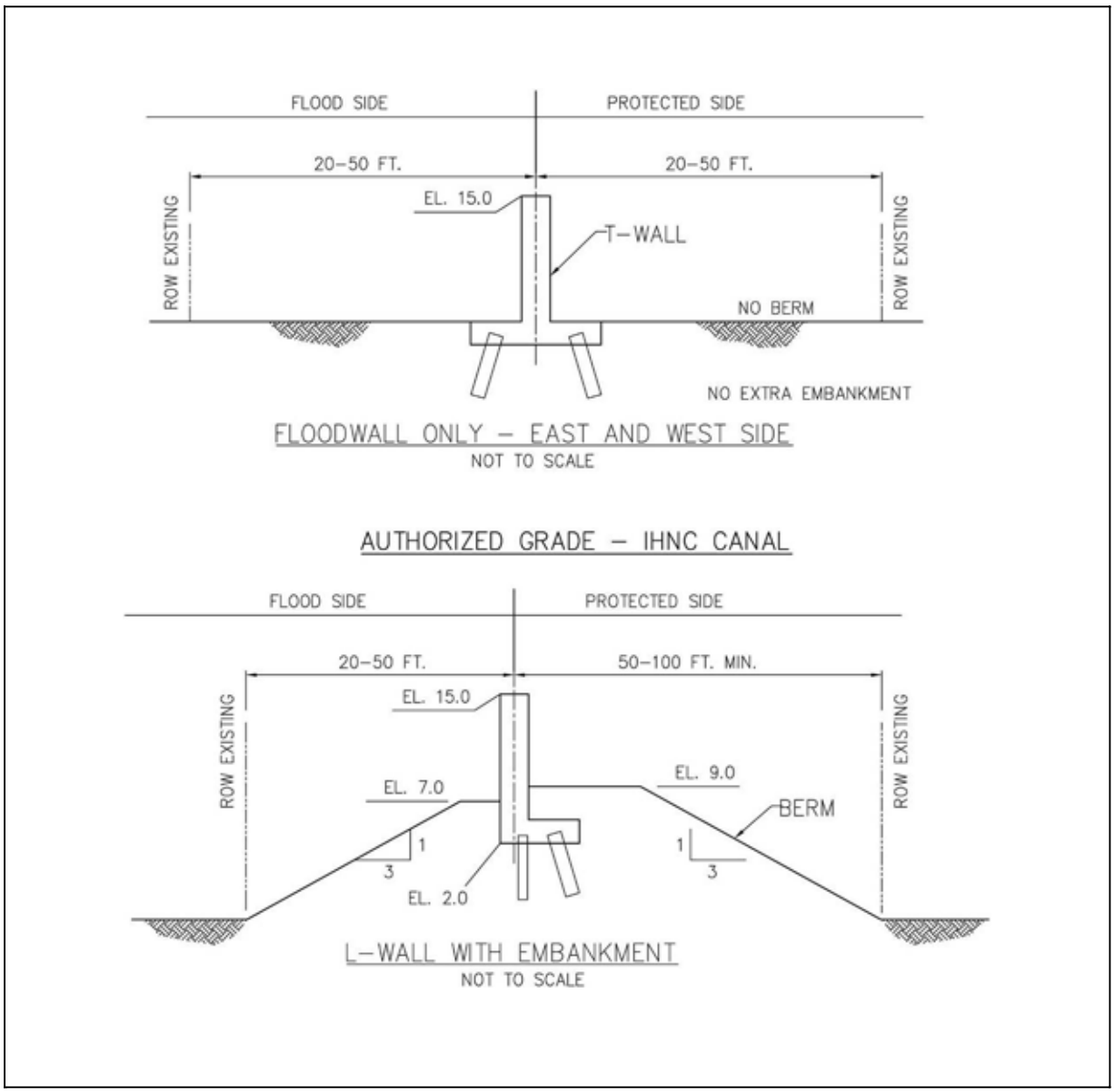


Figure 5 – No-action Alternative – Typical Cross-Sections for raising IHNC L-Walls and T-walls to originally authorized level of hurricane protection using CEMVN Design Guidelines.

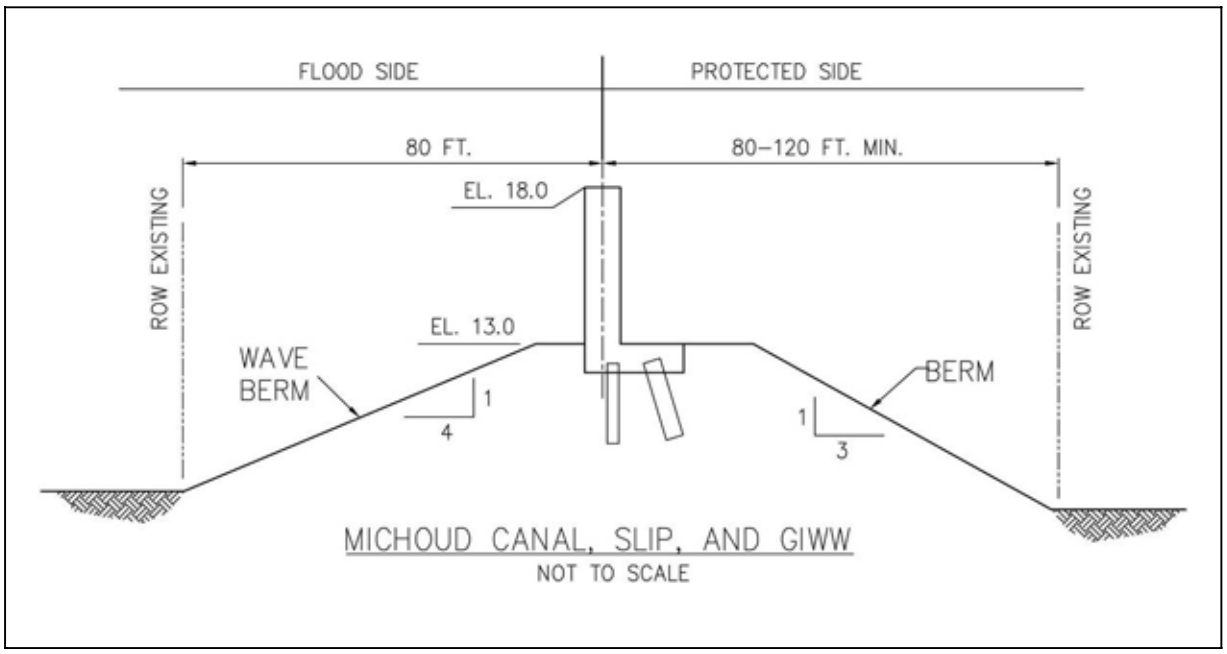


Figure 6 – No-action Alternative – Typical Cross-Sections for raising Michoud Canal, Michoud Slip, and GIWW L-Walls to originally authorized level of hurricane protection using CEMVN Design Guidelines

These improvements, when added to post-Katrina repairs that have already been completed, would provide improved hurricane protection over pre-Katrina conditions. However, the previously authorized level of protection under the no-action alternative is lower than the 100-year level of protection in most areas.

2.2.2.2 Raise Existing HPS to 100-Year Level of Protection Alternative

This alternative would require raising the height of all of the HPS along the IHNC and, to a limited extent, the GIWW and MRGO (figure 7) to the 100-year level of hurricane protection using CEMVN Design Guidelines (USACE, 2007a). As in the no-action alternative, this alternative would replace all projects in kind except in those areas where an existing levee could not be expanded without impacting adjacent businesses or residences. In such a case, the levee section would either be raised using a floodwall cap or replaced by a floodwall. Although this alternative was designed to minimize impacts to adjacent properties, in some cases, even a smaller structure could impact adjacent property.

Typical 100-year level cross sections of levees, levees with floodwall caps, and floodwalls are provided on figures 8, 9, and 10. The heights of the structures would range from approximately 15 feet to 28 feet. On the IHNC south of its intersection with the GIWW, the structures would be raised to approximately 20.5 feet. On the IHNC north of its intersection with the GIWW, the structures would be raised to between 15 feet and 19.5 feet. On the GIWW, the structures would be raised to approximately 20-20.5 feet at its intersection with the IHNC, generally increasing in height toward the Michoud Canal where the height would be approximately 27.5-28 feet. Although the height of these features would vary throughout this area, due to varying hydraulic conditions, the structures would all equally provide the 100-year level of hurricane protection.

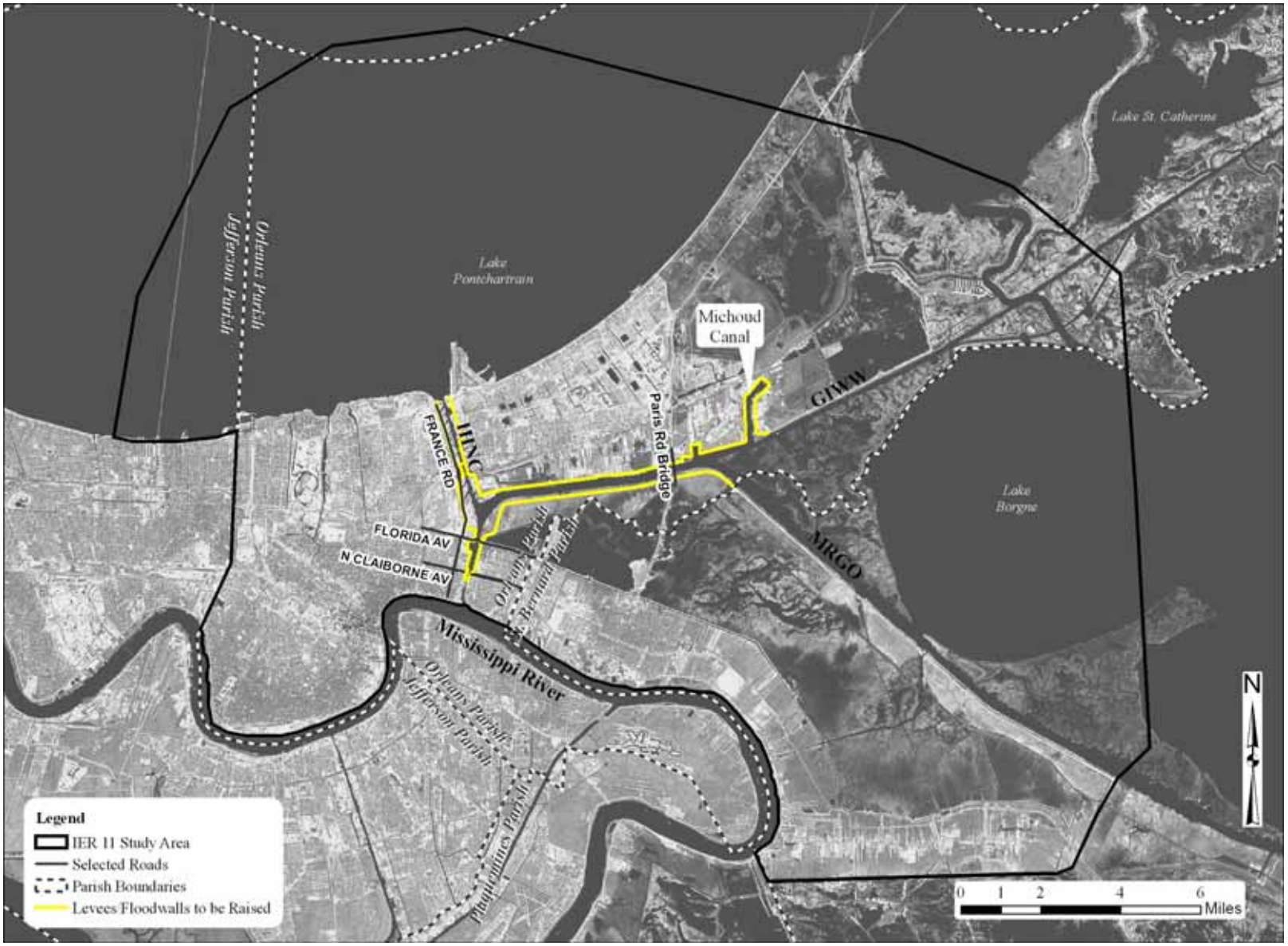


Figure 7 – Existing HPS reaches that would be raised underthe Raise Existing HPSto the 100 -Year Level of Protection Alternative

To raise the levees and levees with floodwalls, the toe or edge of the levee would extend outward from the centerline (crown) of the levee from 140 to 380 feet on the flood side and from 130 to 380 feet on the protected side (figures 8 and 9). The centerline of the structures along the IHNC would remain in its current alignment; however, the centerline of the levees along the GIWW would shift toward the protected side of the existing structures, to a range of 270 to 440 feet from the bank of the GIWW. The footprint of the T-wall portion of the floodwall-only segments, primarily found on the IHNC south of the GIWW, would be approximately 75 feet wide (figure 10).

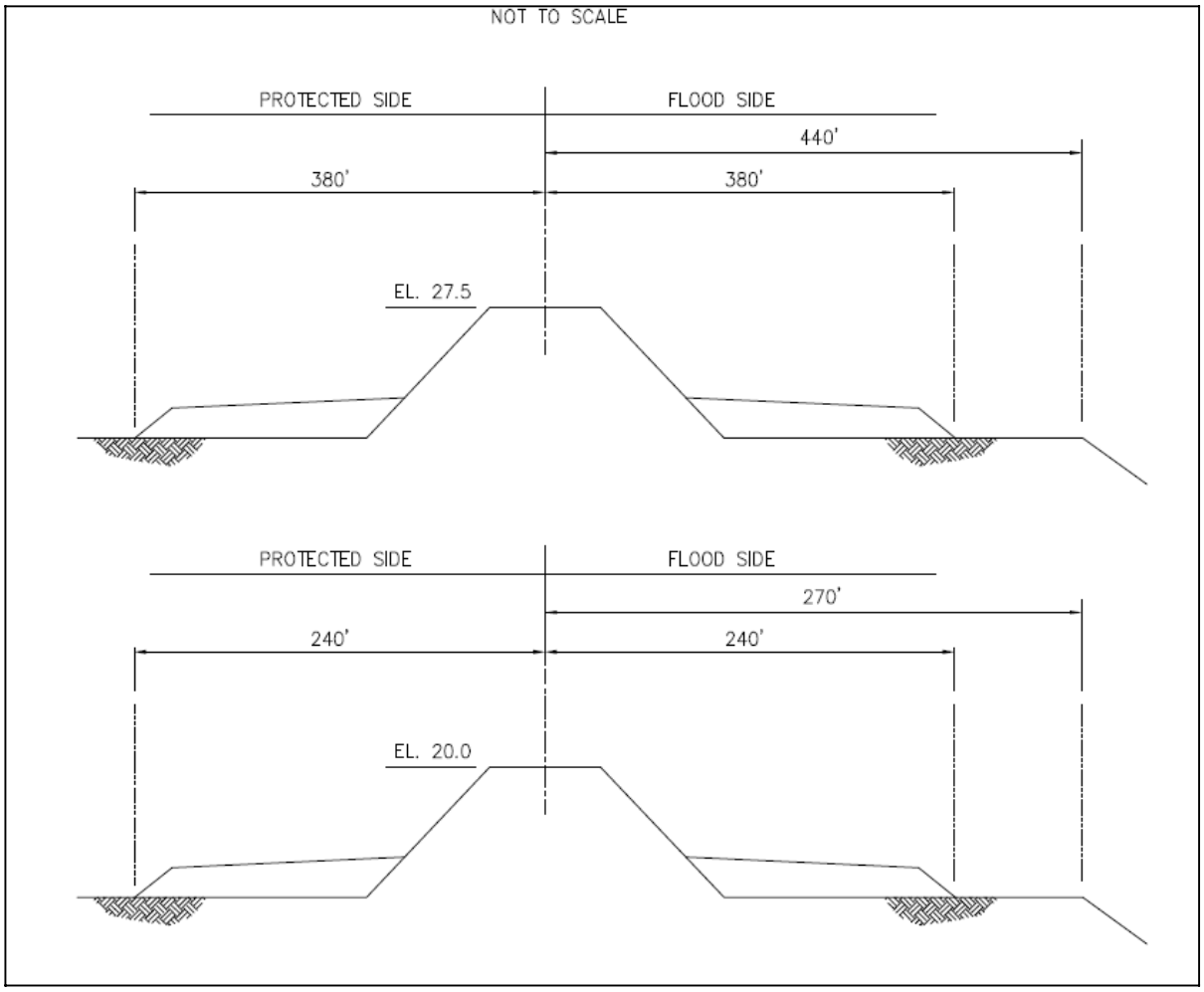
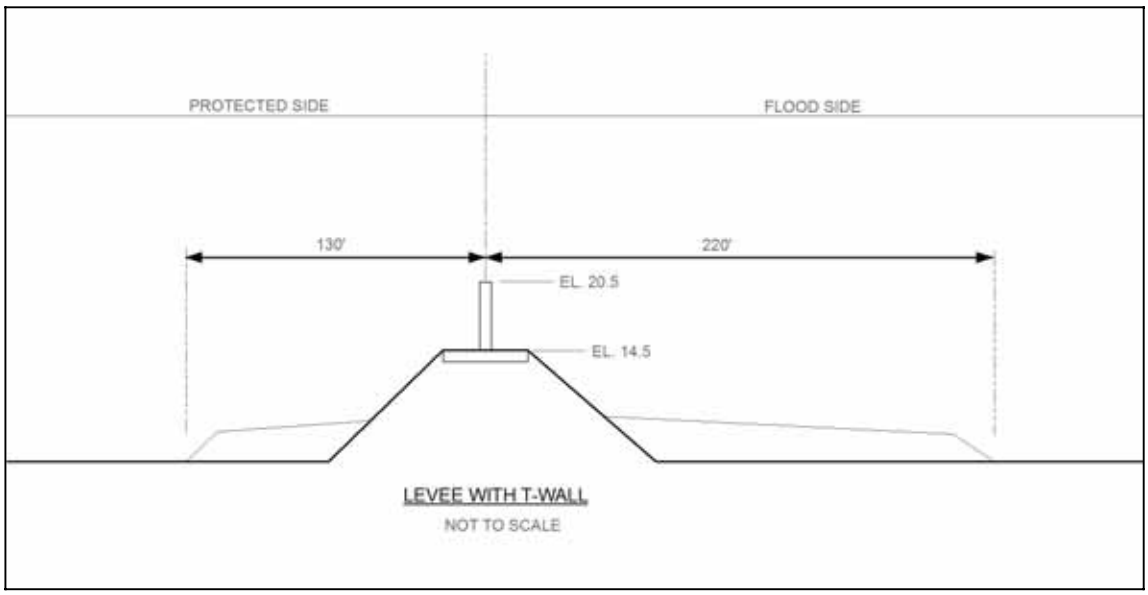


Figure 8 – Typical 100-year level of protection levee cross sections



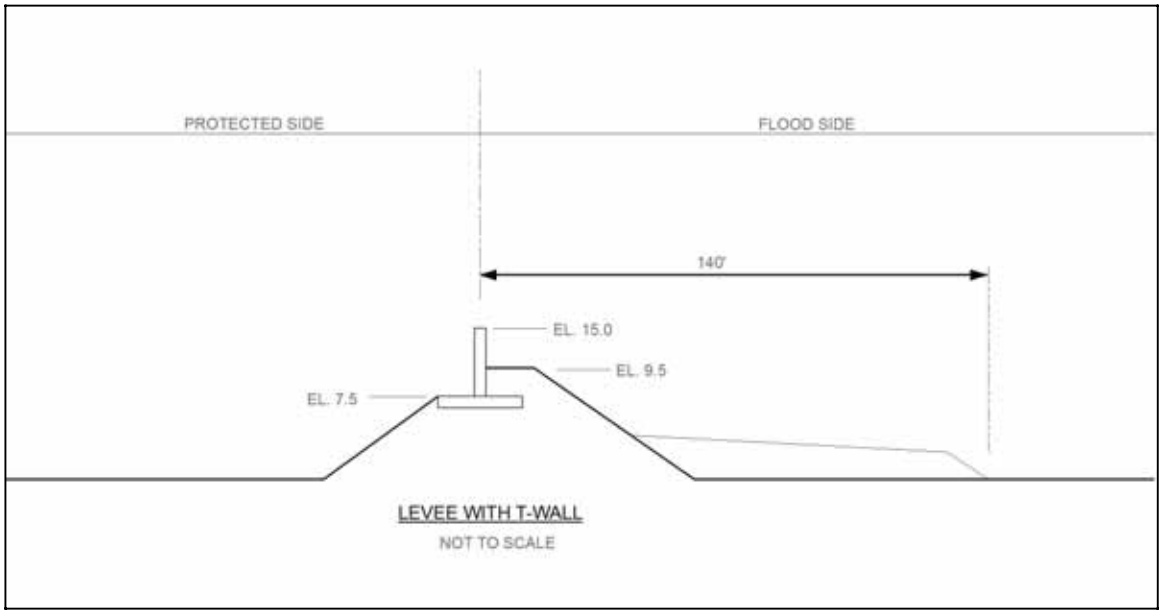


Figure 9 – Typical 100-year level of protection levee with T-wall cap cross sections. Pile support configurations, which would be subsurface, could vary and are not shown.

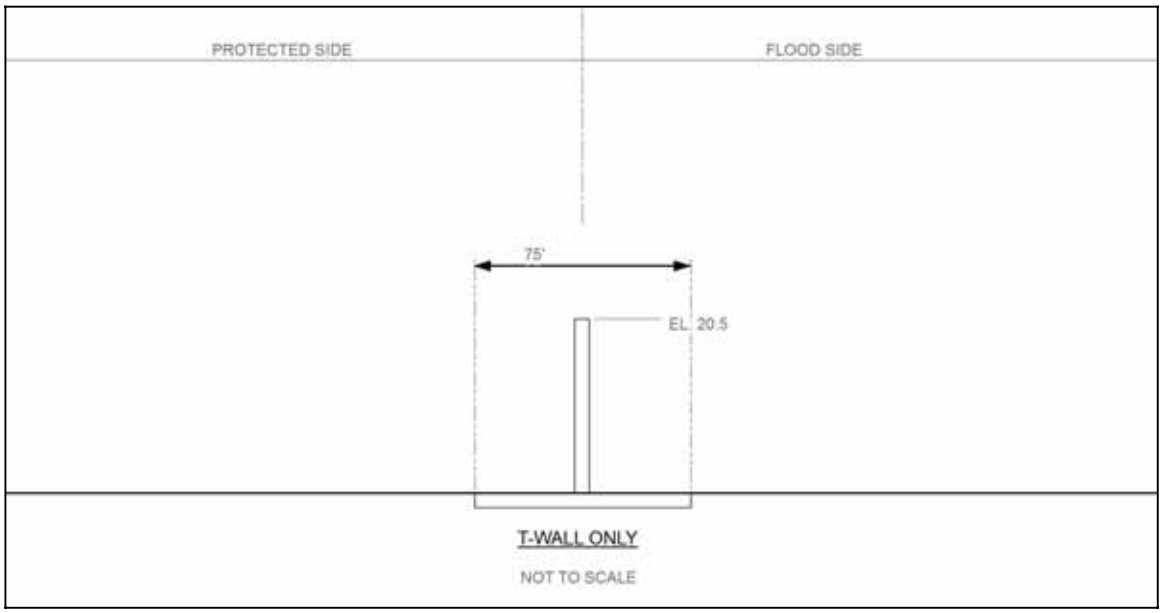


Figure 10 – Typical 100-year level of protection T-wall Cross Sections. Pile support configurations, which would be subsurface, could vary and are not shown.

2.2.2.3 Storm Surge Protection Structure Alternatives

Alternative location ranges for both the Lake Pontchartrain and Lake Borgne complex storm surge protection structures were considered.

2.2.2.3.1 Borgne 2

The location range for Borgne 2 (figure 11) extends from the eastern limit of the Borgne 1 location range to the western shoreline of Lake Borgne. Any storm surge protection structure in this location range would include a shallow draft gate on the GIWW. This gate would be designed according to the design considerations outlined in section 1.1, and would remain open except during extreme storm events.

Any structure built on the MRGO would be a permanent closure rather than a gate. As in Borgne 1, for the purposes of impact analysis, previous conceptual studies for this project were used to estimate the largest possible footprint for any structure built in these channels: 1,000 feet wide and 3,000 feet long, including any necessary tie-in features to existing hurricane protection features such as adjacent levees or floodwalls.

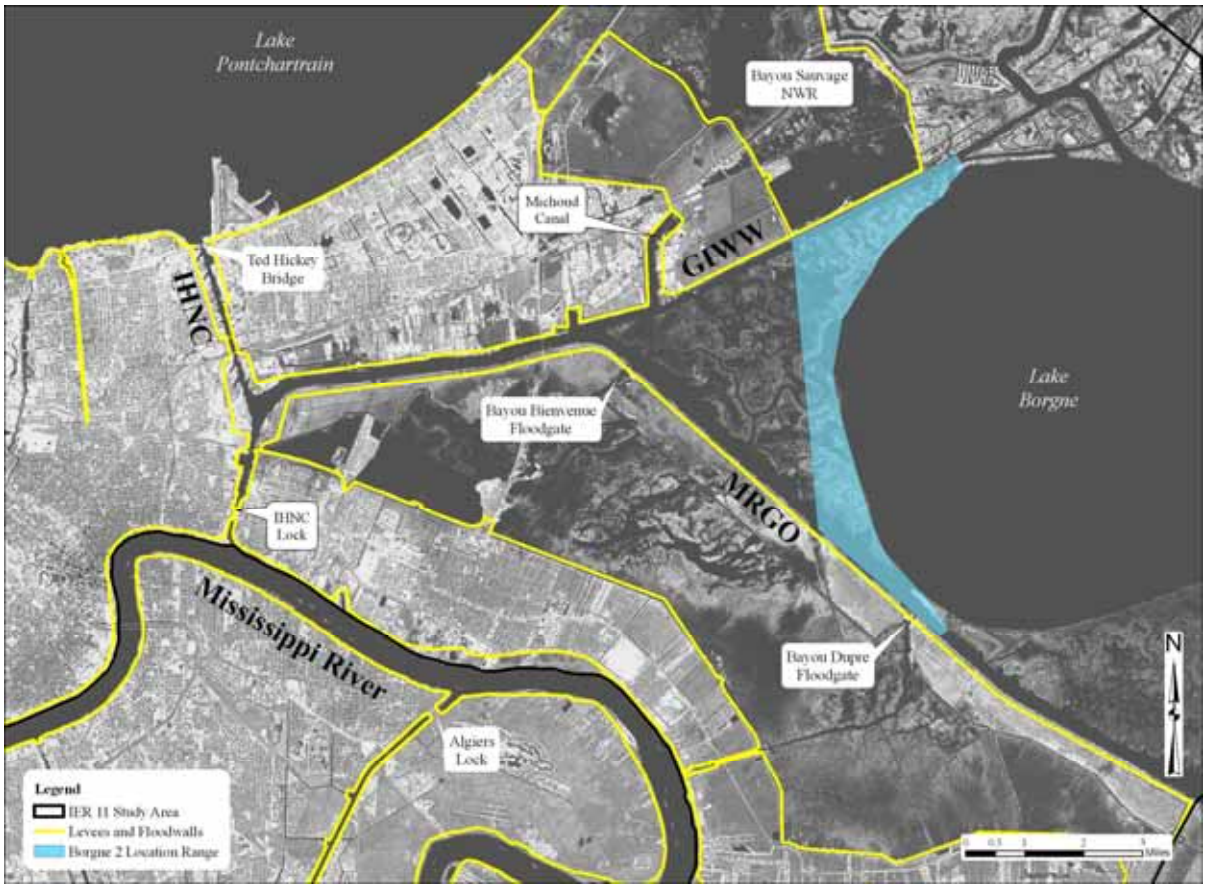


Figure 11 – Borgne 2 Location Range Alternative for Storm Surge Protection Structures

The length of any barrier between these two structures could vary, depending upon the location of the closure and gate. For the purposes of impacts analysis, the largest conceptual barrier footprint within this proposed action is estimated to be 1,000 feet wide and 44,000 feet long.

Any barrier between the GIWW and MRGO would cross Bayou Bienvenue at some point; therefore, a gate would be provided at that point as to maintain the bayou's current cross section and provide passage for recreational and commercial fishing vessels. Similar to any gate built on the GIWW, this gate would remain open except during extreme storm events.

2.2.2.3.2 *Borgne 3*

The location range for Borgne 3 (figure 12) is within the western portion of Lake Borgne and would consist of a breakwater system spanning the north-south boundaries of the lake. For purposes of the impacts analysis, the following conceptual breakwater configuration (Haskoning, 2006) was considered: a series of breakwaters extending across the open water of Lake Borgne for a distance of approximately 22,500 feet. The breakwaters would be arranged in two parallel lines oriented in a north-south direction; the lines would be spaced approximately 2,000 feet apart.

Each breakwater segment in the eastern line would be approximately 6,000 feet long and 155 feet wide at the base, and would be spaced approximately 2,000 feet apart. A series of five or more such breakwaters would be needed to span the distance between the GIWW and MRGO.

The breakwaters of the western line would be approximately 4,000 feet long and 155 feet wide at the base, and spaced approximately 4,000 feet apart. This line of breakwaters would be staggered in relation to the first, so that each breakwater segment to the west would cover the spaces between breakwater segments to the east. All segments would be constructed to an elevation of 16.5 feet (NAVD88). To achieve the 100-year level of protection, this alternative would have to be used in combination with features from the Borgne 1 or Borgne 2 alternatives.

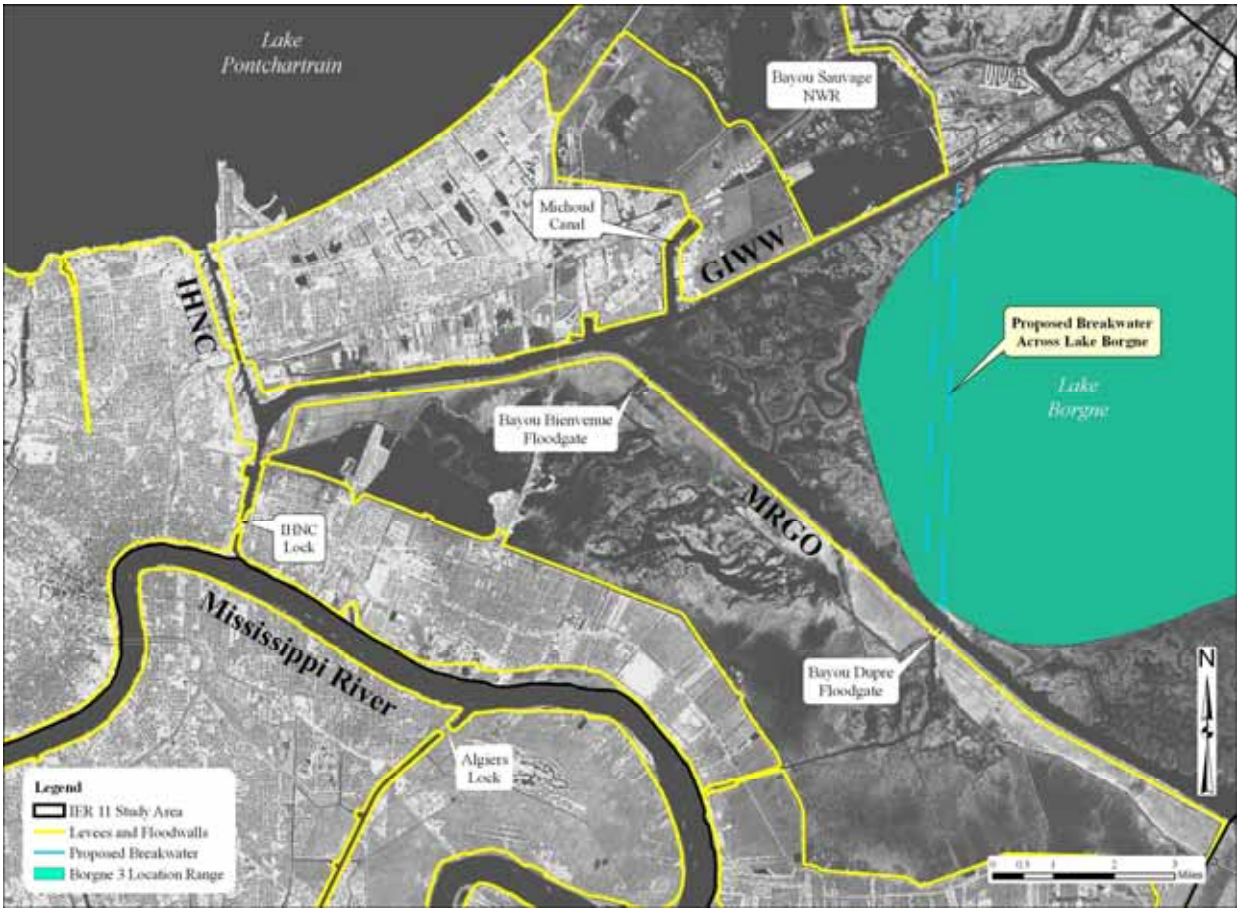


Figure 12 – Borgne 3 Location Range Alternative and Conceptual Layout for Storm Surge Protection Structures. Any breakwater built in the Borgne 3 Location Range would have to be used in conjunction with structures in the Borgne 1 or Borgne 2 Location Ranges to provide the 100-year level of protection.

2.2.2.3.3 *Pontchartrain* 1

The Pontchartrain 1 location range encompasses a portion of Lake Pontchartrain from the mouth of the IHNC, at the Senator Ted Hickey Bridge, to approximately 6,000 feet north into the lake (figure 13).

Figure 13 – Pontchartrain 1 Location Range for Storm Surge Protection Structure, extending from the Senator Ted Hickey Bridge approximately 1,000 feet north into Lake Pontchartrain.

Any gate built within this location range would be designed to allow shallow draft navigation, and would remain open except during extreme storm events. For the purposes of impact analysis, previous conceptual studies (Arcadis 2006a, 2006b) for this project were used to estimate the largest possible footprint for any structure built in this channel: 1,100 feet long and 8,000 feet wide, including any necessary tie-in features to existing hurricane protection features such as adjacent levees or floodwalls.

2.3 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

2.3.1 Nonstructural Alternatives

In accordance with Section 73 of WRDA, ER 1105-2-100 that nonstructural measures can be considered independently or in combination with structural measures (USACE 2000). Nonstructural measures reduce flood damages without significantly altering the nature or extent of flooding. Damage reduction from nonstructural measures is accomplished by changing the use made of the floodplains, or by accommodating existing uses to the flood hazard. Examples are flood proofing, relocation of structures, flood warning and preparedness systems (including associated emergency measures), and regulation of floodplain uses. Orleans and St. Bernard Parishes already have flood warning systems and evacuation plans in place and regulation of floodplain uses is addressed by the National Flood Insurance Program (NFIP); therefore, only flood proofing and relocation were considered as nonstructural measures. The flood proofing nonstructural measures evaluated in this analysis are raising structures in place and the relocation of structures subject to flooding through a property acquisition and relocation assistance program.

2.3.1.1 Raise in Place

Flood proofing would require elevating all residential and commercial properties subject to flooding in the study area above the expected levels of flooding. This option of the nonstructural Alternative would also have to consider elevating roadways, public buildings, and some forms of public infrastructure that need to continue operations during and after a storm event. Some facilities such as roadways, railroads, and runways might remain at grade when repair from storm damage would be less costly than the construction, operation, and maintenance of them on elevated structures. The average cost of elevating residential structures in the study area has been estimated at approximately $95 per square foot (USACE 2007b). This includes the cost of administration, design, inspection, cost estimating, project management, and all other associated costs of elevating the structures as well as the costs of the occupants of the residential structures being relocated to temporary housing during the time period that the structures are being elevated. Approximately 107,000 homes in Orleans Parish and 20,000 homes in St. Bernard Parish were damaged by flooding from Hurricane Katrina (U.S. Department of Housing and Urban Development [HUD] 2006). Although Hurricane Katrina was greater than a 100-year storm and not all of this flooding was a product of breaching or overtopping of the IHNC HPS, this figure is reasonably representative of the magnitude of homes in these parishes that are vulnerable to storm surge induced flooding. At $95 per square foot, the cost to raise the average 1,600-square-foot residence above the expected level of flooding would be approximately $152,000. Based on this figure, the cost of raising flood-prone homes could be estimated at approximately $16.3 billion in Orleans Parish and $3 billion in St. Bernard Parish for a total cost of $19.3 billion.

Other costs associated with flood proofing would include elevating non-residential buildings, roads and railroads, and other infrastructure. No information is available on the cost of elevating commercial, industrial, and public buildings because these buildings are so non-homogeneous that information would have to be developed for each individual building.

However, it can reasonably be expected that it would easily equal the costs of elevating the residential structures and bring the total to more than $40 billion.

Elevating the area's roadways would be equivalent to converting all roadways and railroads to bridges. The costs for repairing all roads and railroads would be much more reasonable, and these costs were estimated based on highway design assumptions and current unit prices. A nonstructural alternative that left roads and railroads at existing elevations would result in these structures having to be repaired after each storm event. Costs for repairing two-lane asphalt roads with shoulders were estimated at $400,000 per mile. There are approximately 1,432 miles and 363 miles of two-lane roads in Orleans and St. Bernard Parishes, respectively. Roughly 80% of these roads in Orleans Parish and 100% in St. Bernard Parish were flooded during Hurricane Katrina. Therefore, repair costs would be approximately $458.3 million and $145.2 million in Orleans and St. Bernard Parishes, respectively, for each storm event that exceeded the level of flood protection. Repair costs are greater for railroads ($100 per linear foot[1]) and four-lane roadways ($800,000 per mile). There are approximately 398 miles of four-lane roadways and 114 miles of railroad in Orleans Parish and 42 miles of four-lane highway and 24 miles of railroad in St. Bernard Parish.

No information is available on the costs for elevating other infrastructure, such as electrical distribution and transmission grids, gas distribution lines, drainage, sewage and water distribution facilities, communication networks, public transit, and waterborne navigation facilities.

The total estimated costs as outlined above for elevating all flood-damaged properties in the study area could likely approach, if not exceed, $50 billion, which greatly exceeds the funds appropriated by Congress to achieve the purpose and need of the entire 100-year HPS. However, because these costs are based on the number of homes flooded as a result of Hurricane Katrina, this cost clearly overestimates the cost to raise those homes susceptible to flooding from the 100-year storm. Nonetheless, even if the cost of this alternative were reduced by 50% to account for the differences between pre-Katrina and post-Katrina population estimates and the difference between flooding potential from a Katrina-like event and a 100-year event, this cost would still greatly exceed funds appropriated for the entire 100-year HPS.

2.3.1.2 Real Estate Acquisition and Relocation Assistance

Mandatory public acquisition of properties in areas subject to flooding is one way to reduce the damages from storms and hurricanes. Acquisition of these properties as part of a Federal project and for projects where there is Federal financial assistance would be subject to the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, 42 USC Section 4601, et seq., as amended (the Uniform Act). Accordingly, a nonstructural alternative based on acquisition of properties in flood-prone areas would be subject to these guidelines, including payment of just compensation for the acquired

[1] RS Means Construction Cost Estimating Guides & 2006 Construction Cost Data. The demolition and repair costs were based upon factoring the installation cost.

properties and payment of Uniform Relocation Assistance Benefits under Title II of the Uniform Act for the displacement of individuals, families, businesses, farms, and non-profit organizations.

There are several options that could be offered for the acquisition and relocation option of the non-structural alternative, such as acquisition of the site and home or commercial structure by the local sponsor for demolition and relocation of the displaced residents and business in accordance with the Uniform Act or, acquisition of the site by the local sponsor and relocation of the structure to a comparable site outside the area of flooding.

The most recent average sale price of a single-family home on the East Bank of Orleans Parish was $227,000 and $75,000 in St. Bernard Parish (Brookings 2007). Multiplying these prices by the 107,000 homes damaged from flooding in Orleans Parish and the 20,000 in St. Bernard Parish, the total cost for acquisition of residential properties would be approximately $24.3 billion and $1.5 billion, respectively. This does not include the cost of Uniform Relocation Assistance benefits which are due for displaced residents. Another option would be to relocate all these structures. Assuming an average value of $95,000 per lot in Orleans Parish and $25,000 in St. Bernard Parish (Louisianaatoz.com 2007) plus an average cost of moving and re-siting a 1,600-square-foot structure of $30,000, the cost of this option of the nonstructural alternative for residential properties only damaged by flooding would be $13.4 billion and $1.1 billion, respectively. Under this alternative, the affected property owners would relinquish title to their existing lot in exchange for ownership of the property to which they were relocated.

The above costs are not inclusive of the real estate transaction costs. In addition, the Uniform Act states that displaced persons may be eligible for residential and/or business relocation assistance benefits, which may include reimbursement of expenses for moving themselves and their personal or business-related property, limited expenses in searching for a replacement business or farm, and reasonable and necessary expenses for reestablishment of a displaced farm, nonprofit organization, or small business at its new location.

As in the "Raise in Place" non-structural alternative, these numbers are based on flooding as a result of Katrina and therefore could be an overestimate. Nonetheless, they are a reasonable means to represent the magnitude of the homes vulnerable to flooding from storm surge events. The acquisition and relocation option of the non-structural alternative is a complex, costly, and time-consuming process. Acquired properties would have to remain in the public domain or, at best, be developed with features that could withstand flooding, the cost of which could be an undesired impact to the local sponsor. Moreover, there could be indirect impacts of this alternative to the local economy, such as a reduced tax base from the reduced population.

2.3.2 Create Wetlands

This alternative would consist of construction of wetlands in the vicinity of Lake Borgne. It is generally accepted that wetland functions include flood reduction, water quality improvement, and in some instances storm surge reduction. However, because the ability of wetlands to achieve surge reduction varies from location to location, and depends on a variety of variables whose effect has not been clearly quantified by science, it would be

inappropriate to extrapolate wetland data and estimate surge reduction potential for the study area.

Although capable of providing multiple benefits, the engineering effectiveness and design requirements to achieve the 100-year level of protection from wetlands creation are not considered to be feasible for this project. However, CEMVN fully acknowledges the role wetlands may play in a holistic, multi-tiered HPS. Therefore, CEMVN, as well as other agencies and interests, is pursuing other large-scale wetlands development projects. For example, the Louisiana Coastal Protection and Restoration (LACPR) study is investigating storm surge protection by increasing wetlands, barrier islands, and HPS features between coastal Louisiana and the Gulf of Mexico. Depending upon location, these wetlands may contribute to the effectiveness of any storm surge and flood protection measures in place. The measures investigated and implemented by this and other projects and plans such as Coastal Protection and Restoration Authority (CPRA) of Louisiana's Master Plan, Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects and the Louisiana Coastal Area (LCA) Ecosystem Restoration Study all represent potential additional lines of defense in reducing the risk of coastal Louisiana from potentially catastrophic events.

The nonstructural and create wetlands alternatives were eliminated from further consideration because neither accomplishes the purpose and need of the project. The nonstructural alternative would likely greatly exceed the funding appropriated for the entire 100-year HPS. This alternative also has socially unacceptable impacts such as disruption of the local economy and extreme economic burden on the local sponsor. The create wetlands alternative was not considered an effective engineering solution to provide 100-year hurricane protection.

2.4 SUMMARY TABLE

Table 1 provides a summary of the preliminary alternative screening results.

Table 1
Preliminary Alternative Screening Results

Alternative	Detailed Impact Analysis
No-Action	☑
Nonstructural	X
Raise Levees and Floodwalls	☑
Storm Surge Protection Structures	☑
• Pontchartrain 1	☑
• Pontchartrain 2	☑
• Borgne 1	☑
• Borgne 2	☑
• Borgne 3	☑
Create Wetlands	X

X – Eliminated from further study.

☑ – Considered in detail.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 ENVIRONMENTAL SETTING

This section presents general information on the existing conditions of the environment in the proposed study area. It describes the environmental setting for the study area and identifies and describes significant physical, biological, social, and economic resources in the vicinity of the proposed action.

3.1.1 Geologic and Hydrologic Setting and History

The study area is on the south shore of Lake Pontchartrain, in the northeastern portion of the Mississippi River deltaic plain. Dominant physiographic features in the vicinity include Lake Pontchartrain, the lakefront levee, and the IHNC. The natural surface environment of marsh and swamp has been altered by filling and drainage for development.

The surface and shallow subsurface in the study area is composed of up to 18 feet of hydraulic fill from Lake Pontchartrain. Fill deposits contain sand, silt, and clay, overlying

lacustrine and beach deposits. Lacustrine deposits are characterized by soft to medium clays with some silt and sand layers and shells and are approximately 10 feet thick. Beach deposits are approximately 30 feet thick and are related to the Pine Island Beach Ridge that trends east-west across the area. The beach deposit is generally composed of silty sand and sand with shells. Beach deposits overlie 5 feet to 10 feet of bay-sound deposits which are characterized by soft to medium clays, silts, and some sand containing shell fragments. Pleistocene deposits are located beneath bay-sound deposits at approximate elevation of -50 feet NAVD88. These deposits are mainly stiff to very stiff, oxidized clays, silts, and sands. The study area also contains Aquents soils, which are poorly drained soils that are stratified and clayey to mucky throughout, resulting from hydraulically dredged material (U.S. Department of Agriculture, Soil Conservation Service 1989a). Groundwater has been artificially lowered at the study area by forced drainage. The sands and silts in the fill and beach deposits may be hydraulically connected to Lake Pontchartrain or the IHNC.

At the MRGO/GIWW site, dominant physiographic features include the MRGO, GIWW, protection levees, Lake Borgne, and broad areas of marsh. The surface and shallow subsurface is composed of 10 feet to 15 feet of marsh deposits. Marsh deposits are characterized by very soft to soft organic clays and peat with some silt strata. Marsh deposits overlie interdistributary deposits which are composed of very soft to medium clays and silty clays with shell fragments. Interdistributary deposits are approximately 30 feet thick. Natural levee deposits approximately 10 feet thick are present adjacent to Bayou Bienvenue. They are composed of soft to stiff clays and silty clay. Interdistributary deposits overlie bay-sound deposits of soft to medium clay, silt, and sand containing shell fragments and are approximately 5 feet to 10 feet thick. Pleistocene deposits are located beneath bay-sound deposits at an approximate elevation of -60 feet NAVD88. These deposits are mainly stiff to very stiff, oxidized clays, silts, and sands.

The MRGO/GIWW site contains Clovelly-Lafitte-Gentilly soils, which are level, very poorly drained soils that have a moderately thick, thick, or thin mucky surface layer and clayey underlying material (U.S. Department of Agriculture, Soil Conservation Service 1989b). Groundwater is at or near the surface at the MRGO/GIWW site.

Long-term relative subsidence resulting mainly from compaction of Holocene sediments is estimated at 0.5 foot per century at both sites. Eustatic sea level is predicted to rise an additional 1.3 feet over the next century (Intergovernmental Panel on Climate Change 2001). Therefore, the natural, long-term, relative subsidence rate in the study area is estimated to be 1.8 feet per century. Ground subsidence related to artificial lowering of the water table far exceeds the natural rate of subsidence and is estimated at several feet in areas within the HPS.

The study area constitutes a significant portion of the Lake Pontchartrain Greater Drainage Area (figure 14). Geographically, the Pontchartrain Basin includes a large estuary lying adjacent to and just north of the city of New Orleans. The basin also includes two other estuaries, Lake Maurepas and Lake Borgne. Rivers draining into this basin are the Pearl, Amite, Tangipahoa, Tickfaw, and Tchefuncte. Numerous navigation channels, drainage canals, and access canals have altered the hydrology of the basin. These channels may

confine freshwater flow, cross natural drainage boundaries, or convey more saline water inland (USACE 1984; 2006).

The drainage area of Lake Pontchartrain is approximately 4,600 square miles including all tributaries (USACE 1984; 2006). The lake is connected with Lake Maurepas on the west by Pass Manchac, with Lake Borgne on the east by Chef Menteur and Rigolets Passes, and with the MRGO by the IHNC and GIWW.

Also connected with Lake Pontchartrain on the south are the Mississippi River, connected to the lake by the IHNC, and the Bonnet Carré Spillway, which passes flow from the Mississippi River to Lake Pontchartrain when necessary to reduce Mississippi River flood flows that would endanger low-lying areas downstream from the spillway.
Lake Pontchartrain is approximately 16 miles wide (25 miles wide at the widest point); 40 miles long, and has a shoreline perimeter length of approximately 112 miles.
This 640-square-mile lake has an average water depth of 12 feet west of the Causeway Bridge and 16 feet on the east side (USACE 1984; 2006).

The study area falls within three sub-basins of the Pontchartrain Basin. These sub-basins are the Orleans East Bank, New Orleans East, and Chalmette Loop (figure 1). The Orleans East Bank Sub-basin extends westward from the IHNC to the 17th Street Canal, bordered to the north by Lake Pontchartrain and to the south by the Mississippi River. The New Orleans East Sub-basin extends eastward from the IHNC toward the Rigolets Pass, bordered on the north by Lake Pontchartrain and on the south by the GIWW. The Chalmette Loop Sub-basin extends east and south, bordered on the north by the GIWW, on the east by the MRGO, and on the south by the Mississippi River and the portion of the Chalmette Loop Levee that runs from the Mississippi River to Highway (Hwy) 46 between the communities of Caernarvon and Verret (USACE 1984; 2006).

Figure 14 – Regional Hydrology Map.

3.1.2 Climate

The area's climate is subtropical and influenced by the water surfaces of nearby lakes, streams, and the Gulf of Mexico. Summers are long and hot with high humidity and an average daily temperature of 81 degrees Fahrenheit (°F). Winters are influenced by cold, dry, polar air masses moving southward from Canada, with an average daily temperature of 53°F. Average annual precipitation is approximately 61 inches with monthly averages varying from 2.8 inches in October to 6.5 inches in July (USACE 1974; National Oceanic and Atmospheric Administration [NOAA] 1987).

Precipitation in Louisiana is largely due to convectional activity in the summer and tropical storms during the winter. Due to its proximity to the Gulf of Mexico, the study area is

susceptible to tropical waves, tropical depressions, tropical storms, and hurricanes. These weather events can produce significant amounts of precipitation over a very short period of time and are often accompanied by strong winds, tornadoes, and storm surge along the coastal areas. Analysis of historic data from the National Hurricane Center dataset on tropical cyclones (including tropical depressions, tropical storms, and hurricanes) of the Louisiana coast from 1900 to 1999 shows a total of 63 storms, of which 49 were Category 3 or less. Not all of these storms had direct contact with the New Orleans metro area (U.S. Geological Survey [USGS] 2002a). Since 1999, a total of 10 storms, of which 7 were Category 3 or less, have impacted Louisiana (USACE, 2006b)

3.1.3 Inner Harbor Navigation Canal History and System Summary

In 1914, the Louisiana State Government authorized the City of New Orleans to build a deep-water shipping canal between the Mississippi River and Lake Pontchartrain. The official name for the resulting waterway is the Inner Harbor Navigation Canal. Although this is the name used by the USACE and the one found on nautical charts, commercial mariners and local residents generally call it the Industrial Canal. The Port of New Orleans completed the existing lock that connects the IHNC to the Mississippi River in 1923, which is now a historic landmark (USACE 2007c; d; e).

The GIWW was constructed during the 1930s. The GIWW traces the U.S. coast along the Gulf of Mexico from Apalachee Bay near St. Marks, Florida, to the Mexican border at Brownsville, Texas. From its intersection with the IHNC, the waterway extends eastward for approximately 376 miles and westward for approximately 690 miles. The first six miles of the GIWW east of the IHNC is also considered to be part of the MRGO; however, to avoid confusion, the entire length of the channel is referred to in this document as the GIWW. At approximately six miles east of the IHNC, the GIWW branches north and the MRGO branches south. Numerous side channels and tributaries intersect both the eastern and western main stem channel of the GIWW, providing access to inland areas, coastal harbors, and the Gulf of Mexico.

The MRGO was authorized in 1956. Construction started in 1958 and was completed in 1968, and at that time, boat traffic along the MRGO began using the IHNC lock. As explained earlier, CEMVN has proposed the construction of a rock dike, or “plug” on the MRGO at Bayou La Loutre. A Legislative EIS has been completed for this proposed project, and its construction has been authorized in the WRDA 07, although a final Record of Decision has not yet been signed. The MRGO will be officially deauthorized upon the submittal of the MRGO Deauthorization Chief’s Report to Congress.

The IHNC lock complex located at the southern terminus of the IHNC is capable of accommodating a limited number of the deep-draft vessels that operate on the MRGO, but the primary use is serving shallow-draft barge traffic transiting the GIWW. Thus, navigation traffic in the three waterways (IHNC, GIWW, and MRGO) is currently using the same lock to connect to the Mississippi River. A variety of recreational vessels, commercial fishing vessels, and U.S. government vessels also use the lock (USACE 2004a).

3.1.3.1 Hurricane Protection Projects

The levees and floodwalls bordering the IHNC, GIWW, and MRGO are part of the LPV HPS. Two other hurricane protection projects, the West Bank and Vicinity (WBV) Hurricane Protection Project, and the New Orleans to Venice (NOV) Hurricane Protection Project, have been designed and partially constructed in New Orleans and southern Louisiana. These three projects make up the New Orleans HPS (USACE 2006; 2007e; 2007f). The HPS system in the study area is shown on figure 15 and includes:

- Levees and floodwalls along the IHNC
- Levees and floodwalls along the GIWW
- Levees along the MRGO
- Bayou Bienvenue and Bayou Dupre Floodgates

3.2 SIGNIFICANT RESOURCES

This section contains a discussion of the significant resources located in the study area. The existing condition discussion comprises what is known in the NEPA process as the Affected Environment. The discussion of impacts details those resources that could be impacted, directly or indirectly, by the no-action alternative, the proposed action, or the alternatives to the proposed action. Direct impacts are those that would take place at the same time and place (40 CFR §1508.8(a)) as the action under consideration. Indirect impacts are those that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR §1508.8(b)).

Cumulative impacts considers the effects on the resource that result from the incremental impact of the action being considered when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taken place over a period of time (40 CFR §1508.7). A complete description of the known projects considered for the cumulative impacts analysis is provided in section 4.

The resources described in this section are those recognized as significant by laws, executive orders, regulations, and other standards of national, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public. Further detail on the significance of each of these resources can be found by contacting CEMVN or on www.nolaenvironmental.gov, which offers information on the ecological and human value of these resources, as well as the laws and regulations governing each resource. Search for "Significant Resources Background Material" in the website's digital library for additional information.

Table 2 shows the significant resources found within the study area and notes whether they may be impacted by any of the alternatives analyzed in this report. A "T" indicates that impacts, if any, would be temporary, lasting only for the duration and within proximity of construction activities.

Table 2
Significant Resources in Study Area

Significant Resource	Impacted	Not Impacted
Hydrology	X	
Water Quality	X	
Wetlands	X	
Aquatic Resources	X	
Fishery Resources	X	
Essential Fish Habitat	X	
Terrestrial and Upland Resources	X	
Wildlife Resources	X	
Threatened and Endangered Species	X	
Recreation	X	
Noise	T	
Air Quality	T	
Aesthetics	X	
Cultural Resources	X	
Socioeconomic	X	

T – Temporary

3.2.1 Hydrology

3.2.1.1 Existing Conditions

The Pontchartrain Basin includes the estuarine areas of Lake Pontchartrain and Lake Borgne. The basin has been substantially altered by a system of waterways, levees, and hydraulic control structures which range in size from the Mississippi River to the MRGO deep-draft channel to oil well access canals.

The IHNC is hydrologically connected to the GIWW, MRGO, Mississippi River, and Lake Pontchartrain. The IHNC is approximately 30 feet deep, with a minimum 150-foot bottom width and 300-foot top width. Parts of the GIWW and the portion of the MRGO within the study area have been authorized as 36-foot deep, 500-foot bottom width waterways. The IHNC lock is located at the southern terminus of the IHNC and allows waterborne traffic to transit to and from the Mississippi River.

The major influences on water levels within the basin are wind and tide with some localized effects by vessel traffic. Tidal ranges average approximately 1 foot and 2 feet at Lake Pontchartrain and Lake Borgne, respectively (Westerink et al. 2006). Average flow velocity in the IHNC is about 0.6 feet per second (fps); however, surface ebb and bottom velocities may exceed 2 fps. During periods of low inflows into Lake Pontchartrain, typically July

through November, surface ebb and bottom velocities in the IHNC average about 0.8 and 1.7 fps, respectively (USACE 1997).

The basin is susceptible to flooding from hurricane storm surge. Lake levels are increased by the influx of surges from Lake Borgne and the Gulf of Mexico that accompany hurricanes from the southeast, south, and southwest (USACE 1967; USACE 1995; USACE 2007f; Westerink et al. 2006).

Modeling conducted by the Interagency Performance Evaluation Task Force (IPET) indicates that the GIWW reach has effects on storm surge due to the fact it connects Lake Borgne and Lake Pontchartrain (USACE 2007g). During storms, the surges experienced in the GIWW and the IHNC are functions of the surges generated from both Lake Borgne in the east and Lake Pontchartrain in the north. The IPET models suggest that the levees along the GIWW and MRGO can locally enhance storm surge in this vicinity depending on wind speed and direction, with strong winds from the east tending to maximize the local effect (USACE 2007g). However, the models also suggest that the increase in storm surge amplitude due to this effect is small.

During major storm events, storm surges can propagate north into Lake Borgne and are then redirected west, converging into the IHNC and resulting in high water levels and large waves. Observed peak water levels in the IHNC during Hurricane Katrina indicate a maximum water level gradient of 3 feet between the intersection with the GIWW and Lake Pontchartrain. Also, model analysis of conditions during that event suggests that waves up to 4 feet high occurred within the IHNC (USACE 2007g).

The historic gage record (1923-2006) at the IHNC Lock shows that the median range of low to high water levels is -0.79 to 3.71 feet NGVD29. The recorded water level was 10.61 feet NGVD29 during Hurricane Betsy. Although there are no water level records at the IHNC Lock for Hurricane Georges, records are available for nearby locations. During Hurricane Georges, the highest recorded water level in the IHNC at the Florida Avenue Bridge was 8.35 feet NGVD (1983 ADJ.) on 27 September 1998 (USACE 1998). The highest recorded water level (high water mark), due to Hurricane Katrina, was recorded at 14.28 feet NAVD88 2004.65 (USACE 2007g).

Currently, the MRGO acts as a tidal conduit for the exchange of saline water from the Gulf of Mexico into the IHNC and Lake Pontchartrain. Measurements of non-storm event flows in the IHNC have demonstrated the presence of an upper layer of water flowing out from Lake Pontchartrain and a lower layer flowing toward the lake (USGS 2007). This suggests that dense saline water flows into Lake Pontchartrain even during periods when the average tidal flow is retreating out of the lake. However, the construction of the deauthorization closure structure at Bayou La Loutre should alter this direct saline influence.

In addition to flows and water levels, sediment transport is another aspect of hydrology. The conveyance of sediment in the water column can significantly affect aquatic habitat, including benthic fauna and emergent wetland plants. Suspended sediment is important to the biological structure and function of a water body or wetland, and the amount and composition of suspended sediments is affected by both natural and human factors.

Before major flood control projects were constructed on the Mississippi River, the major source of sediment to the study area was the Mississippi River. The Mississippi River average suspended sediment load decreased 25 percent between the late 1800s and 1950, and 40 percent to 60 percent since 1950, for a total of 79 percent from 1851 to the 1980s (Keown et al. 1981; Kesel 1988). The percentage of suspended sand load has also decreased by 45 percent from the late 1800s to the 1980s due to factors such as trapping sand in upstream reservoirs and construction of revetments to prevent bank caving (Kesel 1988). Deposition of suspended sand from out-of-bank flows is a key to the natural processes that build and maintain wetlands and deltas. The decrease in sediment load has contributed to land loss in the study area.

Bank erosion and channel deposition have been observed along the IHNC, GIWW, and MRGO. The bank erosion is partly due to wave action, tidal movement, and the effect of storm surges. The average rate of erosion along the MRGO/GIWW reach is 21.5 feet per year (ft/yr), and between the GIWW and Bayou La Loutre there is 28 ft/yr of erosion on the north bank and 13 ft/yr on the south bank (USACE 2004b). Erosion losses on the south shore of Lake Borgne amount to 15 ft/yr. Most of the material eroded from the bank is likely deposited within the channel. Substantial resuspension and redistribution of sediments during storm events have also been documented (USACE 2007f). Hurricane Katrina deposited considerable amounts of sediment throughout the Pontchartrain Basin area (Turner et al. 2006). Dredging is required to remove deposited sediment after severe storms in addition to normal annual maintenance dredging activities (USACE 2007h). For the most part, dredging has been required in the channel reach south of the study area, but since 1998 the normal appropriation has not been sufficient to maintain authorized dimensions. No dredging has been undertaken at any location in the MRGO/GIWW since Hurricane Katrina in 2005.

Historically, the sediment load into the wetlands of the study area was probably higher than it is today and the wetlands acted to trap sediment to maintain their elevation; lower current sediment transport into the wetlands is one factor in the net losses presently occurring. To counter the current sediment deficit and erosion problems, shoreline stabilization and marsh creation projects are proposed within the study area. For example, the Lake Borgne Shoreline Protection Project (PO-30) has been developed to curtail the erosion experienced by the "land bridge" between the MRGO and Lake Borgne in order to keep the connection between Lake Borgne and the MRGO from widening and maintain the historic physical separation of these water bodies (USEPA 2005). Furthermore, the deauthorization of the MRGO could decrease shoreline erosion in the study area by restricting the channel's use by deep draft vessels.

3.2.1.2 Discussion of Impacts

No-action Alternative

Direct and Indirect Impacts on Hydrology. Because the changes to the HPS under the no-action alternative would consist of increasing the elevation of existing levees or floodwalls, replacing existing levees or floodwalls essentially in kind, this alternative would not be

expected to have significant large-scale direct impacts on flows and water levels in the study area during non-storm conditions.

Installation of additional sheet pile walls and other subsurface portions of the HPS structures could restrict groundwater flow in their immediate vicinity. However, these effects would be localized and are unlikely to be significant.

The primary direct impact of this alternative would be that low-lying areas on the protected side of the HPS could experience inundation less frequently, at reduced depths, and for shorter durations than under current conditions because of the greater level of protection provided. The upgraded floodwalls and levees could reduce the risk of protected-side flooding due to wave action and storm surges up to the standard project hurricane described in the LPV EIS (USACE 1984). However, until construction is complete, the risk of system flooding would largely be determined by the most vulnerable reach at that time.

As a temporary direct impact during construction, exposed soils may be dislodged by rainfall and be transported by storm water runoff. Where construction occurs adjacent to waterways, turbidity in the immediate vicinity may be increased. Coarser particles because they are larger and denser, deposit closer to the point of origin; finer particles tend to remain suspended in the water column for a longer period of time. However, Best Management Practices (BMPs) and Stormwater Pollution Prevention Plans (SWPPPs) would be fully implemented to minimize runoff and turbidity impacts during construction so temporary impacts would be negligible.

Once the levees are raised to the previously authorized level of protection and shaped to the design slope, the rates of bank erosion and sedimentation could be minimized. Channel widening along the MRGO and GIWW could continue to be an issue; however, the levee improvement activities including re-growth of vegetation could minimize bank and shoreline erosion.

Cumulative Impacts on Hydrology. Under the no-action alternative, the IHNC would remain at risk to storm surges from the north and east in the future regardless of the MRGO deauthorization.

Several of the larger projects under study could have a notable impact on non-storm hydrologic conditions. Implementation of the Violet Canal Freshwater Diversion Project could change the flow patterns between the Mississippi River and the MRGO in the vicinity of the Central Wetlands. The proposed diversion could pass freshwater from the river into the wetland area via the Violet Canal. After passing through the wetland, this flow could mix into the more saline waters of the MRGO and Lake Borgne. The diversion could greatly increase fine sediment transport and deposition into the marshes between the Mississippi River and MRGO.

Implementation of CEMVN's MRGO and Lake Borgne Wetland Creation and Shoreline Stabilization Project, which aims to protect, restore, and increase wetlands in this area, could enhance sediment accretion within the limits of the created wetlands, and in protected areas behind shoreline stabilization. However, although the connectivity through existing natural channels would not be affected, these projects could reduce sheet flow from Lake Borgne

into adjacent emergent wetlands. Installation of additional foreshore protection measures in Lake Pontchartrain, Lake Borgne, and the MRGO is expected to reduce the rate of erosion in the vicinity of those measures and may encourage some deposition in those areas. Shoreline stabilization in the vicinity of the "land bridge" could provide more complete protection and reduce that land mass erosion, which could subsequently result in decreased inflows from the MRGO into Lake Borgne.

The no-action alternative could incrementally impact flows and water levels when added to other actions in the study area. The incremental effect on erosion and disturbed sediments during construction would be negligible and would be addressed through BMPs and SWPPPs. The incremental benefits from the no-action alternative through reduced risk of flooding would be minor compared to the incremental benefits of the proposed action.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Hydrology. The primary direct impact on hydrology from Borgne 1 is that the gates, when they are closed during extreme storm events, could significantly reduce surges entering the IHNC from the east. Because these storm surges in combination with surges from Lake Pontchartrain are the most significant influence on high water levels in the IHNC, water levels for events up to the 100-year storm could be reduced by several feet. Storm surge in general carries a great deal of energy associated with the height and motion of the water. By stopping the surge, the barrier and closed gates could dissipate the energy of the surge, but could also cause turbulence east of the structures, and increase the potential for erosion near the structures and adjacent wetlands. There could also be increased deposition of sediment in the project area after large storm events, as well as the potential for scour holes and/or shoaling to occur.

All gates of Borgne 1 would remain open except during extreme storm events and would not significantly reduce flows, but could have localized effects on water surface elevations and velocities. Although the open gate structures could cause some turbulence in the immediate vicinity, the gates would be designed to allow flows to pass smoothly with minimal turbulence.

Any barrier could directly and permanently prevent sheet flow water exchange between the wetland area west of the barrier and Lake Borgne. The barrier could decrease the circulation and quantity of water entering these wetlands; however its water supply would continue to have inputs from Bayou Bienvenue and the GIWW. The wetland area to the west of the barrier would also receive less sediment inflows due to its reduced interaction with Lake Borgne, although it would still receive inputs from Bayou Bienvenue and the GIWW. However, these water bodies are not significant sediment sources. The sediment transported into this wetland area would be more likely to deposit, because on average it would remain within the wetland for a longer time. It is likely that on balance there would be a net reduction in the amount of deposition in that wetland under this alternative.

Additionally, if Borgne 1 includes a barrier through the wetlands area west of Lake Borgne, it could create a storage area between the barrier and the existing flood protection levees.

This storage area could relieve some of the effects of a Lake Pontchartrain storm surge on the IHNC by preventing Lake Borgne storm surge from entering the IHNC. The storage volume would be directly related to the distance between the barrier and the levees; therefore, the farther east the barrier is located, the greater this potential benefit.

The barrier could temporarily expose as much as approximately 542 acres of soil during its construction. BMPs and SWPPPs would be implemented to minimize erosion. In-channel work necessary for construction of the Borgne 1 gate and closure could impact as much as 100 acres of channel bottom of the GIWW, MRGO, and Bayou Bienvenue. Cofferdam construction and flow diversion could be required. Much of the redirection of flows could be permanent due to the barrier's footprint.

Cumulative Impacts on Hydrology. The cumulative impact of the altered flows and reduced sedimentation from this alternative is minor when considered with past and present activities because the hydrology has already been altered by the maintained navigable waterways (GIWW, IHNC, MRGO) and the existing HPS; furthermore, the Borgne 1 area is no longer freely connected with the sediment source of the Mississippi River. Because a hydrologic connection to Bayou Bienvenue, Central Wetlands Area, IHNC Canal, Lake Pontchartrain, and Lake Borgne would continue through the proposed gate structures, the minor, localized, and temporary negative impacts associated with Borgne 1 could partially be offset by the beneficial large-scale effects on water levels and flows of the future projects of shoreline protection, marsh creation, and freshwater diversion. However, the incremental effect of Borgne 1 would significantly reduce the effect of surges from extreme events up to the 100-year storm, further enhancing the overall benefits of the entire proposed 100-year hurricane protection system throughout the area.

<u>*Pontchartrain 2*</u>

Direct and Indirect Impacts on Hydrology. Construction activities for Pontchartrain 2 would be limited largely to in-channel work, which could impact up to 5 acres of channel bottom in the IHNC. When closed, the Pontchartrain 2 gate would significantly reduce storm surge from the lake. Flow eddies and turbulence could result in localized erosion in the vicinity of the structure. However, appropriate control measures would be incorporated into the design of the gate structure to minimize the adverse effects, and not increase the velocity of water or tidal flow in the IHNC greater than the existing conditions.

Cumulative Impacts on Hydrology. Lake Pontchartrain was not connected with the Mississippi River via the IHNC until 1914, the GIWW was constructed in the 1930's, and the MRGO was not constructed until 1958; these actions created an open connection to Lake Borgne subjecting the project area to an increase in tides and subsequent mixing. The future projects proposed in the vicinity of Pontchartrain 2 include building levees and floodwalls to the 100 year level of protection to fortify the system. The proposed gate structure at Pontchartrain 2 would be designed to not increase the velocity of water or tidal flow in the IHNC greater than the existing conditions. Therefore, the cumulative impacts of Pontchartrain 2 would not result in large-scale effects on water levels and flows, and any negative impacts are expected to be minimal, localized, and/or temporary. The incremental effect of Pontchartrain 2 would significantly reduce the effect of surges from extreme events

up to the 100-year storm, further enhancing the overall benefits of the entire proposed 100-year hurricane protection system throughout the area.

Alternatives to the Proposed Action

Raise Existing HPS to 100-Year Level of Protection

Direct and Indirect Impacts on Hydrology. The direct and indirect impacts of this alternative on flows and water levels within the study area could be similar to those described for the no-action alternative, with the exception that the risk of flooding due to overtopping could be reduced because of the added height of the levees and floodwalls. Construction of larger levees and floodwalls could result in a greater area of disturbance, thereby creating the potential for a greater amount of eroded sediment associated with this action. However, this impact would be minimized through BMPs and SWPPPs.

Cumulative Impacts on Hydrology. This alternative would meet the requirements to address the 100-year design water levels by increasing the height of the levee and floodwalls, further enhancing the overall benefits of the entire proposed 100-year hurricane protection system throughout the area. The cumulative effects of this alternative would be similar to those described in the no-action alternative, except that it would be of a larger or greater scale.

Borgne 2

Direct and Indirect Impacts on Hydrology. The impacts described for Borgne 1 under the proposed action, including storm surge reduction, reduced interaction between Lake Borgne and areas to the west, and impacts of gate and barrier construction, would also apply to Borgne 2. However, the construction footprint of the Borgne 2 barrier (1,164 acres) could be significantly larger than that of the Borgne 1 barrier. The effects of the Borgne 2 structures during extreme storm conditions would be similar to those described under the proposed action, with the addition that near shore areas of Lake Borgne could also be affected by turbulence and deposition. Additional impacts for Borgne 2 could increase the isolation of the entire wetland area west of Lake Borgne (up to 4655 acres[2]) from sheet flow with the lake. However, as discussed in Borgne 1 openings via gates on the GIWW and Bayou Bienvenue would connect this wetland area and allow for circulation with Lake Borgne, and maintain the hydrologic connection with Lake Pontchartrain and the Mississippi River through the IHNC. Secondly, if located along the Lake Borgne shoreline, the Borgne 1 barrier could enhance or replace proposed Lake Borgne shoreline protection projects by serving as a shoreline protection feature.

Cumulative Impacts on Hydrology. The cumulative impacts of constructing Borgne 2 would be similar to those described for the easternmost alignment of the proposed action. Because the Borgne 2 barrier would extend along the edge of Lake Borgne the effects of turbulence during extreme storms could extend into the near shore areas of the lake. The incremental

[2] This acreage includes only that area which is occupied by marsh vegetation, not that portion (2394 acres) that is open water.

effect of Borgne 1 would significantly reduce the effect of surges from extreme events up to the 100-year storm, further enhancing the overall benefits of the entire proposed 100-year hurricane protection system throughout the area.

Borgne 3

Direct and Indirect Impacts on Hydrology. During extreme conditions, the Borgne 3 breakwaters could reduce the movement of surges and decrease wave heights. Preliminary analyses (Haskoning 2006) suggest that a breakwater system in Lake Borgne could reduce wave heights by 4 feet to 6 feet. These breakwaters would not completely block flows to and from Lake Borgne and its wetlands, but it could change the rates of flow and circulation patterns. The presence of breakwaters could alter the exchange of water between the area to the west and the rest of Lake Borgne. The breakwaters could also reduce the wind fetch across the lake and thereby reduce the wave energy from some easterly winds.

Borgne 3 could directly cause higher tidal velocities in the gaps between the breakwaters, likely to initiate some degree of scour, and reduce velocities initiating deposition in areas near the midpoints of the breakwaters. Reduced wave energies could reduce the amount of shoreline erosion, especially to the west of the structure, and reduced mixing may increase the rate of sediment deposition west of the structure. Design of the structure would have to develop appropriate rock sizing and slopes to resist scour of both the structure and the lake bottom in the vicinity of the structure during overtopping and high-energy wave conditions.

In order to construct the Borgne 3 breakwaters, approximately 153 acres of lake bottom would be disturbed. Increased turbidity could be a short-term and temporary impact that would be addressed to the extent possible by BMPs and SWPPPs.

Cumulative Impacts on Hydrology. Borgne 3 could enhance proposed shoreline protection and restoration projects in the Lake Borgne area by diffusing the wave energy directed at the shoreline; however for projects proposing to dredge the lake to create marsh in the project area the breakwaters could limit potential dredge sites. The possible colonization of benthic and invertebrates species on these breakwaters, in essence by creating artificial reefs, could provide benefits by cycling material within the water column and eventual settlement and sedimentation. If Borgne 3 were constructed as an added feature to Borne 1 or Borgne 2 alternatives, other cumulative impacts in addition to those described in the other alternatives include localized effects on flows and velocities and the reduction in wave fetch, wave heights, and mixing in Lake Borgne.

Pontchartrain 1

Direct and Indirect Impacts on Hydrology. The impacts on flows and water levels associated with the Pontchartrain 2 gate described under the proposed action would be similar for Pontchartrain 1.

Cumulative Impacts on Hydrology. The cumulative effects of this alternative would be similar to those of the Pontchartrain 2 alternative.

3.2.2 Water Quality

Water quality is important because it affects physical, chemical, geological, and biological processes throughout the estuarine system associated with the IHNC. The Louisiana Department of Environmental Quality (LDEQ) has prescribed water quality standards for surface waters of the state of Louisiana in order to promote a healthy and productive aquatic system. Surface water standards are set to protect the quality of all waters of the state, including rivers, streams, bayous, lakes, reservoirs, wetlands, estuaries, and many other types of surface water. Some of the key water quality parameters monitored by LDEQ in the study area include salinity, dissolved oxygen, and fecal coliform (Table 3). These parameters help describe the existing conditions of water bodies and identify outside influences to the health and water quality of the study area.

3.2.2.1 Existing Conditions

Salinity is the dissolved salt content of a body of water and is an ecologically important factor because it influences the types of organisms that exist in a body of water. Salinity also increases the density of water which can cause higher saline waters to sink beneath fresher water. Salinity measurement is utilized for evaluating estuarine hydrology and habitat potential (Orlando et al. 1993) because it is the predominant factor responsible for change of freshwater, intermediate, brackish, and saline habitats. Flynn et al. (1995) indicates that increases in salinities may lead to the conversion of fresh and intermediate marshes to open water. According to Orlando et al. (1993), the salinity patterns throughout the major basins of coastal Louisiana may be influenced by the following forcing mechanisms: freshwater inflow, tides, wind, and coastal shelf processes. The freshwater sources discharging into the estuaries of Lake Borgne and Lake Pontchartrain vary seasonally and this is reflected by fluctuations in salinity. Generally, the high-inflow/low-salinity periods are from late winter to late spring. The low-inflow/high-salinity periods are typically from late spring to late fall. Table 3 was compiled using several years of water quality data from LDEQ monitoring sites located in the proposed study area (LDEQ 1984; 2005; 2007). Figure 15 illustrates the sampling locations. The differences in salinity ranges in parts per thousand (ppt) between the Lake Pontchartrain sites (Causeway Crossovers #7 and #4) from 0.2 ppt to 12.6 ppt and the MRGO at Marker #94 site from 10.2 to 21.7 ppt indicates a saline influence from the Gulf of Mexico.

Table 3
Louisiana Department of Environmental Quality Water Quality Data (1986-2006)

Sites	Dates Sampled	Salinity Range (ppt)	Dissolved Oxygen Range (mg/L)	Fecal Coliform Range MPN/COL/ 100 mL
Site No. 137/Lake Pontchartrain (Causeway Crossover #7) near Metairie, Louisiana	1/13/1986 – 5/11/1998	0.2 – 8.9	2.1 – 12.85	20 – 220
Site No. 138/Lake Pontchartrain (Causeway Crossover #4) near Metairie, Louisiana	1/14/1991– 6/19/2007	0.2 – 12.6	4.22 – 12.92	2 – 170
Site No. 306/Inner Harbor Navigation Canal at New Orleans, Louisiana	12/15/1992 – 5/7/2007	0.2 – 18.5	2.44 – 12.05	8 – 9,000
Site No. 1074/Lake Borgne near mouth of Blind Rigolets	1/23/2001 – 12/6/2006	2.6 – 15.97	5.67 – 10.06	2 – 130
Site No. 1064/ Intracoastal Waterway at New Orleans Public Service gas pipeline crossing	1/23/2001 - 12/5/2006	5.8 - 17.6	4.18 - 10.66	2 - 350
Site No. 1085/ Mississippi River Gulf Outlet at Marker #94	1/2/2001 - 12/13/2006	10.2 - 21.7	4.48 -10.39	2 - 170

ppt – parts per thousand; mg/L – milligrams per liter.; MPN/COL/100 mL – most probable number of colonies per 100 milliliters. Source: Louisiana Department of Environmental Quality 2007.

The presence of dissolved oxygen is a good measure of the health of the water body being sampled. Low dissolved oxygen can be indicative of nutrient, chemical, and/or temperature impacts. Measured dissolved oxygen levels in the IHNC generally remain above the minimum state standard (4 milligrams per liter [mg/L]) and USEPA criteria; however, these levels can fall below the minimum during the hot summer months. The persistent high temperatures during the summer along with the high vertical salinity gradients originating from the IHNC can combine to produce hypoxic conditions in the bottom waters of Lake Pontchartrain (USGS 2002a). Hypoxia is a phenomenon that occurs in aquatic environments as dissolved oxygen becomes reduced in concentration to a point detrimental to aquatic organisms.

The LDEQ Water Pollution Control Division published a Report on Interim Findings, Water Quality Investigation of Environmental Conditions in Lake Pontchartrain, dated April 1984. This report focused on the speculation of hypoxic/anoxic zones that cover large areas of the lake bottom. Between 1979 and 1982, studies by the Center for Wetland Resources (CWR) at Louisiana State University documented drastically fewer numbers of benthic (bottom dwelling) organisms than had been found earlier (Poirrier 1978). Subsequent studies demonstrated that summer hypoxic conditions can extend from the IHNC to the middle of the lake and that low dissolved oxygen associated with salinity stratification is the cause of the stressed benthic invertebrate community (Poirrier et al. 1984; LDEQ 1984).

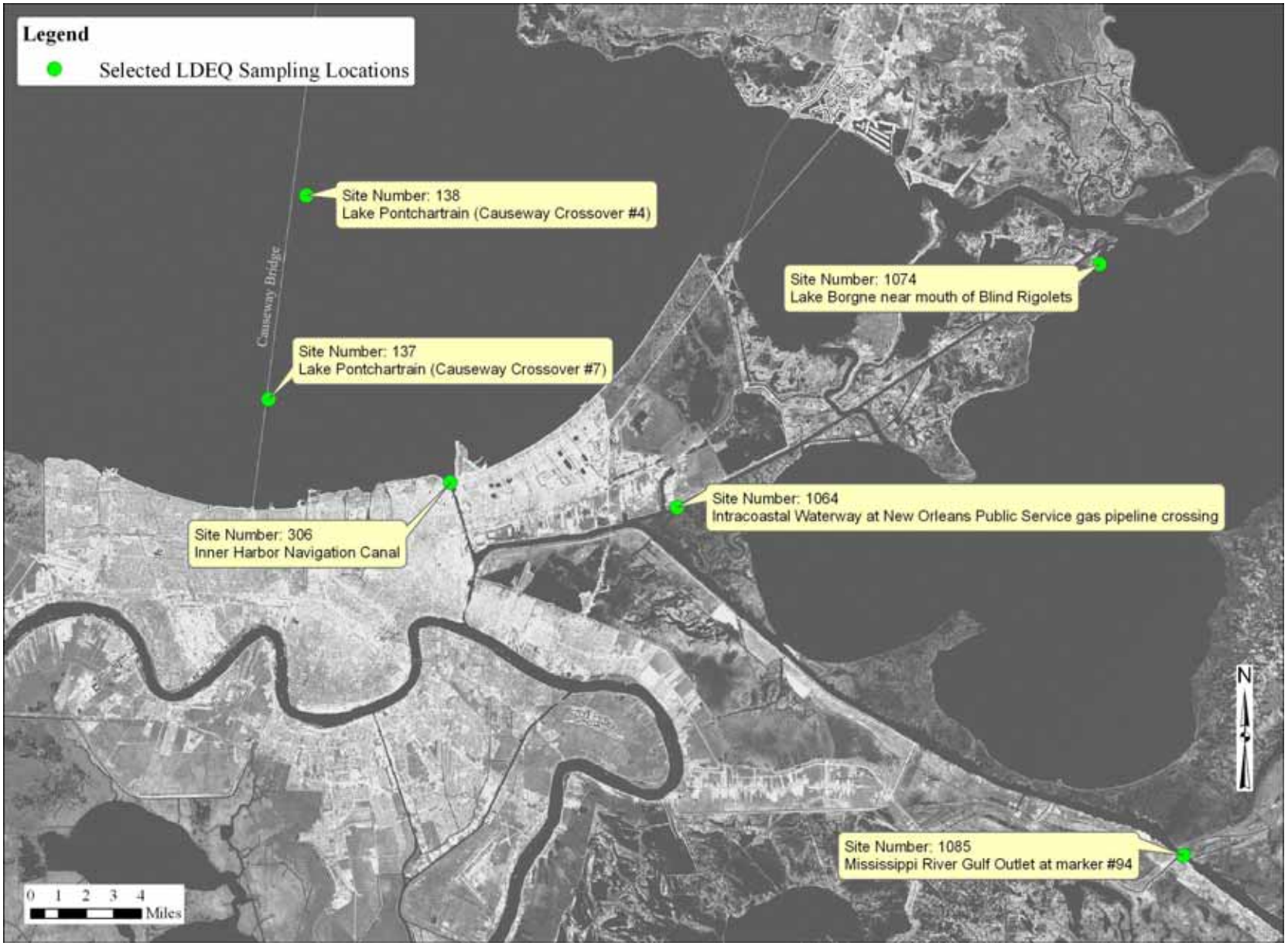


Figure 15–Selected Louisiana Department of Environmental Quality Water Sampling Sites.

Fecal coliforms are often used as indicators of contamination by sewage. Fecal coliform regularly exceeds the LDEQ water quality criteria (most probable number [MPN] not to exceed 14/100 milliliter [mL]) in the IHNC (LDEQ 2007), likely due to wastewater and polluted storm water that enters the IHNC/MRGO/GIWW channel system from several sources. In general, while LDEQ and USEPA standards are exceeded on occasion, overall water quality and health of the water bodies in the study area are generally good at this time.

3.2.2.2 Discussion of Impacts

No-action Alternative

Direct and Indirect Impacts on Water Quality. Direct impacts of this alternative are limited to a temporary increase in the concentration of fine sediments as result of construction. However such impacts would be minimized through the use of SWPPPs and BMPs. Wastewater and polluted storm water would continue to enter the project area from many sources. Urban storm water runoff and the discharge of other pollutants could likely contribute to continued water quality degradation as they continue to flow into Lake Pontchartrain, Lake Borgne, and the IHNC.

Existing water quality regulatory programs, such as the National Pollutant Discharge Elimination System (NPDES), LDEQ's Non-point Source Pollution Program, Louisiana Department of Natural Resources' (LDNR's) Coastal Non-point Pollution Program, and Total Maximum Daily Load (TMDL) would continue.

Cumulative Impacts on Water Quality. Except for the Violet Canal Freshwater Diversion and the MRGO deauthorization closure structure, which could reduce salinities in Lake Borgne and Lake Pontchartrain, the other past, present, and future projects are not expected to have a significant effect on the large-scale water quality conditions in the study area. However, localized water quality degradation could occur during construction of these projects. Concurrent construction of other 100-year HPS projects could cause significant short-term impacts to water quality that could exceed LDEQ's water quality standards. The cumulative construction impacts of the no-action alternative, namely a temporary increase in concentration of fine sediments within the water column due to upland erosion or sediment disturbance in waterways, would be additive to similar impacts caused by other levee improvement projects planned. This could lead to increased turbidity and possible reductions in dissolved oxygen levels in the vicinity and downstream of construction activities. These sediments could also act as a source of nutrients within the water column. These impacts would generally be localized to areas where construction would occur and are anticipated to be temporary. The implementation of BMPs and SWPPPs would further mitigate cumulative impacts from construction.

Continued industrial activities, urban wastewater discharges, and construction activities would lead to a continued decline in water quality. However, state and Federal programs are in place to regulate and improve water quality, so the cumulative impact over time could be the improvement of water quality for the study area.

The no-action alternative would not enhance nor detract from the salinity reduction benefits created by other planned projects. In addition to the salinity reductions from the MRGO

deauthorization closure structure, localized areas of salinity reduction may occur where planned or unplanned freshwater diversions introduce less saline water into saline wetlands. The introduction of large volumes of freshwater from the Mississippi River due to the diversion at Violet could substantially lower salinity in the Central Wetlands. Some freshwater from the diversion could cross the more dense saline waters of the MRGO and reduce salinity in Lake Borgne and the Biloxi Marshes. Subsequent freshening of the study area could reduce the erosion of the "land bridge" between the MRGO and Lake Borgne.

Upon completion of construction, localized water quality enhancements would be expected within the wetlands created and enhanced by the projects planned and under investigation by CEMVN, LACPR, and CWPPRA due to pollutant trapping and processing. Due to the size of wetlands affected relative to the water quality issues, it is not expected that these benefits would result in observable large-scale cumulative improvements in water quality.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Water Quality. During gate construction, the potential increases of turbidity, decreases in dissolved oxygen, and influx of nutrients associated with sediment disturbance within the 100 acre construction footprint could occur within the GIWW, MRGO, and Bayou Bienvenue. An additional water quality impact could be potential degradation associated with sediment in runoff from the upland areas used for construction staging. However, BMPs and SWPPPs would be implemented to minimize these impacts. Turbidity, dissolved oxygen, and nutrient effects could also affect water quality from disturbance of as much as 542 acres of wetlands and mud bottom within the construction footprint of the easternmost alignment of the Borgne 1 barrier.

Any water quality and salinity effects from Borgne 1 are expected to be minimal. Salinity levels in the IHNC would be reduced only during the times in which the GIWW and Bayou Bienvenue gates are closed. This positive impact would be temporary.

Cumulative Impacts on Water Quality. There may be increased salinity in the wetlands west of the barrier and decreased salinity in Lake Borgne due to the deauthorization closure structure within the MRGO. Wetland changes associated with higher salinity levels and changed mixing patterns could affect the degree of water quality benefit provided in these areas. The potential water quality impacts during construction, including increases of turbidity, decreases in dissolved oxygen, and influx of nutrients could be greater due to the exposure of up to 642 acres of soil. Because these impacts are temporary and minimized they are not likely to detract benefits gained from the existing water quality regulatory programs.

Pontchartrain 2

Direct and Indirect Impacts on Water Quality. The magnitude of flow restriction associated with these structures while the gates are open is not expected to significantly affect the salinity dynamics between the IHNC and Lake Pontchartrain. The gates would be closed during extreme events, and only for a limited duration; therefore, the Pontchartrain 2 gates

could have only minor and temporary effects on the salinity influx in the study area. These impacts are temporary and minimized and not likely to detract benefits gained from existing water quality regulatory programs. During gate construction, potential increases of turbidity, decreases in dissolved oxygen, and influx of nutrients associated with sediment disturbance within the 5 acre construction footprint could occur within the IHNC.

Cumulative Impacts on Water Quality. In addition to the cumulative impacts described in the no-action alternative, the cumulative effects of this alternative could include greater increases of turbidity, decreases in dissolved oxygen, and influx of nutrients due to as much as 5 acres of channel bottom disturbance.

Alternatives to the Proposed Action

Raise Existing HPS to 100-Year Level of Protection

Direct and Indirect Impacts on Water Quality. The direct and indirect impacts of this alternative on water quality could be similar to those described in the no-action alternative, with the exception that the design elevations of the levees and floodwalls would be set to maintain a 100-year level of protection against overtopping for the 50-year project design life, and therefore would be greater because of the larger construction footprint.

Cumulative Impacts on Water Quality. The cumulative effects of this alternative to water quality could be similar to those described in the no-action alternative, with the exception that a greater area of disturbance would be necessary to construct the larger levees; therefore, there could be a potential for a greater degree of water quality impact from the greater amount of eroded sediment. However, these impacts would be minimized through the use of BMPs and SWPPPs. Therefore these temporary and minimized impacts are not likely to detract from any benefits gained from existing water quality regulatory programs.

Borgne 2

Direct and Indirect Impacts on Water Quality. The direct and indirect impacts of this alternative to water quality would be similar to those described in Borgne 1 and could include storm surge reduction, reduced interaction between Lake Borgne and areas to the east, and temporary impacts resulting from gate and barrier construction. Increased disturbance of sediment is anticipated to be a temporary direct impact during construction. The adverse impacts associated with this alternative are anticipated to be of greater magnitude than Borgne 1 due to the more eastward location and thus larger construction footprint.

Cumulative Impacts on Water Quality. The cumulative impacts of constructing Borgne 2 would be similar to those described for the proposed action. The larger barrier footprint of this alternative would increase the area potentially affected by erosion and lake bottom disturbance, which could temporarily reduce the water quality benefits provided by the shoreline stabilization and wetland creation projects within the Lake Borgne area. However, if construction of Borgne 2 preceded other planned projects, it would not be expected to detract from water quality benefits. The construction effects of Borgne 2 would likely extend

to the adjacent near shore areas of Lake Borgne because it would directly receive construction runoff.

Borgne 3

Direct and Indirect Impacts on Water Quality. The potential increases of turbidity, decreases in dissolved oxygen, and influx of nutrients associated with sediment disturbance within the 153 acres construction footprint of the Borgne 3 breakwaters within Lake Borgne. Another direct and indirect impact of constructing the Borgne 3 breakwaters could be the colonization of plankton species and invertebrates such as sponges, clams, and oysters on these breakwaters which could then develop into an artificial reef community. The presence of these filtering organisms could minimize to some extent turbidity and improve water quality in the area.

Cumulative Impacts on Water Quality. Borgne 3 is an alternative that would be considered in addition to one or more of the other alternatives. The primary cumulative impacts in addition to those described in the other alternatives would be the potential increases of turbidity, decreases in dissolved oxygen, and influx of nutrients associated with sediment disturbance in Lake Borgne.

Pontchartrain 1

Direct and Indirect Impacts on Water Quality. The Pontchartrain 1 alternative would have similar direct and indirect water quality impacts as Pontchartrain 2. However, these impacts could be greater due to the larger construction footprint (202 acres) and related sediment disturbance.

Cumulative Impacts on Water Quality. The Pontchartrain 1 alternative would have similar cumulative water quality impacts as Pontchartrain 2.

3.2.3 Wetlands

3.2.3.1 Existing Conditions

The coastal vegetation resources in the approximate 245,000-acre study area formerly consisted of bottomland forest and freshwater, brackish, and saline marshes. Historically, the influx of high volumes of freshwater from the Mississippi River system maintained marshes in the study area as predominantly freshwater or brackish. Changes in the extent of habitat types in the study area are a result of both biotic (living) and abiotic (non-living) forces. These forces, many related to the geophysical processes of deltas, are consistent across Louisiana's coastal marshes. Natural subsidence and the development of human infrastructure are the main causes of a general decline of marsh and other wetland habitats (USACE 2007f).

Specifically, there is a continuing progression toward open water that is overwhelmingly driven by continual subsidence of marsh. Sediments associated with normal freshwater flow are blocked from entering the coastal marshes due to human alteration of the landscape for flood protection and navigation. Consequently, wetlands are not being replenished through

the natural deltaic process (USACE 2004a). Over time, saltwater intrusion as a result of subsidence has raised salinity levels, causing a proliferation of saline marsh. Today, brackish and saline marshes predominate, with some fragmented areas of freshwater marsh and bottomland forest still intact.

Formerly diverse in freshwater wetland flora, intrusion of saltwater created a much less diverse system, dominated by a few plants tolerant of the increased salinity levels such as smooth cordgrass (*Spartina alterniflora*), glasswort (*Salicornia virginica*), and salt grass (*Distichlis spicata*) (USACE 2004a).

The storm surge associated with Hurricane Katrina may have contributed to increases in salinity within many previously freshwater and brackish marshes within the study area. The storm surge destroyed a portion of the levee structure located between the Central Wetlands Area (CWA) and the MRGO and led to the replacement of relatively freshwater with more saline water. The storm surge also overtopped levees between the Bayou Sauvage National Wildlife Refuge (NWR) and the GIWW (USACE 2007d), increasing the salinity of freshwater wetlands within the refuge. Much of the saltwater was pumped out of the levee system that protects the refuge within weeks of the storm, and the freshwater marsh of Bayou Sauvage continues to recover from this saltwater intrusion, as rains flush through the system (U.S. Fish and Wildlife Service [USFWS] 2007). Comparison of 2005 and 2006 aerial photography, along with site verification, showed tree loss within the study area, primarily in bottomland forest and cypress-tupelo swamps.

According to information provided in the IPET Report, there is no indication flooding and subsequent floodwater pumping from Greater New Orleans contributed to wildlife loss in the delta, wetland, and Gulf of Mexico areas outside the city (USACE 2007d). A much greater impact to regional habitat and biological resources is the physical damage or alteration of habitats (USACE 2007d). These impacts include the loss of bottomland hardwoods and cypress-tupelo swamps to wind and storm surge damage and the intrusion of saltwater into previously freshwater or brackish marshes initiated through breaches or overtopping of the levees (USACE 2007d).

Figure 16 illustrates the habitat types that currently exist within the study area. The wetland vegetative communities are divided into two categories: marsh and coastal forests. The study area consists primarily of three wetland marsh types: freshwater, brackish-intermediate marsh, and saline marsh. Together, these marshes comprise approximately 50,738 acres of the total study area (20.8 percent). Cypress-tupelo swamps were previously more common in the study area than they are today. Saltwater intrusion, as well as other factors such as subsidence, has largely eliminated cypress trees and greatly reduced the extent of cypress-tupelo swamp habitat. A few remnant stands can be found in the Bayou Sauvage NWR.

Marshland type and distribution was determined for this study using Louisiana Department of Wildlife and Fisheries (LDWF) data collected in 1997 (LDWF 1997) and U.S. Geological Survey National Wetlands Inventory data (USGS 2006). These data are the result of digitizing the extent of dominant vegetation communities across southern Louisiana. Because of significant overlap in salinity ranges to which certain vegetation communities are

adapted, we have combined the intermediate and brackish communities established by LDWF in the original dataset.

Freshwater marshes were once prevalent in the study area. Predominant vegetative species within these marshes include Jamaica sawgrass (*Cladium jamaicense*), bull tongue arrowhead (*Sagittaria lancifolia*), maiden cane (*Panicum hemitomon*), slough sedge (*Carex obnupta)*, cattails (*Typha latifolia*), and rushes (*Juncus phaeocephalus*). Aquatically adapted wildflowers such as yellow pond-lily (*Nuphar polysephalum)*, water buttercup (*Ranunculus orthorhynchus)*, and succulent water parsley (*Oenanthe sarmentosa)* are also typical freshwater marsh inhabitants. Freshwater marshes support the greatest array of wildlife species of the three marsh types found within the study area, especially wintering waterfowl. Table 1 in Appendix A presents the freshwater marsh species found within the study area. Saltwater intrusion is one of the contributing factors for the evolution of these wetlands to brackish or saline marsh; therefore, the number of acres of freshwater marsh that currently exists within the study area is limited to approximately 7,028 acres (2.9 percent of study area).

Brackish-intermediate marshes comprise approximately 39,663 acres (16.2 percent) of the study area. These marshes are found in areas where enough freshwater can enter the system to maintain low salinity levels. Brackish-intermediate marsh types are dominated by salt meadow cordgrass (*Spartina patens*), cowpea (*Vigna luteola*), and salt marsh bulrush (*Schoenoplectus maritimus*). Wiregrass gentian (*Gentiana pannelliana*), black needle rush (*Juncus roemerianus*), saltwort (*Batis maritima*), sturdy bulrush (*Schoenoplectus robustus*), coast cockspur grass (*Echinochloa walteri*), Jamaica sawgrass (*Cladium jamaicense*), arrowhead (*Sagittaria* sp.), and common reed (*Phragmites australis*) are also present (Visser et al. 1998). Brackish-intermediate marshes act as important nursery and feeding areas for many species of amphibians, reptiles, birds, and mammals. Table A-2 (appendix A) presents the intermediate-brackish marsh species found within the study area.

Saline marshes are a common wetland type within the study area and account for approximately 1.7 percent of all habitat types present (4,047 acres). These marshes support very little plant species diversity and are heavily dominated by rooted smooth cordgrass, glasswort, and salt grass (LDWF 1997). Other plants such as rushes (*Juncus* spp.), saltwort, and black mangrove (*Avicennia germinans*) inhabit the saline marshes in low densities (Visser et al. 1998). This habitat is located mainly in the vicinity of the confluence of the MRGO and GIWW and in the southeast part of the study area. Saline marshes provide valuable nursery and developmental habitats for aquatic organisms. Several species of reptiles inhabit the marsh. Numerous birds use the saline marshes as feeding habitat. Table A-3 (appendix A) presents the saline marsh species found within the study area.

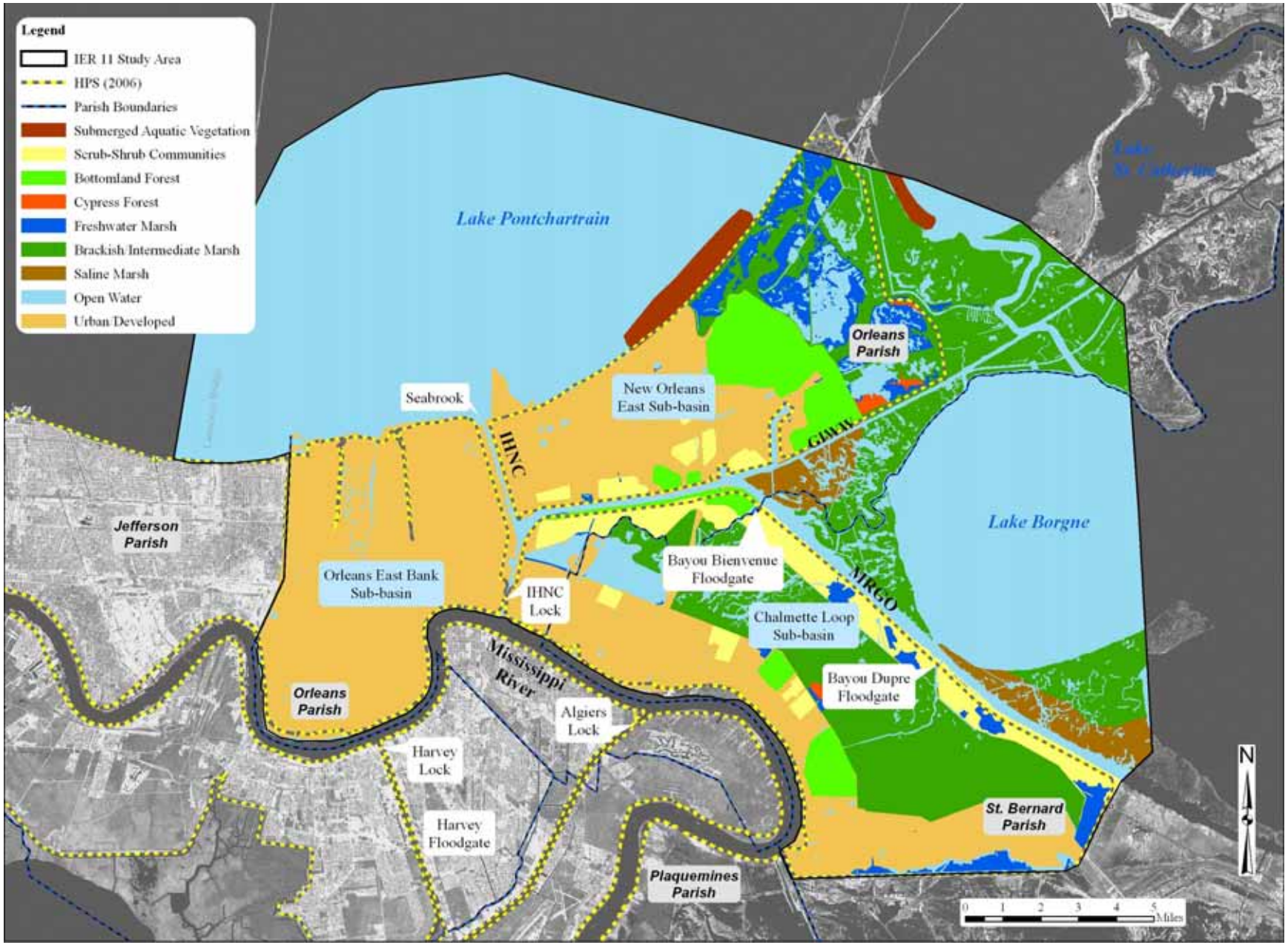


Figure 16 – Habitat Types Within the Study Area *Source: LDWF (1997) and USGS (2006)*

Bottomland forests are typically found within the study area in locales immediately adjacent to levees, especially in those locations where construction of the levee has raised surface elevations slightly above those of the surrounding marshes. This habitat is also common west of the Bayou Sauvage NWR. This habitat type covers approximately 7,815 acres of the study area, which contributes to approximately 3.2 percent of the total study area. Bottomland hardwood forests may contain American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), overcup oak (*Quercus lyrata*), water hickory (*Carya aquatica*), and red maple (*Acer rubrum*). Understory species may include swamp dogwood (*Cornus foemina*), hawthorn (*Crataegus* spp.), red mulberry (*Morus rubra*), giant cane (*Arundinaria* spp.), deciduous holly (*Ilex decidua*), wax myrtle (*Myrica cerifera*), pokeweed (*Phytolacca* spp.), and dwarf palmetto (*Sabal minor*). Spiderworts (*Tradescantia* spp.), seaside goldenrod (*Solidago sempervirens*), green dragon (*Arisaema dracontium*), smartweed (*Polygonum* spp.), and maiden fern (*Thelypteris* spp.) may also be present. Pepper-vine (*Ampelopsis arborea*), poison ivy (*Toxicodendron radicans*), trumpet-creeper (*Campsis radicans*), rattan vine (*Berchemia scandens*), and greenbrier (*Smilax* spp.) may also occur. Bottomland forests provide important ecosystem functions including productive habitat for a variety of wildlife species. However, unlike primary growth bottomland hardwood forests found in floodplain areas of large river systems, bottomland hardwood forests within the study area consist primarily of secondary growth forests occurring in narrow strips or small patches growing in previously disturbed areas scattered throughout the area. It is unlikely that these fragmented forests provide the same habitat value as more expansive primary growth forests, and as such, it is unlikely that many species known to utilize this habitat type (Louisiana Black Bear, for example) would be found within the study area. Table A-4 (appendix A) presents the bottomland forest species typically found in Louisiana (LDWF 2005).

Cypress-tupelo swamps were more common in the study area prior to the construction of the MRGO. Saltwater intrusion, as well as other factors such as subsidence, has to a large extent eliminated cypress trees and greatly reduced the extent of cypress-tupelo swamp habitat within the study area. A few remnant stands of cypress-tupelo swamp can be found in the Bayou Sauvage NWR. These forests are comprised principally of tupelo (*Nyssa aquatica*), cypress (*Taxodium distichum*), and sugarberry (*Celtis laevigata*) and have relatively low floristic diversity. Common associated species include swamp blackgum (*Nyssa sylvatica* var. *biflora*), swamp red maple (*Acer rubrum* var. *drummondii*), black willow (*Salix nigra*), pumpkin ash (*Fraxinus profunda*), green ash (*F. pennsylvanica*), water elm (*Planera aquatica*), water locust (*Gleditsia aquatica*), Virginia willow (*Itea virginica*), and buttonbush (*Cephalanthus occidentalis*).

3.2.3.2 Discussion of Impacts

No-action Alternative

Direct and Indirect Impacts on Wetlands. Under the no-action alternative, direct impacts to marsh resources would primarily result from construction activities related to placement of fill material to raise the existing hurricane protection system. A full levee section would likely require a wide stability berm that could fill approximately 10 acres of isolated fringe marsh adjacent to the existing GIWW levee toe.

Approximately 75 acres of bottomland forest (mainly along the GIWW and at the confluence of the GIWW and MRGO) could be impacted by the levee/floodwall footprint expansion.

No impacts to cypress-tupelo swamps would be anticipated under the no-action alternative because none fall within the proposed expanded footprint for this alternative.

No indirect impacts to wetlands would be anticipated under the no-action alternative.

Cumulative Impacts on Wetlands. Given that any wetland impacted by this project would be mitigated, the negligible amount of isolated fringe marsh impacted by this alternative would be a negligible impact when considered cumulatively with the various marsh creation and freshwater diversion projects planned in the study area.

Although it too would be mitigated for, the loss of bottomland forests would not be as insignificant as the loss of fringe marsh. Several other 100-year hurricane protection projects in the LPV system, including the acquisition of borrow, or clay, material for levee construction, could result in further bottomland forest loss in the area. Moreover, as compared to marsh creation projects, mitigation of bottomland forest is a more time and resource intensive process. Conversely, one beneficial impact would be the increased level of hurricane protection associated with reduced storm surge inundation provided to bottomland forests inside the hurricane protection system by this and other 100-year protection projects. However, because the no-action alternative would provide a lower level of protection than the rest of the 100-year system, this beneficial impact would be considered negligible.

Aside from the negligible cumulative impact of increased hurricane protection for remnant stands protected by the hurricane protection system, no significant cumulative impacts to cypress-tupelo swamps would be anticipated under the no-action alternative because none fall within the proposed expanded footprint for this alternative.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Wetlands. Figure 17 delineates the westernmost and easternmost possible alignments within Borgne 1 to show the minimum and maximum direct impacts to wetlands that could occur under the proposed action.

No direct or indirect impacts to marsh would be expected from the westernmost alignment of this alternative. Up to 39 acres of direct impacts to bottomland forest could occur from any necessary clearing for construction of the GIWW gate and levee tie-ins. No indirect impacts to bottomland forest would be expected from this alignment.

The maximum direct impacts to marsh, as shown as the easternmost possible alignment in figure 17, could be the loss of up to 346[3] acres of brackish-intermediate marsh from construction of the barrier between the GIWW and Bayou Bienvenue gates.

Any barrier constructed through the marsh could cause indirect impacts to marshes through alteration of water circulation and sediment processes as described in section 3.2.1.2. The magnitude of these impacts could vary and increase as the alignment of any barrier structure is moved toward the easternmost alignment. Therefore, the indirect impacts associated with the easternmost alignment, as shown in figure 17, represents the maximum acreage (2786 acres[4]) that could be indirectly impacted.

Conversely, the storm surge protection provided by Borgne 1 could reduce the likelihood of storm surges converting marsh into open water habitat during extreme storm events. However, marsh adjacent to the barrier could experience more erosive forces as a result of the wave break and storm surge reflecting off the barrier.

If a gate were constructed on the GIWW between the Michoud Canal and Maxent Canal, direct impacts to isolated pockets of bottomland forest could occur from any necessary clearing for construction of the gate and levee tie-ins. Likewise, if a closure is built on the MRGO between its intersection with the GIWW and the Bayou Bienvenue Floodgate, a minimal amount of bottomland forest could be directly impacted. Together, these closures could impact up to 39 acres of bottomland forest. No indirect impacts to bottomland forests are anticipated under the proposed action.

No direct or indirect impacts to cypress-tupelo swamps are anticipated under the Borgne 1 alternative because none fall within the location range for this alternative.

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[3] This acreage includes only that area which is occupied by marsh vegetation, not that portion (296 acres) that is open water.

[4] This acreage includes only that area which is occupied by marsh vegetation, not that portion (1471 acres) that is open water.

Figure 17 – Area of Impact for Borgne 1 Alternative. This figure delineates the westernmost and easternmost possible alignments within Borgne 1 to show the minimum and maximum direct impacts to wetlands that could occur under the proposed action.

Cumulative Impacts on Wetlands. Although this alternative could result in the direct loss of marsh through construction, this impact would be fully mitigated and, when considered cumulatively, could be further offset through future additional marsh creation and freshwater diversion projects. Likewise, any indirect impacts to marsh, when considered cumulatively with such marsh creation projects may have a minor incremental impact on marsh degradation in the project area. Furthermore, the cumulative impact of this alternative could be further enhancement of marsh creation projects that take place on the protected side of any barrier constructed through the marsh through storm surge protection. However, if the barrier is constructed east of the Michoud Canal, a portion of the marsh intended for enhancement under the MRGO and Lake Borgne Wetland Creation project could be precluded from use.

The cumulative impact of these proposed structures on bottomland forests when combined with other projects in the study area could result in minimal habitat loss. These additional impacts would be fully mitigated and therefore would represent no net loss of bottomland forests in the Pontchartrain Basin. Furthermore, when considered cumulatively with other proposed 100-year level of hurricane protection projects for the LPV system, this project would have a beneficial additive impact associated with reduced storm surge inundation through increased hurricane protection for bottomland forests enclosed by the hurricane protection system.

No cumulative impacts to cypress-tupelo swamps, other than additional hurricane protection benefits associated with reduced storm surge inundation when considered with other 100 year level of hurricane protection projects in the study area, would be anticipated.

Pontchartrain 2

Direct and Indirect Impacts on Wetlands. No direct or indirect impacts to wetlands, bottomland hardwoods, or cypress-tupelo swamps would be expected from Pontchartrain 2 because none of the aforementioned habitats exist within the proposed footprint of this structure.

Cumulative Impacts on Wetlands. There would be no cumulative adverse impacts anticipated from this alternative when considered with other projects in the study area because there are no wetlands, bottomland hardwoods, or cypress-tupelo swamps in the general vicinity of this alternative. When considered in conjunction with the other 100-year level of hurricane protection projects in the area, the cumulative benefit afforded by this alternative could be the incremental additional storm surge protection provided to wetlands protected by the HPS.

Alternatives to the Proposed Action

Raise Existing HPS to 100-Year Level of Protection

Direct and Indirect Impacts on Wetlands. Direct impacts to marsh for this alternative would primarily result from construction activities related to placement of fill material to raise the existing hurricane protection system. The expanded levee footprint could require filling of approximately 10 acres of isolated fringe marsh adjacent to the existing GIWW levee toe.

As compared to the no-action alternative, the expanded levee and floodwall footprints that would be constructed for this alternative could have greater impacts to bottomland forests that exist on the south side of the GIWW. Taking into consideration the total toe-to-toe footprint, the enlargement of the structures could result in direct impact to approximately 200 acres of the bottomland forest habitat.

No impacts to cypress-tupelo swamps would be anticipated under this alternative because none fall within the proposed expanded footprint for this alternative.

No indirect impacts to wetlands would be anticipated under this alternative.

Cumulative Impacts on Wetlands. Given that any wetland impacted would be mitigated, the negligible amount of isolated fringe marsh impacted by this alternative would be considered a negligible impact when considered cumulatively with the various marsh creation and freshwater diversion projects planned in the study area.

The incremental adverse impact to bottomland forests, when considered cumulatively, would be greater than the no-action alternative due to its larger footprint. This impact, however, could be offset primarily by mitigation, as well as the increased level of hurricane protection associated with reduced storm surge inundation provided to bottomland forests inside the hurricane protection system above what would be provided under the no-action alternative.

Aside from the cumulative impact of increased hurricane protection for remnant stands protected by the hurricane protection system, no significant cumulative impacts to cypress-tupelo swamps would be anticipated under this alternative because none fall within the proposed expanded footprint for this alternative.

Borgne 2

Direct and Indirect Impacts on Wetlands. Because Borgne 2 is a variation of the same features of Borgne 1, but with a more eastward alignment, the direct and indirect impacts of this alternative could be greater than Borgne 1. The maximum direct impacts to marsh, as shown as the easternmost possible alignment in figure 18, could be the loss of up to 844[5] acres of brackish-intermediate marsh from construction of the barrier between the GIWW, Bayou Bienvenue, and MRGO structures.

Indirect impacts from changes in the hydrology and sediment transport processes would be similar to those that could occur from the easternmost alignment of Borgne 1 except that, as shown on figure 18, the areal extent of marsh west of the structure (up to 4655 acres[6]) is greater than that enclosed by Borgne 1. Conversely, the storm surge protection provided by

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[5] This acreage includes only that area which is occupied by marsh vegetation, not that portion (320 acres) that is open water.

[6] This acreage includes only that area which is occupied by marsh vegetation, not that portion (2394 acres) that is open water.

Borgne 2 could reduce the likelihood of storm surges converting marsh into open water habitat. However, marsh adjacent to the barrier could experience more erosive forces as a result of the wave break and storm surge reflecting off the barrier.

Direct impacts to bottomland forests would be expected to be similar to the proposed action. No indirect impacts to bottomland forests would be anticipated.

No direct or indirect impacts to cypress-tupelo swamps would be anticipated under the Borgne 2 alternative because none fall within the location range for this alternative.

Cumulative Impacts on Wetlands. It is expected that the cumulative impact of this alternative on marsh would be similar to the proposed action, although the incremental benefits and adverse impacts could be slightly greater under this alternative given the larger marsh area both impacted and protected by Borgne 2. The cumulative impact of this alternative on bottomland hardwood and cypress-tupelo swamp would be expected to be the same as with under the proposed action.

Borgne 3

Direct and Indirect Impacts on Wetlands. As shown on figure 19, no direct loss of marsh would be anticipated as a result of constructing breakwaters within the Borgne 3 location range. The proposed breakwaters could help reduce the impact of surges on marshes to the west. However, the effects on hydrology, flows, and water levels described in section 3.2.1.2 could indirectly impact the marsh, by changing the rates of flow across the marsh due to the water going around the breakwaters under normal conditions. If the rate at which water leaves the marsh after high tide is decreased as a result of the proposed breakwaters in Borgne 3, the duration of inundation could increase for the lower elevations within the marsh. Thus, the plants living in these areas now could be stressed by the increased period of inundation.

No direct or indirect impacts to bottomland forest or cypress-tupelo swamp would be expected from the Borgne 3 because none exist within the location range for this alternative.

Cumulative Impacts on Wetlands. Borgne 3 would likely not directly impact any wetland habitat; thus, the cumulative effect of this alternative when considered with other projects in the study area would be limited to its incremental additional storm surge protection benefit when considered cumulatively with either Borgne 1 or Borgne 2, and the other 100-year level of hurricane protection projects. The incremental benefit of this alternative would be less than that of Borgne 1 or Borgne 2 because it could not, as a stand alone feature, provide 100-year level of hurricane protection.

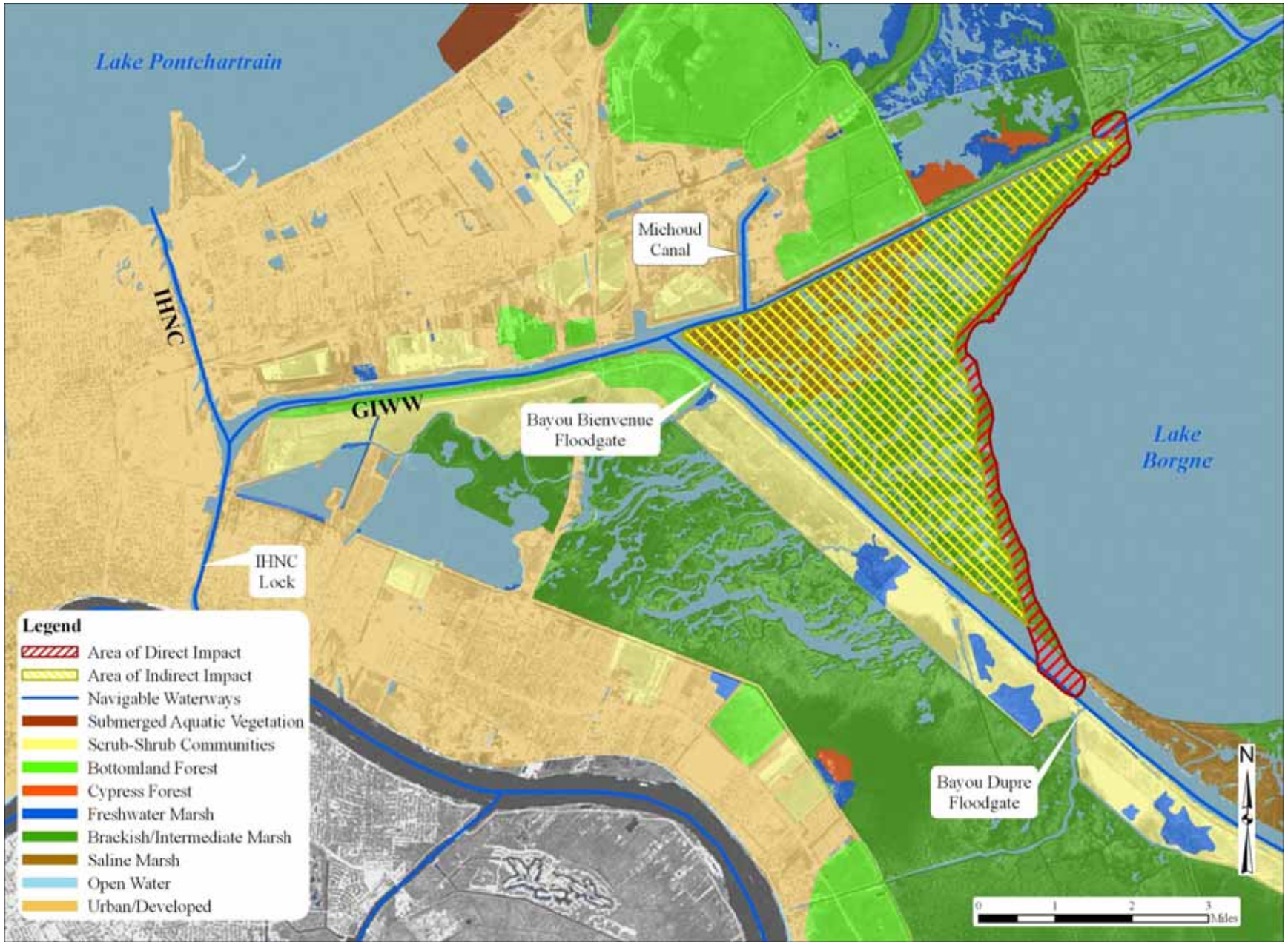

Figure 18 – Area of Impact for Borgne 2 Alternative. The figure delineates the easternmost alignment to show the maximum possible impacts.

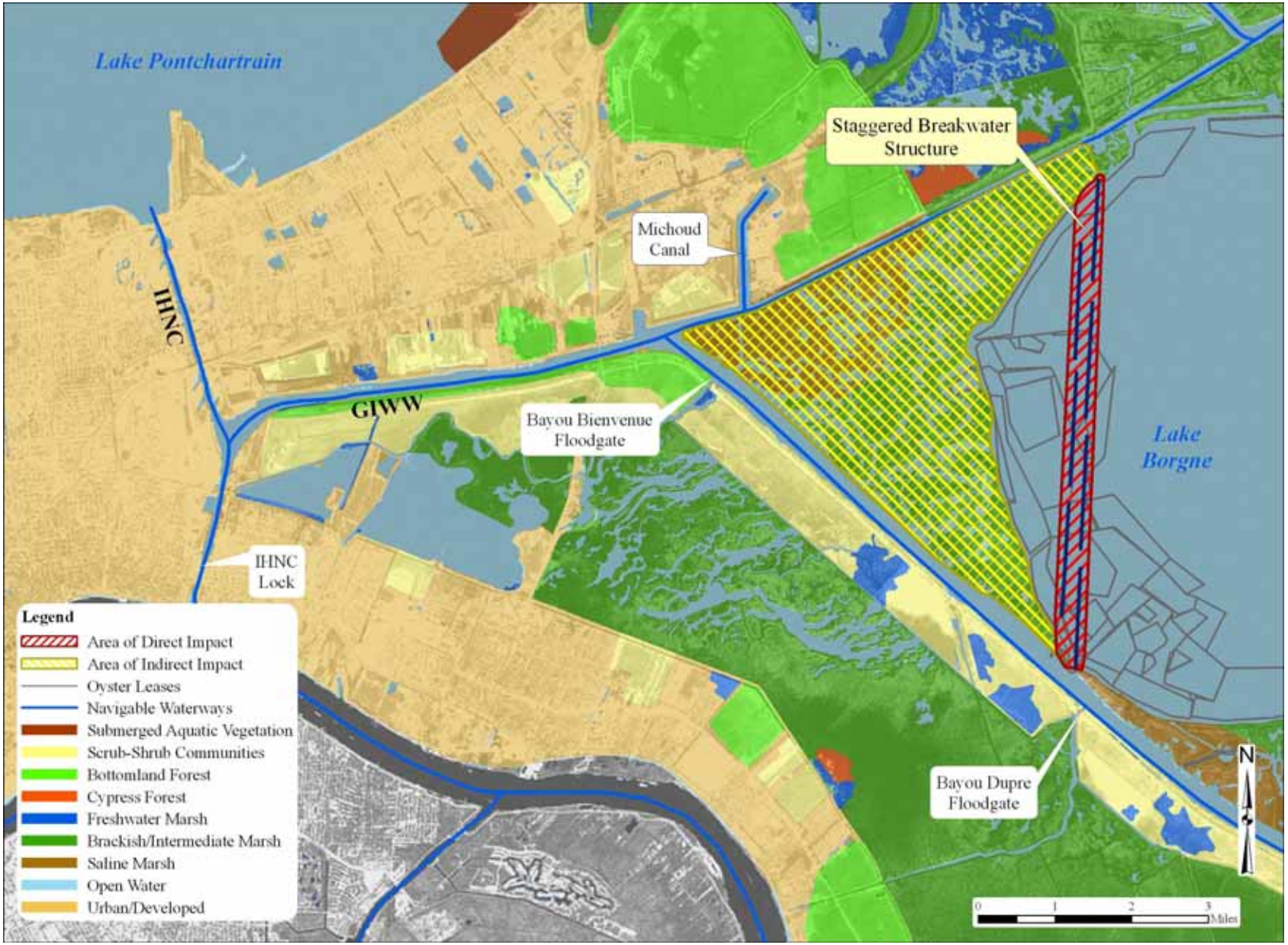

Figure 19– Area of Impact for Borgne 2 Alternative.

Pontchartrain 1

Direct and Indirect Impacts on Wetlands. There would be no direct or indirect impacts to wetlands, bottomland hardwoods, or cypress-tupelo swamps expected from Pontchartrain 1 because none of the aforementioned habitats exist within the proposed footprint of this structure.

Cumulative Impacts on Wetlands. There would be no cumulative adverse impacts from this alternative when considered with other projects in the study area because there are no wetlands, bottomland hardwoods, or cypress-tupelo swamps in the general vicinity of this alternative.

3.2.4 Aquatic Resources

3.2.4.1 Existing Conditions

The extent of the aquatic resources within the study area is dependent on seasonal and daily variations in the water level. Tidal ranges are minimal (approximately 2 feet within the study area). Water quality of the open water resources has been discussed in detail in section 3.2.2 (Water Quality) of this report.

Plankton are important because they are an integral part of the aquatic food chain in the study area. There are two broad types of plankton (microscopic aquatic plant and animal organisms) in the study area: phytoplankton (single-cell algae) and zooplankton (animal species). Balance of the populations of zoo- and phytoplankton is key for a healthy ecosystem or estuary. The dominant groups of phytoplankton are diatoms and dinoflagellates. These species along with green and blue-green algae species are responsible for large blooms in the study area waters, particularly in the summer when high temperatures and low turbidity stimulate their proliferation. Large phytoplankton blooms are also linked to nutrient-rich runoff from the developed and agricultural portions of the contributing watershed.

Zooplankton includes a variety of forms. Certain species resemble plankton in the adult stage of their life cycle (e.g., jellyfish); others only resemble plankton in earlier life stages and become benthic or free-swimming as adults (e.g., oysters). Zooplankton abundance varies with salinity, and seasonal patterns of abundance have been observed.

Historically, submerged aquatic vegetation (SAV) was a significant component of aquatic habitat located within the study area. Two substantial SAV beds had been identified within the study area (USACE 1984) along the northern shore or flood side of the New Orleans East Area HPS in Lake Pontchartrain and on the eastern side of South Point heading toward Lake St. Catherine. These SAV communities have declined as salinity conditions increased. Much of the remaining SAV may have been impacted as a result of Hurricane Katrina. However, observations indicate that SAV populations may be returning to pre-storm levels (McInnis and Rogers 2006).

SAV communities are comprised primarily of widgeon grass (*Ruppia maritima*), hydrilla (*Hydrilla verticillata*), grassleaf mudplantain (*Heteranthera dubia*), Eurasian watermilfoil (*Myriophyllum spicatum*), wild celery (*Vallisneria americana*), and sago pondweed (*Potamogeton pectinatus*).

SAV provides food and shelter for diverse communities of waterfowl, fish, shellfish, and invertebrates. SAV provides habitat for numerous vertebrate and invertebrate species while contributing to water quality by reducing turbidity (the amount of sediment suspended in the water). Microscopic zooplankton feed on the decaying SAV and, in turn, are food for larger organisms such as fish and clams. SAV is also a very valuable source of food for waterfowl. In the fall and winter, migrating waterfowl search the sediment for nutritious seeds, roots, and tubers. Resident waterfowl may feed on different species of SAV year-round.

3.2.4.2 Discussion of Impacts

No-action Alternative

Direct and Indirect Impacts on Aquatic Resources. No permanent direct or indirect impacts to aquatic resources would be expected to be caused by this alternative. Placement of fill material related to levee and floodwall construction to the authorized grade along the canals may lead to temporary, localized reductions in water quality associated with increased turbidity, increased temperatures, nutrient availability, and low dissolved oxygen and therefore have a temporary adverse impact to plankton populations. There are no SAV populations that would be directly impacted by this alternative and SAV populations may continue to recover in the near future if water quality in Lake Pontchartrain remains stable or improves. Temporary construction impacts would be minimized by implementation of BMPs and SWPPPs and, therefore, this alternative would not be expected to impact aquatic resources significantly.

Cumulative Impacts on Aquatic Resources. The cumulative impacts of the no-action alternative, when considered with other HPS projects within the study area could add minor and temporary localized water quality impacts from turbidity. When considered with the shoreline protection and marsh nourishment or creation projects in the study area there would be an overall benefit of potentially creating conditions suitable for SAV reestablishment primarily due to freshwater and sediments supplied to the study area via the Violet Diversion and salinity reductions attributed to the MRGO deauthorization closure structure.

Diversion projects could contribute to the possible displacement of plankton resources via increased flows, but the displaced species should return once the flows stabilize and construction activities cease.

Projects stabilizing erosion, building wetlands to counter subsidence, and improving water quality by the diversion of freshwater could alter the conditions in surrounding areas such that they become sufficient for SAV establishment. The no-action alternative would not impede these benefits because aquatic resource impacts would be minor and temporary.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Aquatic Resources. The proposed construction activities for Borgne 1 could have temporary water quality impacts to open water resources and these are described in section 3.2.2.2 and can be reduced by following BMPs and SWPPPs. Conditions should return to normal after a moderate recovery period post-construction. Permanent direct impacts include up to 100 acres of open water habitat lost in the areas of the proposed GIWW gate and MRGO closure. A maximum of 196 additional acres of open water in the various small channels through the marsh could also be lost if the proposed barrier is constructed in the easternmost alignment (figure 17). Furthermore, Borgne 1 could limit the conversion of the protected side wetland and shoreline areas to open water by reducing the risk of storm surge impacting these resources. According to existing information and data collected in field surveys, no known SAV would be impacted by the Borgne 1 alternative.

Plankton resources may experience increased mortality from temporary, localized declines in water quality resulting from the construction of Borgne 1. Also, in the long term, the velocities created as a result of flow constriction through the proposed gates on the GIWW and Bayou Bienvenue could redistribute plankton. The barrier in the MRGO could shift plankton distributions in relation to the new flushing patterns through that area. Any barrier, plug, or accumulated material in the MRGO would be a barrier to plankton movement.

Cumulative Impacts on Aquatic Resources. Historically aquatic resources in the project area have expanded at the expense of wetland and shoreline habitat. The project area no longer supports productive SAV, and there are many projects proposed to enhance wetlands and restore or protect the remaining shoreline of Lake Borgne. The cumulative effect of Borgne 1 when considered with other HPS and wetland creation or shoreline stabilization projects within the study area could replace up to 296 acres of open water habitat with a barrier and gates, and this figure could increase as a result of the MRGO deauthorization closure structure. However, when compared to historic conditions in which the study area was a thriving productive marsh with abundant SAV beds interspersed, and that Lake Pontchartrain and Lake Borgne provide a profuse supply of open water estuary habitat, this impact is considered minor. Plankton resources temporarily impacted by increased turbidity by construction projects or possible displacement of plankton resources via increased flows related to the proposed Violet Diversion should return once the flows stabilize and construction activities cease.

By further reducing the conveyance of saline water eastward, the cumulative impact of this alternative when considered with other projects within the study area could aid in the potential re-establishment of SAV habitat associated with the reintroduction of freshwater, nutrients, and sediments to the area and salinity reductions attributed to the MRGO deauthorization closure structure

Pontchartrain 2

Direct and Indirect Impacts on Aquatic Resources. There could be a temporary adverse impact to plankton populations during construction activities. A localized and short-term

decrease in available and dissolved oxygen, an increase in turbidity, and localized mortality due to dredged and fill material placement into shallow and open water habitats could be expected. These impacts would be temporary and localized and are not expected to impact plankton resources on any larger geographic scale and could be minimized by following BMPs and SWPPPs. In the long-term, the velocities created as a result of flow constriction through the proposed gate at Pontchartrain 2 could redistribute plankton resources.

Up to 5 acres of open water could be directly impacted by construction activities under this alternative. Placement of material related to construction may lead to temporary, localized reductions in water quality associated with increased turbidity, increased temperatures, nutrient availability, and low dissolved oxygen. Even though the proposed floodgate could reduce the flow area by reducing channel width, it is likely that no significant impact on salinity resulting from closing the floodgate would occur. Gate construction could temporarily mobilize bank sediments and disturb bottom sediments, potentially altering conditions to levels that would not support SAV growth or establishment. Because there is no documented SAV in the Pontchartrain 2 area, no impact resulting from construction of the floodgate would be anticipated.

Cumulative Impacts on Aquatic Resources. The cumulative effect of the alternative when considered with other HPS projects within the study area could be slight temporary impacts to plankton resources caused by increased turbidity and/ or possible displacement of plankton resources. However, the displaced species should return once the flows stabilize and construction activities cease. The proposed gate structure at Pontchartrain 2 would be designed not to increase the velocity of water or tidal flow in the IHNC greater than the existing conditions and would tie into and fortify the HPS. Therefore, the incremental impact of Pontchartrain 2 would be minor.

Alternatives to the Proposed Action

Raise Existing HPS to 100-Year Level of Protection

Direct and Indirect Impacts on Aquatic Resources. As in the no-action alternative, no permanent direct or indirect impacts to aquatic resources would be expected to be caused by this alternative.

Cumulative Impacts on Aquatic Resources. The cumulative impacts of this alternative would be the same as those under the no-action alternative.

The cumulative impacts of this alternative, when considered with the other projects within the study area, would be a potential creation of conditions suitable for SAV establishment related to the freshwater and nutrients supplied by the proposed Violet Freshwater Diversion and salinity reductions attributed to the MRGO deauthorization closure structure. This alternative would not impede these benefits because aquatic resource impacts would be minor and temporary.

Borgne 2

Direct and Indirect Impacts on Aquatic Resources. Borgne 2 is a variation of the same features of Borgne 1 but with a more eastward alignment and incrementally larger aquatic resource impacts due to higher habitat loss associated with a larger project footprint.

This alternative would not impact SAV aside from temporarily mobilizing bank sediments and disturbing bottom sediments which would alter conditions to levels that would not support SAV growth or establishment. Therefore, the impact associated with this alternative would be similar to or some degree more intrusive than the proposed action due to the larger footprint of constructing Borgne 2.

Temporary impacts to open water resources as a result of Borgne 2 would be expected to be identical to those anticipated for Borgne 1. Once constructed, the proposed barrier could occupy approximately 220 acres of open water and marsh edge if constructed in the easternmost portion of this location range. In addition, up to 100 acres of open water could be affected by the construction of the gate on the GIWW and a barrier on the MRGO (figure 18). According to existing information and data collected in field surveys, no known SAV would be impacted by Borgne 2.

There could be a temporary adverse impact of declining plankton populations from construction activities related to gate construction, shoreline protection installation, or barrier construction that could cause temporary minor impacts to water quality from the disturbance of soil material during installation, but could be mitigated for by following BMPs and SWPPPs by utilizing silt screens.

Cumulative Impacts on Aquatic Resources. Aside from SAV, there is abundant aquatic and open water habitat where plankton and oyster populations continue to thrive within the project area. Cumulatively other projects that propose to enhance wetlands and protect the remaining shoreline of Lake Borgne would also decrease available open water habitat to restore the habitat to historic conditions. Borgne 2 could replace up to 320 acres of open water and marsh edge habitat with a barrier and gate within the study area. However, when compared to historic conditions and current conditions of a retreated shoreline and eroding marsh, and given that the Lake Borgne estuary along with its connecting water bodies provide additional aquatic and open water habitat, this impact would be considered minor. Plankton resources temporarily impacted by increased turbidity by construction projects or possible displacement of plankton resources via increased flows related to the proposed Violet Diversion should return once the flows stabilize and construction activities cease.

By further reducing the conveyance of saline water eastward, the cumulative impact of this alternative when considered with other projects within the study area could aid in the potential re-establishment of SAV habitat associated with the reintroduction of freshwater, nutrients, and sediments to the area and salinity reductions attributed to the MRGO deauthorization closure structure.

Borgne 3

Direct and Indirect Impacts on Aquatic Resources. Borgne 3 consists of submerged breakwater structures in Lake Borgne that would reduce the amount of open water in Lake Borgne by up to 153 acres but would reduce surge potential. Borgne 3 could also cause temporary impacts to water clarity, dissolved oxygen, biological oxygen demand, salinity, and temperature from constructing the breakwaters. These impacts may be minimized through BMPs and SWPPPs using the placement of silt curtains or similar aquatic barriers. Temporary impacts of this type would be expected to be minor and dissipate quickly. These impacts could lead to plankton resources experiencing increased mortality from temporary, localized declines in water quality resulting from construction. Also, in the long term, the velocities created as a result of water movement between the breakwaters could redistribute plankton.

According to existing information and data collected in field surveys, no known SAV would be impacted by Borgne 3. Another direct and indirect impact of constructing the Borgne 3 breakwaters could be the colonization of plankton species and invertebrates on these breakwaters and developing into an artificial reef environment. This would have a direct impact for existing oyster reefs, but recolonization could occur in the future.

Cumulative Impacts on Aquatic Resources. The Borgne 3 breakwaters may increase mortality in plankton resources from temporary, localized declines in water quality resulting from construction; however BMPs and SWPPPs would be applied to minimize impacts. Therefore, this impact would be minor when compared to other HPS, wetland creation, and shoreline creation projects. Cumulatively Borgne 3 could remove up to 153 acres of open water and existing oyster reef habitat. However, breakwaters constructed as part of Borgne 3 could reduce wave action on existing shoreline restoration and marsh creation projects proposed in the study area. Brackish and marine invertebrate species colonizing the breakwaters and developing into a reef community may change as result of the freshwater influence of Violet Diversion and the MRGO deauthorization closure structure.

The cumulative impact to SAV associated with this alternative would be negligible because none exist currently in Lake Borgne, but conditions could improve to support establishment as a result of the introduction of freshwater and nutrients via the Violet Diversion and salinity reductions attributed to placing the MRGO deauthorization closure structure.

Pontchartrain 1

Direct and Indirect Impacts on Aquatic Resources. Pontchartrain 1 consists of essentially the same gate as Pontchartrain 2, but with a more lakeward location and minimal impacts to aquatic resources. Pontchartrain 1 would impact open water habitat because the gate structure would be constructed out into the lake, but those impacts would be localized and temporary water quality reductions. Up to 202 acres of open water would be directly impacted by the construction activities of Pontchartrain 1. Placement of material related to construction may lead to temporary, localized reductions in water quality associated with increased turbidity, increased temperatures, nutrient availability, and low dissolved oxygen. Even though the proposed floodgate would reduce the flow area by reducing channel width it is likely that no significant impact on salinity resulting from closing the floodgate would

occur. Because there is no documented SAV in the area of Pontchartrain 1, no impact resulting from construction of the floodgate would be anticipated.

There could be a temporary adverse impact to plankton populations during construction activities. A localized and short-term decrease in available and dissolved oxygen, an increase in turbidity, and localized mortality due to fill material placement into shallow and open water habitats would be expected. These impacts would be temporary and localized and are not expected to impact plankton resources on any larger geographic scale. In the long term, the velocities created as a result of flow constriction through the proposed gate at Pontchartrain 1 could redistribute plankton resources.

Cumulative Impacts on Aquatic Resources. The cumulative effect of the Pontchartrain 1 alternative, when considered with other HPS projects within the study area could be slight temporary impacts to plankton resources caused by increased turbidity and or possible displacement of plankton resources but the displaced species should return once the flows stabilize and construction activities cease. The proposed gate structure at Pontchartrain 1 would be designed not to increase the velocity of water or tidal flow in the IHNC greater than the existing conditions and would tie into and fortify the HPS. Therefore, the incremental impact of Pontchartrain 1 would be minor.

3.2.5 Fishery Resources

3.2.5.1 Existing Conditions

The landings of all the fisheries species combined in the State of Louisiana in 2005 and 2006 are shown in table 4. These include finfish, shrimp, crabs, and benthic fauna.

Table 4
Annual Landing Statistics for all Fisheries Species Combined for the State of Louisiana in 2005 and 2006.

Year	Metric Tons	Pounds	Value ($)
2005	385,231.0	849,280,372	251,677,999
2006	414,710.6	914,270,916	270,727,835
Grand Totals	799,941.6	1,763,551,288	522,405,834

Source: NOAA Fisheries 2007.

Waters of the study area provide habitat for a number of finfish species. These species fill a variety of ecological niches and support commercial and recreational harvests either directly (in the form of takes) or by providing prey for harvested species. Movement between fresher and more saline waters is essential to the life history of many of these species. Impacts to fisheries of the study area from Hurricanes Katrina and Rita are estimated to be temporary, except as related to wetland loss, which affects the early life stages of many species (USACE, 2006). Some marine species have increased in abundance following the hurricanes, perhaps due to a decrease in fishing effort. For example, the fall 2005 trawl surveys found no indication of reductions in offshore fish or shrimp populations or saltwater fish kills. In fact, trawl catches of certain species averaged 30 percent greater than average

pre-Katrina catches (USACE 2004a). Major sport fish species of fresh to slightly brackish waters include black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), largemouth bass (*Micropterus salmoides*), spotted sunfish (*Lepomis punctatus*), yellow bass (*Morone mississippiensis*), catfish (*Ictalurus punctatus*), red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), speckled trout (*Cynoscion nebulosus*), and menhaden (*Brevoortia tyrannus*) (USACE 1984).

The waters of Lake Borgne and other brackish portions of the study area support commercial and recreational fisheries of southern flounder (*Paralichthys lethostigma*), sheepshead (*Archosargus probatocephalus*), sea catfish (*Arius felis*), sand seatrout (*Cynoscion arenarius*), spotted seatrout (*Cynoscion nebulosus*), Atlantic croaker (*Micropogonias undulatus*), red drum (*Scianops ocellatus*), and black drum. Commercial catches of catfish, drum, buffalo (*Ictiobus* spp.), and alligator gar (*Atractosteus spatula*) are confined to fresher waters (USACE 1984).

Statewide, a total of 39.1 million pounds of brown and 62.1 million pounds of white shrimp were landed in 2005, with a value of $41.3 million and $91.9 million, respectively (USACE 2004a). National Marine Fisheries Service (NMFS) annual shrimp landing data from 1988-2000 show a continuing trend of brown shrimp landings exceeding those of white shrimp in the combined areas of Lake Pontchartrain and Lake Borgne. With the exception of 1985, which showed exceptionally high landings of brown shrimp, peak landings of brown shrimp and white shrimp were similar to those observed in the 1970s.

Blue crab (*Callinectes sapidus*) is an important commercial species and is fished in Lake Pontchartrain and Lake Borgne. Blue crabs migrate considerably during their life cycle occupying waters with a range of salinity (3-15 ppt) and depth. When air temperatures drop below 50°F, adult crabs leave shallow, inshore waters and seek deeper areas where they bury themselves and remain in a state of torpor throughout the winter. Blue crab growth is regulated by water temperature. Growth occurs when water temperatures are above 59°F (15 degrees Celsius [°C]). Water temperature above 91°F (33°C) is lethal (USACE 2004a).

Statewide, a total of 38.1 million pounds of blue crab were landed in 2005, with a value of $27.4 million (USACE 2004a). The blue crab is an important commercial species in the Lake Pontchartrain Basin. A decline in blue crab landings in Lake Pontchartrain in the 1970s resulted in a mean annual catch of 1.4 million pounds, or only about 9 percent of the total state landings, compared to 2.6 million pounds (27 percent) in 1959-64 (Thompson and Stone 1980). By 1978-81, the mean annual catch had increased to 2.1 million pounds or about 12 percent of the total state catch, which represented a break in the steady decline noted in the preceding years (Thompson and Stone 1980).

In other trawl surveys in the study area (Rounsefell 1964), blue crab abundance declined as salinity increased. Rounsefell (1964) observed that small blue crabs (less than 50 millimeters [mm]) were most abundant in the open, low-salinity waters of Lake Borgne. The slightly larger crabs (50-99 mm) were more abundant in the Bayou Dupre area, indicating that smaller crabs migrate toward shallow and low-salinity areas as they grow (Rounsefell 1964).

Mature female crabs eventually migrate considerable distances over just a few days to reach the higher salinity waters for spawning and hatching.

Benthic species are organisms that live at the bottom of the body of water in which they are found, often in an attached or semi-attached manner. As many as 24 benthic species exist in Lake Pontchartrain (USACE 1984). The Rangia clam (*Rangia cuneata*) and the American oyster (*Crassostrea virginica*) are the most economically important benthic species in the study area. Rangia clams inhabit much of the estuarine waters of Lakes Pontchartrain and Borgne, but are more abundant in Lake Pontchartrain in all life stages (USGS 2002b). Shells of these clams were the target of commercial dredging until the practice was prohibited in 1990 (USACE 2007d). Similarly, American oyster adults are common in Lake Borgne throughout the year, but the abundance of other life stages varies temporally (USGS 2002b). The eastern limit of the study area is comprised of well-marked oyster leases lining the western and southwestern portions of Lake Borgne (figure 19).

Statewide, a total of 12.1 million pounds of oyster were harvested in 2005, with a value of $33.3 million (USACE 2004a). Production of oysters in Louisiana has been relatively stable for the last 50 years, with harvest from public beds replacing the decreasing harvest from private leases. However, the Louisiana oyster industry has been experiencing many stressors over the past several decades that threaten the long-term sustainability of both the industry and the resource. Increasing coastal land loss is reducing the amount of marsh that provides shelter to reefs, and saltwater intrusion is exacerbating disease and predation. In addition, the industry is faced with changing environmental conditions, fluctuating market demands, public perception issues, and increased competition.

3.2.5.2 Discussion of Impacts

No-action Alternative

Direct and Indirect Impacts on Fishery Resources. Direct impacts to fisheries under this alternative would be associated with short-term impacts to water turbidity, dissolved oxygen, and biological oxygen demand caused by construction activities. Because adult fish are relatively mobile, direct impacts would be expected to be negligible. Dissolved oxygen levels in the IHNC generally remain above the minimum state standard and USEPA criteria (4 mg/L), but can fall below the minimum criteria during hot summer months. Therefore, if the construction activities take place during summer months and further contribute to the lowering of dissolved oxygen levels, they could result in some fish kill events. Construction of the proposed levee and floodwall structures could potentially result in temporary adverse impacts to benthic habitat due to suspension and redistribution of sediment associated with construction. The increase in suspended sediment associated with construction activities would be expected to be temporary and localized, and design and implementation of SWPPPs and BMPs would significantly reduce the above impacts. No permanent or indirect impacts would be anticipated for this alternative.

Cumulative Impacts on Fishery Resources. The cumulative impact of the no-action alternative when considered with other projects within the study area would be expected to be minor and temporary localized water quality impacts from turbidity. The majority of the HPS projects including this alternative propose construction work on land to raise existing

levees and floodwalls which could have minor impacts to fishery resources. Projects stabilizing erosion, building wetlands to counter subsidence, and improving water quality by the diversion of freshwater could improve fishery habitat in the project area. The no-action alternative would not impede these benefits because fishery resource impacts would be minor and temporary and cease after construction completion. In addition, there would be no gates constructed as part of this alternative so the connection of the IHNC to Lake Pontchartrain would be maintained and storm surge from Lake Pontchartrain into this canal would occur for every storm event.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Fishery Resources. Direct impacts to fisheries would generally be associated with construction activities and would be temporary. The implementation of BMPs and SWPPPs would minimize these effects. Fish mortality may occur due to burial, injury or increased turbidity, decreased dissolved oxygen, and increased biological oxygen demand. The increased turbidity caused by construction activities would temporarily displace fishery organisms, but they would be expected to return after activities cease. Sessile and slow-moving organisms, however, are more likely to be covered by dredged and fill material. Regardless, these species would likely return to the study area after construction activities cease.

Cumulative Impacts on Fishery Resources. The cumulative impacts of this alternative when considered with other projects within the study area could be moderate. The gate structures would limit access only during imminent storms and the barrier would impede some access but the design could incorporate alternative measures to reduce that impact. Given that any marsh acreage lost for all HPS projects would be mitigated in addition to other wetland creation projects in the Lake Borgne area, there would be no net loss of wetlands.

Pontchartrain 2

Direct and Indirect Impacts on Fishery Resources. Direct impacts to fisheries would generally be associated with construction activities and would be temporary. Fish mortality may occur due to burial, sudden salinity changes, injury, increased turbidity, decreased dissolved oxygen, and increased biological oxygen demand. The increased turbidity caused by construction activities would temporarily displace fishery organisms, but they would be expected to return after activities cease. Sessile and slow-moving organisms, however, would be more likely to be covered by dredged and fill material. Regardless, these species would be likely to return to the study area after construction activities cease.

Cumulative Impacts on Fishery Resources. The IHNC was not connected to Lake Pontchartrain until 1914 when an opening was made to allow for navigation. There could be temporary impacts to plankton and other food sources for fish species caused by increased turbidity and or possible displacement of fishery resources, but displaced species should return once the flows stabilize and construction activities cease. These temporary impacts would be minimized by BMPs and SWPPPs. Because velocities flowing through the Pontchartrain 2 gate structure would be designed not to exceed existing conditions,

cumulative impacts on fishery migration should be negligible. The gate structures would limit access only during imminent storms when the gates are closed. If the operation of the Pontchartrain 2 gates were changed to control salinity entering Lake Pontchartrain, there would be impacts on fishery migration through the structure. However, with the deauthorization of the MRGO by the construction of a plug, the tidal influx of high salinity water would already be impacted. Therefore, the incremental impact of Pontchartrain 2 would be minor.

Alternatives to the Proposed Action

Raise Existing HPS to 100-Year Level of Protection

Direct and Indirect Impact to Fishery Resources. Impacts to fishery resources under this alternative would be the same as under the no-action alternative.

Cumulative Impacts on Fishery Resources. The cumulative impact of this alternative should be similar to the no-action alternative.

Borgne 2

Direct and Indirect Impacts on Fishery Resources. Construction of Borgne 2 direct impacts to fisheries would be expected to be similar to those described for the eastern alignments of Borgne 1. Although access would still be available through the GIWW and Bayou Bienvenue, the barrier across the marsh could limit access to as much as 7,049 acres of nursery habitat (which includes both marsh and open water habitat) for fish species that use the marshes and sheltered waterways in early life stages. Because this location range ends at the edge of Lake Borgne, the Borgne 2 alternative does not include impacts to Lake Borgne; therefore, no impacts to benthic resources such as oyster or Rangia clams would be expected.

Cumulative Impacts on Fishery Resources. The gate structures would limit access only during imminent storms, shoreline protection features would protect existing habitat, and the barrier would impede some access but the design could incorporate alternative measures to reduce that impact. Assuming newly created marsh is significant enough to mitigate anticipated habitat loss, the cumulative impacts associated with this alternative could be lessened.

Borgne 3

Direct and Indirect Impacts on Fishery Resources. Borgne 3 direct impacts to fisheries would generally be associated with construction activities and would be temporary. These effects would be minimized through the use of BMPs and SWPPPs. Because of the staggered alignment of the breakwater sections, no physical barrier to the movement of fishery species is expected. Also, standards have been set to control the velocities established between the breakwater sections. For this reason, no velocity barriers to fish passage are expected. Approximately 100 acres of oyster bed could be impacted by this option (figure 19). Because it involves placing material along the floor of Lake Borgne, Borgne 3 could result in the loss of a portion of the oyster leases and oyster seed areas.

Cumulative Impacts on Fishery Resources. The cumulative impacts of this alternative when considered with others proposed for the study area would be a temporary reduction in water quality which should not persist much after construction ceases. Because of the staggered alignment of the breakwater sections, no physical or velocity barrier to the movement of fisheries species is expected. In conjunction with other projects in the area these breakwaters may develop into artificial reefs and have a positive impact on fishery resources. Because of the habitat shift it may have a minor effect by shifting oyster reefs in the area. However, considering that freshwater diversion projects are proposed for the area, the oyster habitat will already be impacted.

Pontchartrain 1

Direct and Indirect Impacts of Fishery Resources. Direct impacts to fisheries would be similar to Pontchartrain 2, only greater due to a larger construction footprint.

Cumulative Impacts on Fishery Resources. The cumulative impacts of this alternative when considered with other HPS projects within the study area would be similar to those discussed for Pontchartrain 2. Even though the amount of area impacted with Pontchartrain 1 (202 acres) is larger than Pontchartrain 2 (5 acres), because they are temporary and the operation of the gate structure at Pontchartrain 1 would only close the structure for imminent storm events instead of controlling for salinity, the incremental impact of Pontchartrain 1 is rather minimal when considering fishery resources.

3.2.6 Essential Fish Habitat

3.2.6.1 Existing Conditions

Specific categories of EFH include all estuarine waters and substrates (mud, sand, shell, rock, and associated biological communities), including the sub-tidal vegetation (seagrasses and algae) and adjacent inter-tidal vegetation (marshes and mangroves). The Gulf of Mexico Fishery Management Council, through the generic amendment of the Fishery Management Plans for the Gulf of Mexico, lists the following Federally managed species or species groups as being potentially found in coastal Louisiana: brown shrimp, white shrimp, red drum, gray snapper, and Spanish mackerel.

The open waters, water bottom substrates, and inter-tidal marshes of Lake Pontchartrain and Lake Borgne are considered EFH under the estuarine component. The primary categories of EFH occurring in the project vicinity include mud bottoms, marsh edge, inner marsh, and oyster reef (in Lake Borgne). The following Federally managed species could potentially occur in the project area: brown shrimp, white shrimp, gulf stone crab, and red drum. Coastal wetlands within the study area provide nursery and foraging habitat that supports other economically important marine fishery species such as spotted sea trout, southern flounder, Atlantic croaker, gulf menhaden, striped mullet, and blue crab. These species serve as prey for other Federally managed fish species such as mackerels, snappers, groupers, billfishes, and sharks.

White shrimp (*Litopenaeus setiferus*) and brown shrimp (*Farfantepenaeus aztecus*) fill an important niche as prey species for other animals and are both commercially fished.

Estuarine habitats within the study area are important to juvenile brown shrimp, which move into more saline waters as adults. White shrimp continue to inhabit brackish waters throughout their life cycle (USACE 2004a).

Gulf stone crab (*Menippe mercenaria*) is an important commercial species and is fished in Lake Pontchartrain and Lake Borgne. Gulf stone crab adults inhabit Lake Borgne year-round and move into Lake Pontchartrain during the summer season when salinity there increases (USGS 2002b).

3.2.6.2 Discussion of Impacts

Impacts to EFH and managed fish species from each alternative are similar to those for fisheries for those same alternatives, which were described in section 3.2.5. The consultation requirements in the Magnuson-Stevenson Act (16 U.S.C. 1801-1882) direct Federal agencies to consult with the NMFS when any of their activities may have an *adverse affect* on EFH and defines *adverse affec*t as "any impact that reduces quality and/or quantity of EFH... [and] may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions." Categories of EFH that could potentially be affected by any of the alternatives include water column, estuarine substrates (such as mud, sand, shell, rock, and associated biological communities), and some fringe marsh.

No-action Alternative

Direct, Indirect, and Cumulative Impacts on Essential Fish Habitat. The direct, indirect and cumulative impacts on EFH from the no-action alternative would be essentially the same as those described in fishery resources for this same alternative; that is, this alternative could have minimal and temporary adverse impacts to EFH during and shortly after construction.

Proposed Action

Borgne 1

Direct, Indirect, and Cumulative Impacts on Essential Fish Habitat. The direct, indirect and cumulative effects on EFH from this alternative could be similar to those described for Borgne 1 fishery resources. On the western limits of Borgne 1 up to 129 acres of mud bottom EFH, supporting benthic resources, could be lost due to gate construction, mainly from dredging and filling activities. Construction of the proposed structure could also result in temporary adverse impacts to adjacent benthic habitats due to suspension and redistribution of sediment.

If the easternmost alignment of Borgne 1 is constructed, a maximum of 346 acres of brackish-intermediate marsh EFH could be lost from the placement of material to form the barrier across the marsh. Potentially, another 246 acres of mud bottom/open water EFH could be lost from construction of the barrier across existing water channels including the MRGO and through the marsh. Construction of a gate on the GIWW would impact a net of

50 acres of mud bottom/open water EFH. Marsh EFH impacts could decrease if the project were constructed towards the western limit of this alternative.

Although access would still be available through the GIWW and Bayou Bienvenue, the barrier across the marsh could limit access to as much as 4,257 acres of nursery habitat (which includes both marsh and open water habitat) for fish species that use the marshes and sheltered waterways in early life stages. This limit of access to nursery habitat could indirectly reduce the availability of larvae and eggs for carnivorous species that rely on these for prey. Also, the redistribution of plankton as a result of altered flows through the proposed gates might result in the redistribution of preying fish species.

Assuming the newly created mitigation marsh provides suitable nursery and essential fish habitat, in addition to other proposed projects to create wetlands, enhance wetlands by freshwater diversion, and restore or protect eroding shoreline, the incremental effect of the anticipated habitat losses from the Borgne 1 alternative could be minimized.

Pontchartrain 2

Direct, Indirect, and Cumulative Impacts on Essential Fish Habitat. The direct, indirect and cumulative effects on EFH from this alternative could be similar to those described for Pontchartrain 2 fishery resources. Up to 5 acres of mud bottom EFH at Pontchartrain 2 could be disturbed as a result of construction. The cumulative impacts of Pontchartrain 2 when considered with other HPS projects within the study area would be rather minimal.

Alternatives to the Proposed Action

Raise Existing HPS to 100-Year Level of Protection

Direct, Indirect, and Cumulative Impacts on Essential Fish Habitat. The direct, indirect and cumulative impacts on EFH from this alternative would be essentially the same as those described in fishery resources for this same alternative; that is, this alternative could have minimal and temporary adverse impacts to EFH during and shortly after construction.

Borgne 2

Direct, Indirect, and Cumulative Impacts on Essential Fish Habitat. The direct, indirect and cumulative effects on EFH from this alternative could be similar to those described for Borgne 2 fishery resources. The temporary and long-term impacts of Borgne 2 to EFH would be expected to be greater than those associated with Borgne 1 due to a larger footprint. A maximum of 844 acres of brackish-intermediate marsh EFH could be lost as a result of the placement of material to form the barrier across the marsh. In addition, depending on the final alignment constructed, approximately 270 acres of mud bottom/ open water EFH could be lost as a result of the barrier where existing channels cut through the marsh and the MRGO. Up to 50 acres of mud bottom/ open water EFH in the GIWW would be disturbed as a result of constructing the gate. Other impacts to benthic resources as a result of construction would be expected to be similar to those associated with the easternmost alignment of Borgne 1. The cumulative impacts of this alternative when considered with other projects within the study area could be moderate.

Borgne 3

Direct, Indirect, and Cumulative Impacts on Essential Fish Habitat. The direct, indirect and cumulative effects on EFH from this alternative could be similar to those described for Borgne 3 fishery resources. Borgne 3 would result in temporary, localized impacts to the quality of estuarine water column EFH related to construction activities. With Borgne 3, a maximum of 153 acres of soft bottom and estuarine water column EFH would be occupied by the breakwaters, eliminating it from use, however, given possible brackish and marine invertebrate colonization, as well as the tidal influx of plankton and prey species it is likely that these breakwaters could develop into an artificial reef community providing additional food sources and have a positive benefit to fishery resources.

Pontchartrain 1

Direct, Indirect, and Cumulative Impacts on Essential Fish Habitat. The direct, indirect and cumulative effects on EFH from this alternative could be similar to those described for Pontchartrain 1 fishery resources. The Pontchartrain 1 gate could result in a temporary decrease in the quality of EFH in the study area, including mud bottom and open water, and reduce the area's ability to support several aquatic species. Up to 202 acres of mud bottom, supporting benthic resources could be lost due to gate construction, mainly from dredging activities. Also, construction of the proposed structure could result in temporary adverse impacts to adjacent benthic habitats due to suspension and redistribution of sediment associated with construction. The increase in suspended sediment associated with construction activities is expected to be temporary.

3.2.7 Terrestrial and Upland Resources

3.2.7.1 Existing Conditions

Terrestrial and upland resources are those portions of the study area that are not wetland or open water aquatic. These include the non-wetland portions of Orleans and St. Bernard Parishes. Much of the upland in the study area is urban in character; however, there are isolated parcels that support vegetation and wildlife. All upland areas cover approximately 58,044 acres, which accounts for approximately 23.7 percent of the total study area (LSU 2007).

Since colonial times, upland habitat in the study area has increased as settlers drained and filled wetlands to accommodate the need for land to support agricultural and urban land uses (LCWCRTF and Wetlands Conservation and Restoration Authority [WCRA] 1998). Today, much of the upland within the study area is associated with New Orleans, other communities, and their supporting infrastructure such as roads and hurricane protection structures such as grassed levees. Some of this upland habitat, where vegetation is established, provides limited but important wildlife habitat. Within the urban portions of the study area, Audubon Park, City Park in New Orleans, and other tracts of manicured, vegetated and grassed land can provide wildlife habitat.

However, the primary terrestrial and upland resource that provides important wildlife habitat is scrub-shrub communities that cover approximately 9,800 acres of the total study area

(approximately 4 percent). Scrub-shrub habitats are characterized by low, multi-stemmed woody vegetation in young or stunted stages of growth. Such habitats commonly result when mature woodlands or other habitats are disturbed by wind, fire, flooding, or commercial activities such as timber harvesting, farming, or clearing and grubbing. The species composition is variable, depending on the location and length of time since disturbance, abandonment, or management. Scrub-shrub communities can be dense and impenetrable or can consist of a mosaic of low woody cover interspersed in herbaceous cover. Trees may be present but are widely spaced. Scrub-shrub habitats within the study area are typically found in various disturbed sites and locales immediately adjacent to levees, especially in those locations where construction of the levee or resultant spoil piles has raised surface elevations slightly above those of the surrounding marshes.

Scrub-shrub is an important habitat for a number of breeding and wintering bird species. Individual bird species have unique habitat requirements for nesting and feeding. Bird species richness is likely to be greatest in stands of mixed scrub-shrub of varying age groups. Typically, these stands are found in un-maintained areas because frequent mowing results in even-age re-growth. Mixed stands support a wider range of invertebrates such as grasshoppers (e.g., Eastern Lubber Grasshopper *Romalea guttata*), crickets (e.g., Southern ground cricket *Allonemobius socius*; striped ground cricket *A. fasciatus*), beetles, dragonflies (e.g., great blue skimmer *Libellula vibrans;* blue dasher *Pachydiplax longipennis*; roseate skimmer *Orthemis ferruginea*), ants (e.g., *Labidus coecus*; *Formica omnivora; Formica coeca*), katydids, wasps, spiders, earthworms, and sow bugs and produce a greater variety of fruits thereby providing enhanced foraging opportunities for birds.

Upland scrub-shrub habitat covers approximately 2,200 acres of the study area (0.9 percent). Characteristic tree species include elm (*Ulmus* spp.), ash (*Fraxinus* spp.), oak (*Quercus* spp.), hickory (*Carya* spp.), and red maple (*Acer rubrum*). Understory species may include hawthorn (*Crataegus* spp.), red mulberry (*Morus rubra*), giant cane (*Arundinaria* spp.), deciduous holly (*Ilex deciduas*), wax myrtle (*Myrica cerifera*), and dwarf palmetto (*Sabal minor*). Goldenrod (*Solidago* sp.), smartweed (*Polygonum* spp.), pokeweed (*Phytolacca* spp.), invasive Chinese tallow (*Sapium sebiferum*) and fern species may also be present. Common vines in the uplands include pepper-vine (*Ampelopsis arborea*), poison ivy (*Toxicodendron radicans*), trumpet-creeper (*Campsis radicans*), rattan vine (*Berchemia scandens*), and green briar (*Smilax* spp.). Portions of the levees within the study area have also been colonized by clover (*Trifolium* spp.).

3.2.7.2 Discussion of Impacts

No-action Alternative

Direct and Indirect Impacts on Terrestrial and Upland Resources. Terrestrial and upland habitats are currently widely scattered and segmented within the study area, primarily due to the commercial, industrial, and residential development of land on the interior of the levees. Furthermore, these levees comprise a large portion of the upland habitat available within the study area. They are primarily maintained grass and would continue to be in the future. Raising all the levee and floodwall structures to the originally authorized level of hurricane protection could impact approximately 100 acres of upland resources, including scrub-shrub

communities, by conversion of scrub-shrub habitat to maintained grass, through expansion of the project footprint. Additionally, the scrub-shrub habitat impacted could see an increase in invasive Chinese tallow because this species can out-compete native species after a disturbance.

Cumulative Impacts on Terrestrial and Upland Resources. Construction of 100-year level of hurricane protection projects throughout the project area could impact significant amounts of terrestrial and upland resources through borrow acquisition and expansion of HPS footprints; however, because the footprint of this alternative would likely be smaller than those required for these 100-year projects, the incremental additional impact for this alternative would be minor when considered cumulatively. The increased level of protection from storm surge inundation afforded by this alternative could actually detract from those benefits provided by the 100-year level of protection projects in the project area; the HPS as a whole cannot provide the 100-year level of hurricane protection to terrestrial and upland resources unless the entire system is raised to that level of protection.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Terrestrial and Upland Resources. The Borgne 1 impact to terrestrial and upland resources would be related to the construction of any gate, closure, or levee tie-in. Up to 56 acres of upland habitat on the banks of the MRGO and GIWW could be lost to the construction of any of these project components. The type of upland habitat (maintained grass, scrub-shrub, or urban) impacted will depend on the exact alignment constructed.

Cumulative Impacts on Terrestrial and Upland Resources. Like the no-action alternative, the cumulative impacts of this alternative when considered with other projects within the study area would be further decline in habitat area; however, the incremental impact of the proposed action would be much less than the no-action because it would occupy significantly less upland habitat than enlarged levee sections. Additionally, unlike the no-action alternative, the cumulative impact of the proposed action would be a significant contribution to the 100-year level of hurricane protection afforded to terrestrial resources enclosed by the HPS.

Pontchartrain 2

Direct and Indirect Impacts on Terrestrial and Upland Resources. The proposed floodgate for Pontchartrain 2 would be tied into the bank of the canal, which could directly impact upland habitat. However, because the area is primarily non-vegetated, urban upland, only fragmented patches of scrub-shrub would be impacted, and the associated effect upon terrestrial or upland resources would be minimal.

Cumulative Impacts on Terrestrial and Upland Resources. Considering the limited additional amount and low quality of habitat that would be impacted, the cumulative impact of this alternative, when considered with other projects that could impact terrestrial and upland resources, would be a negligible incremental impact. The greater cumulative impact

associated with this alternative would be its contribution to the 100-year level of hurricane protection afforded to terrestrial resources enclosed by the HPS

Alternatives to the Proposed Action

Raise Existing HPS to 100-Year Level of Protection

Direct and Indirect Impacts on Terrestrial and Upland Resources. Upland and terrestrial resources potentially impacted by this alternative can be found on both sides of the IHNC (urban areas) and along the GIWW (upland scrub-shrub). Approximately 300 acres of upland scrub-shrub habitat and 250 acres of urban areas could be directly impacted by the expanded footprint of this alternative. All or a portion of the 300 acres of upland scrub-shrub impacted could be converted to maintained grass. Additionally, the scrub-shrub habitat impacted could see an increase in invasive Chinese tallow.

Cumulative Impacts on Terrestrial and Upland Resources. The cumulative impact associated to terrestrial and upland resource loss would be similar to that of the no-action alternative but with greater incremental impact because the project footprints are much larger with this alternative. However, unlike the no-action alternative, this alternative would provide the cumulative benefit of contribution to the 100-year level of hurricane protection afforded to terrestrial resources enclosed by the HPS.

Borgne 2

Direct and Indirect Impacts on Terrestrial and Upland Resources. Impacts to upland and terrestrial resources from Borgne 2 would be the same as those for the easternmost alignment of Borgne 1.

Cumulative Impacts on Terrestrial and Upland Resources. The cumulative impacts of this alternative when considered with other projects within the study area would be the same as Borgne 1.

Borgne 3

Direct and Indirect Impacts on Terrestrial and Upland Resources. No terrestrial or upland habitat would be impacted as a result of construction of Borgne 3.

Cumulative Impacts on Terrestrial and Upland Resources. The cumulative adverse impacts of this alternative when considered with other projects proposed for the study area would be considered negligible because no terrestrial or upland habitat would be impacted as a result of construction of Borgne 3. The cumulative benefit of a contribution to the 100-year level of hurricane protection afforded to terrestrial resources enclosed by the HPS would be incrementally less than Borgne 1 and Borgne 2 because it could not, as a stand alone feature, provide that level of protection.

Pontchartrain 1

Direct and Indirect Impacts on Terrestrial and Upland Resources. Impacts to terrestrial and upland resources from Pontchartrain 1 would be related to habitat conversion for gate construction. The gated structure for this alternative would be tied in to the IHNC bank in urban areas and, therefore, minimal maintained grass would be impacted.

Cumulative Impacts on Terrestrial and Upland Resources. There would be negligible cumulative impacts associated with habitat loss from this alternative, when considered with other projects in the study area, because limited upland areas would be impacted by this alternative. This alternative would, however, provide a significant incremental benefit when considered cumulatively with the other projects that contribute to the 100-year level of hurricane protection afforded to terrestrial resources enclosed by the HPS.

3.2.8 Wildlife Resources

3.2.8.1 Existing Conditions

The study area is comprised of wetland, open water, and upland habitats, all within close proximity to each other. These spaces have become home to certain animals including amphibians, reptiles, birds, and mammals. In general, many populations of wildlife species have exhibited a decline in recent decades due mainly to habitat fragmentation (USACE 2004a). A notable exception to this trend is the invasive nutria (*Myocaster coypus*).

Within the study area, few species of amphibians and reptiles are highly tolerant of increasing salinity within the marshes. As a result, their numbers have declined as salinity within Lakes Pontchartrain and Borgne and adjacent marshlands have increased, reducing the amount of preferable freshwater marsh habitat available to such species. Snapping turtle (*Chelydra serpentina*), alligator snapping turtle (*Macrochelys temminckii*), spiny softshell turtle (*Apalone spinifera aspera*), and diamondback terrapin (*Malaclemys terrapin*) are found in the freshwater and brackish-intermediate marshes. Historically, both the pig frog (*Rana grylio*) and bullfrog (*Rana catesbeiana*) were pursued commercially, although occurrence of these species in the study area is limited to low-salinity marshlands. The American alligator (*Alligator mississippiensis*) can be found in nearly every habitat in the study area, but is most common in intermediate marshes.

All of the habitats within the study area are used by both resident and migratory bird species. Bird species are found to be more diverse in habitats within the study area that exhibit more vegetative diversity. Given the typical dominance of just a few plant species in the more saline regions of the marsh, the quantity and quality of bird habitats within the study area are diminishing. Nonetheless, many species of songbirds either reside in the marsh habitats year-round, settle through the marshes to winter over, or pass through on their annual migration routes. Within the study area, portions of Bayou Sauvage NWR, Chalmette Loop, and some areas adjacent to levees have sustained significant tree loss, primarily in bottomland forest and cypress-tupelo swamps.

The marshes and open water habitats of the study area support a great number of waterfowl of the Central Flyway. Although some species such as mottled duck (*Anas fulvigula*) are year-round residents, most use the study area as wintering grounds. Dabbling ducks such as mallard (*Anas platyrhynchos*), green-winged teal (*Anas crecca*), blue-winged teal (*Anas discors*), northern pintail (*Anas acuta*), gadwall (*Anas strepera*), widgeon (*Anas americana*), and northern shoveler (*Anas clypeata)* use freshwater and intermediate marshes in fall and early winter, later moving on to saline marshes as food supplies dwindle. Mottled duck, wood duck (*Aix sponsa*), and hooded merganser (*Lophodytes cucullatus*) utilize the marshes, swamps, and bottomland forests of the study area as nesting habitat.

Diving ducks use the open-water areas of the study area primarily as wintering grounds. More than 90 percent of the lesser scaup (*Aythya affinis*) that inhabit the Mississippi Flyway during the winter in Louisiana concentrate in the open waters of Lake Pontchartrain and Lake Borgne. Other common species include greater scaup (*Aythya marila*), canvasback (*Aythya valisineria*), and redhead (*Aythya americana*). Game birds such as king rail (*Rallus elegans*), clapper rail (*Rallus longirostris*), common snipe (*Gallinago gallinago*), coot (*Fulica americana*), purple gallinule (*Porphyrula martinica*), and common moorhen (*Gallinula chloropus*) all reside in the study area and nest in the marshes. Other species present in the study area include Louisiana heron (*Egretta tricolor*), great egret (*Casmerodius albus*), roseate spoonbill (*Ajaia ajaja*), and killdeer plover (*Charadrius vociferous*).

The study area is also a potential habitat for the bald eagle (*Haliaeetus leucocephalus*). This species has been documented to exist within the study area, particularly within St. Bernard Parish. Bald eagles frequently nest in cypress snags in swamps, in close proximity to open water. Loss of these trees related to Hurricanes Katrina and Rita could reduce the nesting habitat for eagles (USACE 2007d). Open water and estuarine water areas are utilized as feeding habitat. Listed Federally as a threatened species since 1995, the bald eagle was removed from Federal listing in June 2007. However, the bald eagle is still federally protected under such statutes as the Migratory Bird Treaty Act and Bald Eagle Protection Act.

Nutria and feral hogs (*Sus scrofa*) are invasive mammalian species inhabiting portions of the study area. Nutria are large, rodent-like, herbivorous aquatic mammals with large orange incisor teeth. They were introduced to Louisiana from Argentina between 1900 and 1940 for fur farming. However, when some fur farms failed, the nutria were released into the wild, and it was thought they would act as a biological control for invasive water hyacinth. They are prolific breeders and exacerbate coastal wetland loss by digging into soft wetland soils and eating the roots of emergent wetland vegetation. As the vegetation dies, the soft soils become open water; these holes in the marsh are called “eat-outs”. Historically, high demand for nutria pelts lead to population control through trapping and hunting. After the price of nutria pelts plummeted in 1989, however, nutria populations began to increase (USACE 2004a).

Feral hogs are purebred wild boars or purebred domestic livestock, or a hybrid of the two. As omnivores, feral hogs compete with native wildlife for food resources; prey on young domestic animals and wildlife; and carry diseases that can affect pets, livestock, wildlife, and

humans. In their quest for food, feral hogs damage hurricane protection levees with their snouts and hooves (USACE 2004a).

Bottlenose dolphins (*Tuersios sp*.) are occasional visitors to the open water portions of the study area.

3.2.8.2 Discussion of Impacts

No-action Alternative

Direct and Indirect Impacts on Wildlife Resources. The direct impact on amphibians and reptiles, resulting from raising levees and floodwalls to the authorized grade, would be mainly associated with construction activities. Less mobile life forms (i.e., eggs and larvae) of amphibians and reptiles may experience increased mortality as a result of construction of this alternative. Adults of these species would be expected to disperse from localized construction disturbances, but should re-populate the suitable areas soon after construction is complete. Furthermore, structures like floodwalls could prevent amphibians and reptiles from easily moving to and from the open water resources. However, taking into consideration that the majority of the structures would be replaced in kind and floodwalls could be constructed mainly in the highly developed areas where amphibians and reptiles are not common, this impact would be considered negligible.

Approximately 175 acres of habitat, such as bottomland forest and scrub-shrub communities, could be directly impacted as a result of this alternative; therefore it is highly possible that some avian and terrestrial species could be displaced by this alternative, both during construction and permanently. Because of the high mobility of these species and their adaptability to encroachments on their habitat, mortality due to construction activities would not be anticipated and no significant adverse impact is expected.

Cumulative Impacts on Wildlife Resources. Construction of 100-year level of hurricane protection projects throughout the project area could impact significant amounts of upland resources and bottomland forests through borrow acquisition and expansion of HPS footprints, resulting in the temporary (via construction impacts) and permanent displacement (via habitat loss) of wildlife species; however, because the footprint of this alternative would likely be smaller than those required for these 100-year projects, the incremental additional impact associated with direct habitat loss for this alternative would be minor when considered cumulatively. Nonetheless, borrow excavations and multiple other construction projects in the vicinity could confound the temporary displacement of wildlife. As with the no-action alternative, the limited increase storm surge inundation risk reduction afforded by this alternative could actually detract from those benefits provided by the 100-year level of protection projects in the project area; the HPS as a whole cannot provide the 100-year level of hurricane protection to the wildlife habitat it protects unless the entire system is raised to that level of protection.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Wildlife Resources. Similar to the no-action alternative, one direct impact to wildlife as a result of Borgne 1 could be temporary, localized dispersal during construction. Less mobile life forms (i.e., eggs and larvae) of amphibians and reptiles may experience increased mortality as a result of the construction of Borgne 1. Adults of these species would be expected to disperse from localized construction disturbances, but should re-populate the suitable areas soon after construction is complete.

Avian species and dolphins could be temporarily dispersed from localized areas during construction of Borgne 1, but would be expected to return soon after completion. Because of the high mobility of these animals, mortality due to construction activities would not be anticipated. However, any barrier built across the marsh could eliminate up to 641 acres of marsh and open water habitat used for forage by a number of avian species. Additionally, loss of trees associated with gate construction could also constitute an impact in the form of lost nesting habitat.

Construction of Borgne 1 could temporarily displace terrestrial mammals such as deer (*Odocoileus virginianus*), coyote (*Canis latrans*), and feral hogs using the bottomland forest or upland terrestrial habitat in the vicinity. Because of the high mobility of these species and their adaptability to encroachments on their habitat, no significant impact is expected.

Cumulative Impacts on Wildlife Resources. The cumulative adverse impacts of this alternative when considered with other projects within the study area are not expected to significantly increase with the addition of the proposed project features. Although some foraging habitat could be lost in the vicinity of the proposed action, marsh creation and shoreline protection features as proposed by CWPPRA projects should enhance the habitat areas for amphibians, reptiles, and birds through newly created marsh, nourishing existing marsh, and protection of shorelines. The proposed Violet Diversion structure could cause direct habitat loss from construction but should offset those impacts with the increased productivity the newly conveyed sediment-rich and nutrient-laden water from the Mississippi River could provide. Construction of the MRGO deauthorization closure structure and the Florida Avenue Bridge could have direct but limited negative impacts, but only associated with construction-related noise disturbances because neither project is anticipated to disturb much habitat. The stabilization of existing habitat areas as a result of the protection structures of Borgne 1, along with increased nutrients and sediment potentially increasing heterogeneity and interspersion, along with reduced salinity from the MRGO deauthorization closure structure, could benefit avian resources in the long term. Furthermore, the cumulative impact would be a significant contribution to the 100-year level of hurricane protection afforded to wildlife habitat enclosed by the HPS.

Pontchartrain 2

Direct and Indirect Impacts on Wildlife Resources. The Pontchartrain 2 area is largely developed. Therefore, it is unlikely that it is a valuable habitat for wildlife. However, temporary impacts in the form of injury or mortality to less mobile life forms (i.e., eggs and

larvae) of amphibians and reptiles could result from the construction of the proposed floodgate. Avian resources and occasional dolphins could be displaced during construction of this alternative. With the exception of trees removed (and thus avian habitat), any displacement would be expected to be temporary. Because of the high mobility of these animals, mortality due to construction activities is not anticipated. The area impacted by construction of this action would not be considered quality habitat for terrestrial wildlife, and so impacts to this resource should be negligible.

Cumulative Impacts on Wildlife Resources. Because of the limited quality habitat for wildlife in this location, any cumulative impacts to wildlife due to habitat loss could be considered negligible. Furthermore, the cumulative impact would be a significant contribution to the 100-year level of hurricane protection afforded to wildlife habitat enclosed by the HPS.

Alternatives to the Proposed Action

Raise Existing HPS to 100-Year Level of Protection

Direct and Indirect Impacts on Wildlife Resources. Direct impacts to amphibians and reptiles from this alternative are expected to be similar to the No-action alternative.

Temporary displacement to avian and terrestrial mammal resources due to construction disturbance would be expected to be similar to the no-action alternative. Permanent displacement due to habitat loss could be greater than the no-action alternative because of the larger footprints required. A significant amount of valuable bird and mammal habitat, such as bottomland forest (approximately 200 acres) and scrub-shrub communities (approximately 300 acres), could be impacted as a result of this alternative. In addition, temporary impact to urban bird species could result from the construction disturbance. Furthermore, movement of terrestrial species could be restricted in places where earthen levees would be replaced with floodwalls.

Cumulative Impacts on Wildlife Resources. The cumulative impact associated with terrestrial and upland resource loss from this alternative, when considered with the other projects in the study area, would be greater incrementally to that of the no-action alternative because the project footprints are much larger with this alternative. However, unlike the no-action alternative, this alternative would provide the cumulative benefit of contribution to the 100-year level of hurricane protection afforded to terrestrial resources enclosed by the HPS.

Borgne 2

Direct and Indirect Impacts on Wildlife Resources. Impacts to amphibians and reptiles would be expected to be similar to those from the easternmost alignment of Borgne 1. The common amphibian and reptile species of the study area are not often found far from terrestrial habitat and therefore would be found in very limited portions of the construction area. Impacts to avian species from the construction of Borgne 2 would be expected to be greater in magnitude of habitat loss (up to 1,164 acres of marsh and open water habitat), to those associated with the easternmost alignment of Borgne 1. Impacts to dolphins would be expected to be similar to Borgne 1. Impacts to terrestrial mammals from Borgne 2 would be expected to be identical to those associated with the easternmost alignment of Borgne 1.

Cumulative Impacts on Wildlife Resources. Similar to Borgne 1, the cumulative impacts of this alternative, when considered with other projects within the study area, would not be expected to increase with the addition of the proposed project features. Likewise, the stabilization of existing habitat areas as a result of the protection structures of Borgne 2, along with increased nutrients and sediment potentially increasing heterogeneity and interspersion, along with reduced salinity from the MRGO deauthorization closure structure, could benefit avian resources in the long term. Furthermore, the cumulative impact would be a significant contribution to the 100-year level of hurricane protection afforded to wildlife habitat enclosed by the HPS.

Borgne 3

Direct and Indirect Impacts on Wildlife Resources. Because Borgne 3 would be constructed across the open water of Lake Borgne, no impacts to amphibians or reptiles would be expected. Construction of Borgne 3 may result in temporary localized dispersal of waterfowl and dolphins using Lake Borgne in the vicinity of the breakwaters. Because of the high mobility of these animals, mortality due to construction activities would not be anticipated. No long-term impacts to bird species or dolphins would be anticipated. Because Borgne 3 would be located entirely within Lake Borgne, no impacts to terrestrial mammals would be expected.

Cumulative Impacts on Wildlife Resources. No cumulative impacts to amphibians, reptiles or terrestrial mammals would be anticipated because no direct or indirect impacts are anticipated. No long-term cumulative impacts to bird species are anticipated when this alternative is considered with other projects within the study area.

Pontchartrain 1

Direct and Indirect Impacts on Wildlife Resources. Direct and indirect impacts to wildlife from this alternative would be anticipated to be similar to those for Pontchartrain 2.

Cumulative Impacts on Wildlife Resources. Like Pontchartrain 2, because of the limited quality habitat for wildlife in this location, any cumulative impacts to wildlife due to habitat loss could be considered negligible.

3.2.9 Threatened and Endangered Species

3.2.9.1 Existing Conditions

The presence of federally listed (USFWS) threatened and endangered species has been documented within the study area. The majority of species listed below are dependent upon the combination of marsh and open-water habitats which were historically more abundant throughout the region than presently found. As a result, populations have declined in many cases due to fragmentation of aquatic, marsh, and forest habitats.

Gulf Sturgeon: Both the State of Louisiana and the USFWS list the Gulf sturgeon (*Acipenser oxyrhinchus desotoi*) as a threatened species. Gulf sturgeon critical habitat exists in portions of Orleans and St. Bernard Parishes within the study area (LDWF 2007). Specifically, this

includes Lake Borgne and a portion of Lake Pontchartrain east of the Lake Pontchartrain Causeway. This species is anadromous (lives in saltwater; spawns in freshwater) and is significantly threatened by measures that prevent mobility from saltwater to freshwater breeding habitats. Specifically, these migration routes include the GIWW, IHNC, MRGO, and other channels such as Bayous Bienvenue and Dupre. Continued modification of these channels and water bodies through dredging and construction of obstructions may affect habitat quality and availability.

Kemp's Ridley Sea Turtle[7]: Although the Kemp's Ridley sea turtle (*Lepidochelys kempii*) does not nest in Louisiana, deepwater channels, estuarine, and offshore areas of St. Bernard Parish may provide this species with important feeding, developmental, and hibernation sites. Development or alteration of these areas may be a significant threat to the availability of such habitats. This turtle is listed as endangered at the Federal level.

Loggerhead Turtle: Similar to the Kemp's Ridley sea turtle, the loggerhead turtle (*Caretta caretta*) is not a full-time resident of the study area, but uses the estuaries and bayous of St. Bernard Parish as feeding and developmental habitat. The loggerhead turtle is listed as a threatened species at the Federal level.

Hawksbill Sea Turtle: The hawksbill sea turtle (*Eretmochelys imbricata*) occurs in the waters of southern Florida and the Gulf of Mexico. Hawksbill sea turtles use different habitats at different stages of their life cycle, but are most commonly associated with healthy coral reefs and, therefore, are rare visitors to the study area. This species is listed as endangered at the Federal level.

Green Sea Turtle: The green sea turtle (*Chelonia mydas*) occurs in inshore and near-shore waters of the Gulf of Mexico. Green turtles primarily use three types of habitat: oceanic beaches (for nesting), convergence zones in the open ocean, and benthic feeding grounds in coastal areas. Adult green sea turtles feed primarily on seagrasses and algae, which are limited within the study area. Therefore, the green sea turtle is a rare visitor to the study area. This species is listed as threatened at the Federal level.

Leatherback Sea Turtle: The leatherback sea turtle (*Dermochelys coriacea*) is a highly pelagic (occurring in open oceans) species, venturing inshore only during the nesting season. There are neither pelagic habitats nor sandy nesting beaches within the study area, and, therefore, it is unlikely that this species utilizes the study area. This species is listed as endangered at the Federal level.

Brown Pelican: The brown pelican (*Pelecanus occidentalis*), once extirpated from Louisiana, has been re-established at North Islands, St. Bernard Parish. Although outside the limits of the study area, the estuaries to the south and east of Lake Borgne may be utilized as feeding areas. The brown pelican is listed as an endangered species at both the state and Federal levels. Both the brown pelican and the bald eagle are the most likely of all study area bird

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[7] It is highly unlikely that these turtle species (Kemp's Ridley, Loggerhead, Hawksbill Sea, Green or Leatherback) would be visitors to the project area.

species to have been affected by the flooding and pumping of flood waters into the study area's marshes following Hurricanes Katrina and Rita (USACE 2007d).

Manatee: The West Indian manatee (*Trichechus manatus*) is a rare visitor to the waters of the study area. Found primarily in rivers, bays, and open channels with beds of submerged or floating vegetation, the manatee may occasionally use the open water portions of the study area as feeding habitat. Federally listed as an endangered species, West Indian manatees occasionally enter Lakes Pontchartrain and Maurepas and associated coastal waters and streams during the summer months (i.e., June through September). Manatee occurrences appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers and in canals within the adjacent coastal marshes of Louisiana.

The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide also adversely affect these animals.

3.2.9.2 Discussion of Impacts

Coordination with the USFWS was initiated on November 7, 2007, with a response on December 6, 2007 in which they concurs the construction of proposed project features for this project is not likely to adversely affect endangered species (appendix E).

No-action Alternative

Direct and Indirect Impacts on Threatened and Endangered Species. Short-term impacts of the no-action alternative to water turbidity, dissolved oxygen, and biological oxygen demand due to construction activities could impact habitat utilized by Gulf sturgeon and West Indian manatees. Those impacts, however, would be temporary and would be expected to diminish after the construction activities have ceased. They would also be minimized through the use of BMPs and SWPPPs. Therefore, this alternative would not be expected to have adverse impacts on any threatened or endangered species.

Cumulative Impacts on Threatened and Endangered Species. Because the water quality impacts would be temporary and minimized, when considered cumulatively with other projects in the area, which would be subject to similar BMPs and SWPPPs, the additional incremental impact of this alternative would be negligible.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Threatened and Endangered Species. When closed, the proposed gates of Borgne 1 would constitute physical barriers to the movement of Gulf sturgeon, the West Indian manatee, and endangered sea turtle species. However, given the length of time these structures would be closed, impacts would be anticipated to be minimal. Moreover, the gates would be designed according to NMFS guidance for maintenance of fish

passage, including parameters such as velocities not to exceed 2.6 fps water flow through the gates during peak flow or ebb tides.

Given the possibility of manatee presence in the project area, special precautions would be taken during the construction of any of the project alternatives to prevent adverse impact to the species. All contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. All construction personnel would be responsible for observing water-related activities for the presence of manatee(s). Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign would be placed where it is visible to the vessel operator. Siltation barriers, if used, would be made of material in which manatees could not become entangled, and would be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions would no longer be necessary, but careful observations would be resumed. Any manatee sighting would be immediately reported to the USFWS and the LDWF Natural Heritage Program.

Borgne 1 temporary direct impacts to threatened and endangered species could be related to displacement or avoidance as a result of construction activities. Short-term impacts to water turbidity, dissolved oxygen, and biological oxygen demand due to construction activities could also impact habitat utilized by Gulf sturgeon and West Indian manatees, as well as prey species of the Brown Pelican. Those impacts, however, would be anticipated to be temporary, would be minimized through the use of BMPs and SWPPPs. Furthermore, impacts would be expected to diminish after cessation of the construction activities. With the exception of the brown pelican, the majority of the threatened and endangered species common to the study area are transient; that is, they use the study area as part of a larger habitat and move in and out of it regularly. Because of this relationship and the nature of the proposed work, these impacts would be expected to be localized and species would be expected to return to the vicinity following cessation of construction. Therefore, this alternative would not cause an adverse impact to these species.

Constructing the static barrier in the easternmost alignment could reduce forage habitat for the brown pelican by removing as much as 641 acres of brackish-intermediate marsh and open water habitat. However, this impact does not constitute an adverse impact to this species.

Cumulative Impacts on Threatened and Endangered Species. When considered on a cumulative basis with the additional projects within the study area, no increased impacts are expected to these threatened and endangered species. Moreover, the limited impacts to these species could be partially offset by the benefits gained from other projects, which could

enhance and increase emergent wetland habitat and provide hurricane protection to such habitat. Therefore, the cumulative impact of this alternative would be negligible.

Pontchartrain 2

Direct and Indirect Impacts on Threatened and Endangered Species. Because the IHNC is a potential migration route for both West Indian manatee and Gulf sturgeon, closure of this structure could temporarily block migration. The gate would be designed, however, not to increase velocities above the current condition when open. Any construction related impacts would be temporary. Therefore, this alternative would not cause an adverse impact to these species.

Cumulative Impacts on Threatened and Endangered Species. When considered on a cumulative basis with the additional projects within the study area, no increased impacts to threatened and endangered species would be expected.

Alternatives to the Proposed Action

Raise Existing HPS to 100-Year Level of Protection

Direct and Indirect Impacts on Threatened and Endangered Species. Because it is anticipated that this alternative's impacts to threatened and endangered species would be the same as the no-action alternative, no adverse impacts to these species would be anticipated.

Cumulative Impacts on Threatened and Endangered Species. The cumulative impact of this alternative would be similar to the cumulative impacts of the no-action alternative.

Borgne 2

Direct and Indirect Impacts on Threatened and Endangered Species. Impacts to West Indian manatee, Gulf sturgeon and endangered sea turtle species from Borgne 2 would be expected to be similar to those expected from the easternmost alignments of Borgne 1. Therefore, this alternative would not cause an adverse impact to these species.

This alternative could reduce forage habitat for the brown pelican by removing as much as 1,164 acres of brackish-intermediate marsh. However, these impacts would not constitute an adverse impact to any of these species.

Cumulative Impacts on Threatened and Endangered Species. As in Borgne 1, when considered on a cumulative basis with the additional projects within the study area, no increased impacts would be expected to these threatened and endangered species.

Borgne 3

Direct and Indirect Impacts on Threatened and Endangered Species. The threatened and endangered species associated with the study area are highly mobile. Therefore, the temporary direct impacts from construction of Borgne 3 to threatened and endangered species could be related to displacement as a result of construction activities. Because of this

relationship and the nature of the proposed work, these impacts would likely be localized and species would be expected to return to the vicinity following completion of construction. Secondly, because the structure would be designed so as to minimize velocities between the breakwater sections, adverse impacts to Gulf sturgeon and the West Indian manatee migration would not be expected.

Because 153 acres of open waters in Lake Borgne would be impacted by the construction of the breakwater structure, some critical habitat of Gulf sturgeon could be impacted.

Cumulative Impacts on Threatened and Endangered Species. The cumulative impacts of this alternative on Gulf sturgeon critical habitat could be incrementally significant if the 153 acres lost were of equal feeding and spawning value to other critical habitat lost through other projects in the area. However, this project would not have an incrementally significant impact on this species' migration, nor on other threatened and endangered species, when considered with other projects in the area.

Pontchartrain 1

Direct and Indirect Impacts on Threatened and Endangered Species. Migration impacts to West Indian manatee and Gulf sturgeon would be similar to those of Pontchartrain 2, and would therefore not cause an adverse impact on the species migration. However, the structure could impact Gulf sturgeon critical habitat. The impact of this structure would largely be temporary during construction, except for the approximately 202 acres of water bottom that would be taken out of availability due to the placement of the gates. At the mouth of the IHNC, the water bottom does not comprise high-quality Gulf sturgeon critical habitat; therefore, impacts related to construction and operation of these gates could potentially be minimal.

Cumulative Impacts on Threatened and Endangered Species. Several projects along the Lake Pontchartrain southern shoreline propose the use of dredged access channels to deliver foreshore protection construction materials, which could impact Gulf sturgeon critical habitat. Because Pontchartrain 1 would eliminate a small amount of relatively low-quality habitat, its cumulative impact to Gulf sturgeon habitat would be minimal. Aside form this impact, when considered on a cumulative basis with the additional projects within the study area, no increased impacts would be expected to threatened and endangered species.

3.2.10 Recreation

3.2.10.1 Existing Conditions

National and State Parks and Wildlife Management Areas

Many opportunities for recreational activities exist within the Orleans East Bank, New Orleans East, and Chalmette Loop sub-basins. Recreational activities consist of fishing, boating, water skiing, crabbing, camping, picnicking, field sports, bicycling, swimming, jogging, and other activities. There is one National Wildlife Refuge, a national park, and a state park contained within the study area. These recreational areas are described below and their locations are shown on figure 21.

- Bayou Sauvage NWR – Bayou Sauvage is partially located within the incorporated limits of the City of New Orleans and offered numerous opportunities for bicycling, fishing, and wildlife observation as well as offering interpretive programs. The refuge has not supported most of these activities since Hurricane Katrina.

- Jean Lafitte National Historic Park and Preserve – Jean Lafitte National Historic Park and Preserve consists of a network of six areas located throughout southern Louisiana. One of these areas, the Jean Lafitte Visitor's Center, is located within the French Quarter. The Chalmette Battlefield is located in the southwestern portion of the Chalmette Loop. Since Hurricane Katrina, the Jean Lafitte National Historic Park and Preserve French Quarter Visitor's Center has reopened, but the Chalmette Battlefield remains closed.

- St. Bernard State Park – St. Bernard State Park, located in the extreme southwestern portion of Chalmette Loop, offers camping, picnic areas, a swimming pool, and nature trails. The park has reopened since Hurricane Katrina.

City and Neighborhood Parks

Based on information provided by the USGS Geographic Names Information System (GNIS; USGS 2006b), numerous city, local, and neighborhood parks exist within the study area. The locations of these parks and recreation areas are shown on figure 20. The GNIS indicates 107 parks/monuments in the Orleans East Bank sub-basin, while New Orleans East has 7 city/neighborhood parks/monuments, and the Chalmette Loop has 10 city/neighborhood parks/monuments. It is not known how many of these parks/monuments are back in operation since Hurricane Katrina.

The southern shore of Lake Pontchartrain within the Orleans East Bank sub-basin is easily accessible by the population of New Orleans. According to the 1984 LPV EIS, the Orleans East Bank recreation area along the south shore of Lake Pontchartrain west of the IHNC consisted of the following features:

- Boat launch (8 lanes) at Breakwater Drive;
- Boat launch (18 lanes) at the Ted Hickey Bridge; and
- Fishing Piers at the Seabrook Bridge and at the Breakwater Drive boat launch.

Figure 20 – Recreational Facilities in the Orleans East Bank, New Orleans East and St. Bernard Sub-basins.
Source: Louisiana GIS Digital Map Ma y 2007 Compilation DVD Set Volumes 1 and 2 (Louisiana State University 2007).

Additionally, eastern Orleans Parish had many private fishing camps also owned by individuals living within the New Orleans Metropolitan Area according to the 1984 LPV EIS. According to the Final EIS for the MRGO New Lock and Connecting Channels, ten parks/playgrounds, two recreation centers, and several pools operated by the New Orleans Recreation Department were located in the immediate vicinity of the IHNC. The Mississippi River levee and batture area located near St. Claude Avenue adjacent to the Holy Cross area was heavily used for passive recreational activities. A jogging/walking path on the levee was also heavily used and residents fished in the river, relaxed on benches, and picnicked on the levee. The Lower Ninth Ward and Holy Cross residents also heavily utilized the Oliver Stallings Center and the Stallings Pool according to the MRGO New Lock and Connecting Channels Evaluation Report (USACE 1997). Additionally, the Stallings Center was used for activities such as volleyball, basketball, exercise programs, swimming, weight lifting, intramural programs, and bingo by residents of all ages.

St. Bernard Parish also supported many recreational activities such as hunting and fishing. Fishermen, hunters, boaters, and water skiers were served by many marinas and public boat launches. It is not known how many of these facilities are still operational following Hurricane Katrina.

The Louisiana Scenic Rivers Act of 1976 (amended 1988, No. 947, Section 1) was adopted to preserve certain rivers, or portions thereof, with outstanding natural, cultural, or recreational features in a free-flowing condition. The Act classifies designated rivers as wild, scenic, or recreational although most of these streams are used for recreational purposes. With the exception of Bayou St. John, which is in the Orleans East Bank sub-basin, all of these wild and scenic streams are located within the Chalmette Loop sub-basin or the Lake Borgne marsh:

- Lake Borgne (Violet) Canal
- Bayou Dupre
- Bayou Bienvenue (from Bayou Villere to Lake Borgne)
- Bashman Bayou
- Terre Beau Bayou
- Piroque Bayou
- Bayou St. John
- Bayou Chaperon

The locations of these scenic streams are shown on figure 20.

3.2.10.2 Discussion of Impacts

No-action Alternative

Direct and Indirect Impacts on Recreation. Under the no-action alternative, recreational facilities and resources could remain vulnerable to tropical system surge events like Hurricane Katrina, but this alternative would help reduce risk of inundation for those resources located on the protected side of the system. Recreational fishing and hunting would continue to be at risk from tropical events, which potentially translates into economic

impacts on recreation facilities from both reduced revenue from charter fishing and hunting leases and increased costs associated with storm damage repair. Additionally, recreation infrastructure would continue to remain vulnerable to storm surge flooding, including parks and boat ramps in the study area.

Cumulative Impacts on Recreation. The cumulative impact of the no-action alternative when considered with other projects within the study area would be expected to be minor. The majority of the HPS projects including this alternative propose construction work on land to raise existing levees and floodwalls which could have minor impacts to recreation resources. Impacts to fishing and hunting during construction of authorized Corps projects would be expected to be short-lived and would occur during construction of the project. Projects stabilizing erosion, building wetlands to counter subsidence, and improving water quality by the diversion of freshwater could improve recreation fishing in the project area. The no-action alternative would not impede these benefits because fishery resource impacts would be minor and temporary and cease after construction completion. Beneficial impacts to recreation facilities from raising existing levees to authorized heights would be minimal. Some recreational facilities would remain vulnerable to the effects of 100-year storms.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Recreation. Direct impacts to recreation occur with removal or disturbance of wetland and aquatic habitat. Inversely, the more wetland habitat that is protected, the more recreation use would be protected. Materials suspended by construction could temporarily impact recreation fishing due to the disturbance of fish habitat. Once the proposed action is complete, sediment would settle, benthos would repopulate and other mobile aquatic species would return thereby increasing recreational fishing opportunities. Depending on the actual design of the barrier structure, fishing opportunities in the marsh on the protected side could be affected due to a more limited influx of fish and water into this protected area caused by the barrier structure across the marsh.

Construction in wetlands could cause an increase in turbidity and sedimentation outside of the immediate project area thereby affecting recreational fishing. However, those impacts would be short-term; thus, effects on recreational fishing from the proposed action would be negligible.

Recreational boaters could continue to use Bayou Bienvenue to gain access into Lake Borgne. A gate is proposed across Bayou Bienvenue at the barrier structure, which would remain open except during tropical events.

Cumulative Impacts on Recreation. The potential exists for impacts to recreational fisheries depends in part upon the type of barrier constructed (i.e., with culverts) and whether it allows for movement of water and fish. This project could have permanent cumulative adverse impacts or benefits if foraging or breeding habitats are modified as a result of area projects. It cannot be determined if the implementation of all the projects within the study area would

result in net positive or negative impacts to recreational fisheries until the design details are known. This impact will be addressed in the Tier 2 NEPA document.

Recreational resources would be protected from tropical storm surge events from this and other proposed 100-year level of protection projects. Recreational infrastructure could also be affected by these same projects if either proposed levee and/or other structures' construction necessitates its removal.

Pontchartrain 2

Direct and Indirect Impacts on Recreation. Fishing in the project area, which offers both bank and pier access, could be disrupted from the increase in turbidity due to construction, in the short-term. Construction of a navigable gate at the mouth of the IHNC could also impact the Ted Hickey Bridge boat ramps and pier- and bank-fishing areas in the immediate area either temporarily or permanently depending on the size and exact location of the gate. Boat access to Lake Pontchartrain could be affected during construction of the gate. Impacts to the boat ramps along the lake just outside of the IHNC could be fewer than for Lake Pontchartrain 1 because the ramps are further from the Pontchartrain 2 construction area.

The direct impacts on recreational fishing for this alternative would be less substantial than for Pontchartrain 1 based on the amount of aquatic habitat that could be disturbed. Total long-term adverse impacts to recreational fishing from this alternative would be minimal.

Fishing in the lake outside of the immediate project area could be affected from an increase in turbidity due to construction. This would be expected to be short-lived.

Cumulative Impacts on Recreation. Impacts to fishing in the project area during construction of authorized Corps projects would be expected to be short-lived and would occur during construction of the project. Increased flood protection would benefit recreation infrastructure on the protected side of the flood gate, during storm surge events. Depending on the actual design of this alternative, boat ramps and other features could be permanently displaced. Recreational resources would be protected from tropical storm surge events by this and other proposed 100-year level of protection projects. Recreation infrastructure could also be affected by these same projects by their removal if either proposed levee and/or other structures' construction necessitates its removal.

Alternatives to the Proposed Action

Raise Existing HPS to 100-year Level of Protection Alternative

Direct and Indirect Impacts on Recreation. Direct impacts to recreation occur with removal or disturbance of wetland and aquatic habitat. Inversely, the more wetland habitat that is protected, the more recreation use would be protected. Materials suspended by construction could temporarily impact recreation fishing due to the disturbance of fish habitat; however these impacts would be expected to be minimal.

Construction in wetlands could cause an increase in turbidity and sedimentation outside of the immediate project area thereby affecting recreational fishing. However, those impacts would be short-term; thus, effects on recreational fishing from this alternative would be negligible. Additionally, raising the levee or building floodwalls could impact the boat ramps at the Ted Hickey Bridge and the nearby fishing pier. This impact could be temporary, during construction, or more permanent if the footprint of the expanded levee encroaches on the boat ramp area.

Cumulative Impacts on Recreation. Because the project area already has levees in place, cumulative impacts of raising levees or building floodwalls would be minimal. Recreation use in the project area would return to normal once construction is complete, except boat ramps could be permanently displaced. Also, pier-fishing and bank-fishing near the Ted Hickey Bridge could be displaced by the levee expansion or construction of floodwalls. Due to an increase in flood protection, beneficial cumulative impacts to recreation facilities on the protected side would be realized.

Borgne 2

Direct and Indirect Impacts on Recreation. The direct impacts for this alternative would be more substantial than the proposed project condition. Impacts from an expansive Lake Borgne shoreline barrier on aquatic and fish habitat could be more substantial and therefore recreation fishing in the marshland on the protected side of the proposed project could be impacted. Recreational boaters would continue to use Bayou Bienvenue to gain access into Lake Borgne. A gate is proposed across Bayou Bienvenue at the barrier structure, which would remain open except during tropical events.

The indirect impacts for this alternative would be very similar to those for the Borgne 1 action, but possibly slightly more extensive based on the amount of fish habitat that could be disturbed.

Cumulative Impacts on Recreation. Impacts for this alternative would be similar to and more substantial than with the Borgne 1 alternative.

Borgne 3

Direct and Indirect Impacts on Recreation. The direct and temporary impacts for this alternative would be from the increase in turbidity due to construction. Recreation fishing in Lake Borgne could be temporarily affected. Impacts under this condition could be more positive than the other alternative conditions based on the potential to have an increase in fish habitat from the artificial reef creation effect.

Indirect impacts for this alternative would be a reduction in storm surge on the protected side of the breakwater. Otherwise, impacts to recreational fishing would be similar to the no-action condition.

Cumulative Impacts on Recreation. Impacts for this alternative would be similar to the no-action alternative.

Pontchartrain 1

Direct and Indirect Impacts on Recreation. Construction of a navigable gate at the mouth of the IHNC would impact the Ted Hickey Bridge boat ramps and pier- and bank-fishing areas either temporarily or permanently depending on the size and exact location of the gate. In the short-term, fishing in the vicinity of the project area could be disrupted from an increase in turbidity due to construction, which would be more than Pontchartrain 2. Boat access to Lake Pontchartrain could be affected during construction of the gate.

Fishing in the lake outside of the immediate project area could be affected from an increase in turbidity due to construction. This would be expected to be short-lived.

Cumulative Impacts on Recreation. Impacts for this alternative and other authorized projects would be similar to and slightly greater than impacts from Pontchartrain 2 because the potential area of impact is larger.

3.2.11 Noise

3.2.11.1 Existing Conditions

Ambient noise in the developed portion of the study area is attributed primarily to traffic, particularly within the Orleans East Bank sub-basin. Although there is less road and air traffic than before Hurricane Katrina, ambient noise along the southern shore of Lake Pontchartrain is attributed both to traffic and the New Orleans Lakefront Airport.

Areas surrounding the IHNC, GIWW, and MRGO are exposed to noise generated by shipping, construction, and other industrial activities although ambient noise levels are substantially lower than before Hurricane Katrina. Ambient noise levels in the Chalmette Loop sub-basin are much lower than other portions of the study area due to the rural character of the area and are mainly caused by commercial and sports fishing as well as hunting activities.

3.2.11.2 Discussion of Impacts

All Alternatives

Direct and Indirect Impacts on Noise. Because all of the alternatives would use similar construction equipment, the noise produced could be expected to be similar among alternatives. As noted in table 2, noise impacts from construction would be temporary, but because of the magnitude of the project, construction could be conducted around the clock, seven days a week to get the project completed as soon as possible. This could expose populations near the construction areas to elevated noise levels. Noise impacts from construction would be unavoidable, but every effort would be made to minimize these impacts to the maximum extent practicable. To reduce this impact, specific haul routes would be designated for construction-related traffic to avoid residential areas to the maximum extent possible, and construction staging areas would be located away from heavily populated areas to further reduce impacts to noise levels to the maximum extent practicable.

Noise impacts are largely determined by the type of construction techniques and equipment used. For example, if pile-driving is needed to construct this project, the vibrations and noise associated could cause impacts that are different from those created by bulldozers or backhoes. Secondly, if pile-driving is conducted in water, special consideration should be given to noise or sonic impacts that could be felt by aquatic organisms; conversely, if pile-driving occurs on land, noise impacts to adjacent neighborhoods should be considered. Therefore, further analysis of noise impacts would be necessary in the Tier 2 NEPA document when further design and construction technique details are known.

Nonetheless, noise impacts in general can be analyzed in this document based on the location ranges under consideration. The westernmost alignment of Borgne 1 and Pontchartrain 2 would have the greatest localized effects on people. Borgne 2, Borgne 3, and Pontchartrain 1 would have less of an adverse effect on the majority of the population, but would have a greater impact on birds, fish, and individuals who pursue recreational and commercial activities in the vicinity of Lake Borgne and Lake Pontchartrain. The no-action alternative and the raise existing HPS alternative would cause the noise to be more widespread throughout the study area compared to the storm surge protection structures alternative.

Cumulative Impacts on Noise. Any of the alternatives would add construction noise to the accumulated noise from the planned projects. The no-action alternative and the raise existing HPS to the 100-year level alternative would cause the noise to be more widespread throughout the study area.

3.2.12 Air Quality

3.2.12.1 Existing Conditions

The USEPA Office of Air Quality Planning and Standards has set National Ambient Air Quality Standards (NAAQSs) for six principal pollutants that are called “criteria” pollutants. They are carbon monoxide, nitrogen oxide, ozone, lead, particulate matter, and sulfur dioxide. The USEPA has designated the New Orleans Metropolitan Area as an attainment area for all of the NAAQSs based on area-wide air quality monitoring studies. The New Orleans Metropolitan Area, as defined by the USEPA, encompasses Orleans, Jefferson, St. Charles, and St. Bernard Parishes.

The USEPA has recently proposed changes to the primary and secondary NAAQSs for ozone. The primary standards are set to protect people’s health; the secondary standards are set to protect plants and animals. The proposed changes are scheduled to take effect in 2008. If these standards are accepted and implemented, the New Orleans area could become a non-attainment zone for ozone due to these more restrictive standards. New Orleans is in compliance with the current ozone standards. Non-attainment classifications can be used to specify what air pollution reduction measures an area must adopt and when the area must reach attainment.

3.2.12.2 Discussion of Impacts

All Alternatives

Direct and Indirect Impacts on Air Quality. Like noise, air quality impacts are considered to be temporary. Likewise, because all of the alternatives would use similar construction equipment, the air quality impacts could be expected to be similar among alternatives. Construction activities associated with all of the alternatives could cause temporary and localized decreases in air quality from the emissions of construction equipment during construction operations. Air quality would return to pre-construction conditions shortly after construction completion.

Cumulative Impacts on Air Quality. Cumulative impacts from any of the alternatives would be discernible during the height of construction activities, with the no-action alternative and the Raise Existing HPS Alternative causing the most widespread cumulative impacts. Wetlands created and enhanced by the future projects would cause small-scale, localized air quality enhancements due to absorption and removal of pollutants by wetland plants.

3.2.13 Aesthetic (Visual) Resources

3.2.13.1 Existing Conditions

This resource's institutional significance is derived from laws and policies that affect visual resources, most notably NEPA and the 1976 Louisiana Natural and Scenic Rivers Act (Louisiana Scenic Rivers Act), as amended. The USACE Visual Resources Assessment Procedure (Smardon, 1988) provides a technical basis for identifying the project's visual resources. Public significance is based on public perceptions and professional analysis of the project area.

As described in section 3.3.10, numerous streams, or portions thereof, within the project area are designated under the Louisiana Scenic Rivers Act. These river corridors are largely undeveloped and provide open vistas of solid and broken marshes interspersed with natural levees and spoil banks which support woody vegetation. The relatively unobstructed panoramas contribute to the stream and river wilderness quality and high scenic value.

3.2.13.2 Discussion of Impacts

No-action Alternative

Direct, Indirect, and Cumulative Impacts on Visual Resources. The effects on visual resources from this alternative are insignificant as this alternative's project area visually contains similar development.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Visual Resources. The Louisiana Natural and Scenic River Act established a regulatory program and empowered the Secretary of the Louisiana Department of Wildlife and Fisheries (LDWF) to administer the System through regulations and permits. Impoundments, channelization, clearing and snagging and channel realignment are prohibited by the Act. Therefore, flood control projects on all scenic streams, with a few exceptions, are not permissible. A Scenic River permit may be required if the proposed project causes a detrimental visual effect on Bayou Bienvenue's surrounding area.

Cumulative Impacts on Visual Resources. Cumulatively, the visual impacts caused by flood protection measures regionally and nationwide may be considered significant. Flood prone natural landscapes protected by unnatural visual conditions similar to the proposed project may be increasingly converted to developable land. Land development that may be considered visually distressing depends on the complexity of natural elements lost.

Pontchartrain 2

Direct, Indirect, and Cumulative Impacts on Visual Resources. The effects on visual resources from this alternative are insignificant as this alternative's project area visually contains similar development.

Alternatives to the Proposed Action

Raise Existing HPS to 100-year Level of Protection Alternative

Direct, Indirect, and Cumulative Impacts on Visual Resources. The effects on visual resources from this alternative are insignificant as this alternative's project area visually contains similar development.

Borgne 2

Direct, Indirect, and Cumulative Impacts on Visual Resources. The effects on visual resources from this alternative would be similar to those described above for Borgne 1.

Borgne 3

Direct, Indirect, and Cumulative Impacts on Visual Resources. The effects on visual resources from this alternative are insignificant as, visually, this alternative's project area is remote and inaccessible to most except those traveling via watercraft.

Pontchartrain 1

Direct, Indirect, and Cumulative Impacts on Visual Resources. The effects on visual resources from this alternative are undetermined as project information is not detailed sufficiently to make an assessment. Currently, Lake Pontchartrain does not contain any

similar development. Impacts could be kept to a minimum if floodgate design takes into account the existing visual character of the project area.

3.2.14 Cultural Resources

3.2.14.1 Existing Conditions

Records on file at the Louisiana Division of Archaeology and the CEMVN indicate numerous previously recorded archaeological and historic properties are located within the study area. Site forms, previous archaeological investigations, and historic district surveys describe these known properties. Prehistoric middens, hunting and gathering camps, habitation and village sites, and mound sites tend to be located on active and abandoned distributary channel levee complexes, major beach ridges and other stable portions of the delta and are likely adjacent to marsh and lake environments, including Lake Borgne and Lake Pontchartrain. Due to recent geologic development of the Mississippi delta and the age of the deposits within the study area, the earliest known archaeological sites in the region date to the Poverty Point period (1700-500 B.C.). Similarly, historic period sites and structures, such as forts, plantations, residential neighborhoods, bridges, and industrial facilities, are primarily located on relatively high natural levee areas adjacent to waterways and in urban areas. Historic period watercraft has been recorded in bayou and river channels and lakes in the region. The reader may wish to refer to the following reports for specific historical information on the IER #11 project areas (Coastal Environments, Inc. 1983; Hahn and Hahn 2005; Yakubik et al. 1992; Wiseman et al. 1979).

CEMVN contracted R. Christopher Goodwin and Associates, Inc. to conduct a preliminary Phase 1A cultural resources records review and field reconnaissance of the IER #11 project area. A remote sensing survey of the Lake Pontchartrain shoreline at the lake entrance to the IHNC was also conducted. At the time this study was initiated, researchers were asked to investigate along the entire length of existing authorized HPS within a 1,000-foot-wide area measuring 500 feet from both the protected and flood sides of the levee/floodwall centerline. Proposed new alignments were generally investigated within areas measuring at least 500 feet from the protected side of existing shorelines. The entire Lake Borgne marsh encompassed by the Borgne 1 and Borgne 2 alternatives was also evaluated for known and potential cultural resource site locations.

Researchers utilized background research, cultural resource investigations review, historic map analysis, topographic analysis, and reconnaissance level field data to assess potential project impacts on known historic properties, identify high potential areas for cultural resources, and make recommendations regarding further fieldwork. This research identified 15 high potential areas in the study area, including previously recorded archaeological sites, undisturbed natural levee deposits adjacent to waterways, and submerged areas in Lake Borgne where the potential for historic period watercraft is considered very high.

The CEMVN held meetings with State Historic Preservation Office staff and Tribal governments to discuss the emergency Alternative Arrangements approved for NEPA project review and the development of a Programmatic Agreement (PA) to tailor the Section 106 consultation process under the Alternative Arrangements. The CEMVN formally initiated Section 106 consultation for the LPV Hurricane Protection Project (100-year), which

includes IER 11, in a letter dated April 9, 2007, and emphasized that standard Section 106 consultation procedures would be implemented during PA development. A public meeting was held on July 18, 2007, to discuss the working draft PA. We anticipate the PA will be executed in January 2008. Section 106 consultation with the State Historic Preservation Officer (SHPO) and Indian Tribes is ongoing and will continue during the next study phase. Additional cultural resource investigations may be required if known archaeological sites, historic structures, or high potential areas will be impacted by proposed actions. The Tier 2 NEPA document will further analyze the impacts of any known cultural resources within the study area of the selected alternative.

3.2.14.2 Discussion of Impacts

No-action Alternative

Direct, Indirect, and Cumulative Impacts on Cultural Resources. Under the no-action alternative, all proposed activities associated with raising the existing levees and floodwalls up to the originally authorized grade would be conducted within the existing project Right-of-way (ROW) and would have no direct, indirect, or cumulative impacts on significant cultural resources. The existing project ROW has been subjected to severe ground disturbing activities associated with the construction of the existing levees and floodwalls; excavation and construction of major canals and waterways including the IHNC, Michoud Canal, GIWW, and MRGO; and the development of adjacent control structures and industrial facilities. The likelihood for intact and undisturbed cultural resources in the existing levee ROW is extremely minimal.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Cultural Resources. Activities associated with gate and barrier construction have the potential to impact areas immediately adjacent to existing project ROW as well as undeveloped marsh areas.

Although construction of the GIWW, Michoud Canal, and MRGO has severely impacted existing project ROW, preliminary background review indicates that there are known significant historic structures, archaeological sites, and high potential areas for cultural resources in the proposed alternative location range. This includes two known site locations and three areas exhibiting a high potential for cultural resources. Ongoing cultural resource evaluations may identify additional high potential areas along the natural levee south of Bayou Bienvenue. Proposed construction activities could adversely impact these cultural resources. Therefore, implementation of this alternative will require additional cultural resources investigations and consultation with the SHPO and Indian Tribes during the Tier 2 NEPA document phase. Appropriate measures will be initiated under the Section 106 review process to ensure that impacts to significant cultural resources are avoided, minimized, or mitigated prior to project construction.

Erosion of ground deposits during flood events can result in severe damage and destruction of archaeological sites. Implementation of this proposed alternative would provide an added

level of hurricane protection to such resources and significant historic properties located in the immediate project vicinity, including the Bywater and Holy Cross Historic Districts and archaeological sites located at the southern end of the IHNC.

Cumulative Impacts on Cultural Resources. Implementation of this alternative would have beneficial cumulative impacts on historic properties in the New Orleans metropolitan area. This alternative is part of the ongoing Federal effort to reduce the threat to property posed by flooding. The combined effects from construction of the multiple projects underway and planned for the HPS would reduce flood risk and storm damage to significant archaeological sites, individual historic properties, engineering structures, and 19 historic districts.

Pontchartrain 2

Direct and Indirect Impacts on Cultural Resources. Recent review of state records, archaeological studies, historic structure surveys, and preliminary results of Phase 1A investigations indicates that there are no known significant historic structures, archaeological sites, or high potential areas for cultural resources in the alternative alignment. The area has been severely impacted by the initial construction of the IHNC and the subsequent development of industrial facilities along the entire length of the canal. The likelihood for intact and undisturbed cultural resources in the alternative alignment is considered very minimal.

Implementation of this proposed alternative will provide an added level of flood protection to any archeological sites and significant historic properties located in the immediate project vicinity, including the Bywater and Holy Cross Historic Districts and archaeological sites located at the southern end of the IHNC.

Cumulative Impacts on Cultural Resources. Implementation of this proposed alternative would have beneficial cumulative impacts on historic properties in the New Orleans Metropolitan Area. This alternative is part of the ongoing Federal effort to reduce the threat to property posed by flooding. The combined effects from construction of the multiple projects underway and planned for the HPS would reduce flood risk and storm damage to significant archaeological sites, individual historic properties, engineering structures, and 19 historic districts.

Alternatives to the Proposed Action

Raise Existing HPS to 100-year Level of Protection Alternative

Direct and Indirect Impacts on Cultural Resources. Under this alternative, all proposed activities associated with raising the existing levees and floodwalls up to the 100-year level of protection could impact areas located immediately outside of the existing project ROW. Recent review of background documentation of the IER #11 project area indicates there are known archaeological sites, historic properties, and high potential areas for cultural resources adjacent to the existing project ROW. These include eight previously recorded archaeological sites, eight areas exhibiting high potential for archaeological deposits, and the Bywater and Holy Cross Historic Districts. Proposed activities could adversely impact these cultural resources. Implementation of this alternative would require additional cultural

resources investigations and consultation with the SHPO and Indian Tribes in the Tier 2 NEPA document phase. Appropriate measures would be initiated under the Section 106 review process to ensure that impacts to significant cultural resources are avoided, minimized, or mitigated prior to project construction.

Indirect impacts from this alternative would be essentially the same as those described for the proposed action.

Cumulative Impacts on Cultural Resources. Cumulative impacts from this alternative would be essentially the same as those described for the proposed action.

Borgne 2

Direct and Indirect Impacts on Cultural Resources. Activities associated with gate and barrier construction has the potential to impact the Lake Borgne shoreline, adjacent wetlands, and natural levee deposits adjacent to Bayou Bienvenue.

Preliminary background review indicates that there are known significant historic structures, archaeological sites, and high potential areas for cultural resources in this location range. The entire Lake Borgne shoreline is an extremely sensitive, high potential area for prehistoric sites. Intact shell mound sites with human remains are recorded on or near the lake front. In addition, early 19th century military fortifications are documented along Bayou Bienvenue. Although the area has been subjected to erosion and subsidence, preliminary cultural resource evaluations have identified the entire lake shoreline as a high probability area for cultural resources and suggest that additional high potential areas may exist along the natural levee adjacent to Bayou Bienvenue. Proposed construction activities could adversely impact these significant cultural resources and potential site locations. Implementation of this alternative would require additional cultural resource investigations and a significant amount of consultation with the SHPO and Indian Tribes during the Tier 2 NEPA document phase.

Indirect impacts from this alternative would be essentially the same as those described for the proposed action.

Cumulative Impacts on Cultural Resources. Cumulative impacts from this alternative would be essentially the same as those described for the proposed action.

Borgne 3

Direct and Indirect Impacts on Cultural Resources. Activities associated with breakwater construction have the potential to impact lake bottom deposits and terrestrial deposits adjacent to the GIWW and MRGO.

Preliminary background review indicates that there is a high potential for submerged cultural resources in Lake Borgne. Due to subsidence and severe shoreline erosion, known prehistoric sites are documented in submerged locations adjacent to the shoreline. Throughout the historic period, Lake Borgne was extensively used to enter Bayou Bienvenue from the Gulf of Mexico and to reach other areas along the lakeshore. The potential for submerged historic watercraft in any portion of Lake Borgne is considered very high.

Proposed construction activities could impact significant cultural resources. Therefore, additional cultural resource investigations, including remote sensing survey and possible ground truthing of submerged targets, and further consultation with the SHPO and Indian Tribes would be required during the next study phase.

Indirect impacts from this alternative would be essentially the same as those described for the proposed action.

Cumulative Impacts on Cultural Resources. Cumulative impacts from this alternative would be essentially the same as those described for the proposed action.

Pontchartrain 1

Recent review of state records, archaeological studies, historic structure surveys, and preliminary results of Phase 1A investigations indicates that there are no known significant historic structures, archaeological sites, or high potential areas for cultural resources in the alternative alignment. This submerged area has been severely impacted by the initial construction and ongoing maintenance of the IHNC. Recent remote sensing data collected at the lake outlet are currently being analyzed, but indications are that there are no remote sensing targets exhibiting shipwreck or cultural resource characteristics in this extensively dredged area. The likelihood for intact and undisturbed cultural resources in the alternative alignment is considered very minimal.

Indirect impacts from this alternative would be essentially the same as those described for the proposed action.

Cumulative Impacts on Cultural Resources. Cumulative impacts from this alternative would be essentially the same as those described for the proposed action.

3.3 SOCIOECONOMIC RESOURCES

3.3.1 Human and Economic Resources

Table 5 illustrates the population count for Orleans and St. Bernard Parishes in 2000 and the pre- and post-Katrina estimates through July 2006, which is the latest date for which Census Population Estimates Program data are currently available. Both Orleans and St. Bernard Parishes were estimated to have experienced a major change in population between 2005 and 2006 with decreases of 51 and 76 percent, respectively, as a consequence of Hurricane Katrina.

Table 5
Estimated Change in Population 2000-2006

Geographic Area	Population 2000	Estimated Population July 2005 (Pre-Katrina)	July 2006 (Post-Katrina)	Percent Change 2000 – 2005	Percent Change 2005 – 2006
State of Louisiana	4,468,976	4,507,331	4,287,768	0.86%	-4.87%
Orleans Parish (City of New Orleans)	484,674	452,170	223,388	-6.71%	-50.60%
St. Bernard Parish	67,229	65,147	15,514	-3.10%	-76.19%

Source: U.S. Census Bureau, Census 2000 and Population Estimates Program.

3.3.1.1 Existing Conditions

Socioeconomic conditions have changed dramatically since the 2000 Census. Most of the housing, businesses, and community infrastructure in the three sub-basins were damaged by Hurricane Katrina in 2005. Hurricane Katrina displaced significant portions of the population and the extensive property damage and recovery to pre-hurricane conditions continue. The following sections describe the baseline conditions of the socioeconomic resources in the three sub-basins. The information is presented for Orleans Parish and St. Bernard Parish because the data since Hurricane Katrina were only available at the parish level.

Population projections for the City of New Orleans were prepared after Katrina and published in the Citywide Strategic Recovery and Rebuilding Plan (Citywide Plan) (New Orleans Community Support Foundation and the Community Support Organization 2007). Starting with the lowest population numbers in 2006, the Citywide Plan projected that the population would continue to grow, reaching 43 to 48 percent of the 2000 population by January 2007, 52 to 59 percent by 2008, and 59 to 67 percent in 2009.

Delivery statistics from the U.S. Postal Service also support the estimated rates of depopulation after Katrina, but a more rapid rate of recovery than the Citywide Plan. The lowest points in residential deliveries compared to pre-Katrina numbers approximate the Census estimates of July 2006. Deliveries at that time were reported as 51.5 and 73.7 percent less than the July 2005 numbers (table 6).

Active residential deliveries in Orleans and St. Bernard Parishes have increased at a slow but steady pace from their lowest points in August and October 2006. The average rate of growth per month is approximately 1.5 percent.[8] Were this trend to continue, Orleans Parish would recover approximately 75 percent of its pre-Katrina population and St. Bernard Parish would recover almost 40 percent by the end of 2007.

Table 6
Comparison of Active Residential Postal Deliveries

Proportion of Active Residential Postal Deliveries		
Time Period	**Orleans Parish**	**St. Bernard Parish**
Pre-Katrina: July 2005	100.00%	100.00%
Lowest Point 2006	49.50%	26.30%
January 2007	59.20%	28.80%
February 2007	60.30%	30.60%
March 2007	61.90%	32.10%
April 2007	63.80%	33.20%

Source: Sammamish Data Systems compiled from the U.S. Postal Service's Delivery Statistics Product in the Katrina Index, June 14, 2007, provided online by the Greater New Orleans Data Center (www.gnocdc.org) in cooperation with the Brookings Institution Metropolitan Policy Program.

According to the 2000 Census and as illustrated in table 7, there were more than 200,000 housing units in Orleans Parish and approximately 26,000 in St. Bernard Parish. The vacancy rate in Orleans Parish was 12.5 percent and half that in St. Bernard Parish. Of the occupied units, almost half in New Orleans were occupied by owners. In St. Bernard Parish, the owner-occupancy rate was much higher at almost 75 percent.

[8] Although there is little research to verify the correlation between active residential deliveries and occupied households and the limitations of the research are unknown, these data, which have been used by commercial demographers to indicate population change for a long time (Plyer and Bonagura 2007), are valuable because of the immediate availability on a monthly basis. The most reliable population estimates for counties are prepared by the U.S. Census, but are only released annually, generally nine months after the reference date of July.

Table 7
Housing Statistics in 2000

Housing (2000)	Orleans Parish	St. Bernard Parish
Total Housing Units (Full Count)	215,091	26,790
Occupied Housing Units	87.5%	93.8%
Vacant Housing Units	12.5%	6.2%
Total Occupied Housing Units	188,251	25,123
Owner Occupied	46.5%	74.6%
Renter Occupied	53.5%	25.4%

Source: U.S. Census Bureau. Census 2000 Full-count Characteristics (SF1). From a compilation by the Greater New Orleans Community Data Center. <http://www.gnocdc.org>.

Data from Federal Emergency Management Agency (FEMA) Individual Assistance Registrants and Small Business Administration Disaster Loan Applications were analyzed by the Housing and Urban Development (HUD) Office of Policy Development and Research in February 2006 and revised in April 2006. This study estimates that approximately 71.5 percent of the 2000 occupied housing units were damaged, 55.9 percent severely. In St. Bernard Parish, 80.6 percent were estimated to be damaged, 78.4 percent severely. If the severely damaged housing units are not recovered, this would reduce the number of housing units by approximately 125,000.

Although there is no estimate of how many housing units are vacant, the 2006 Louisiana Health and Population Survey did estimate the number of households in hurricane-impacted parishes. This number correlates with the FEMA/HUD number of housing units with minor or no damage. The survey also determined whether the householders were owners or renters. These data are presented in table 8.

Table 8
Estimated Households.

Renters and Owners (2006)	Orleans Parish	St. Bernard Parish
Total Households	76,352	9,951
Own	61.8%	80.4%
Rent	37.2%	11.9%
Not indicated	1.0%	7.6%

Source: Louisiana Public Health Institute. 2006. Louisiana Department of Health & Hospitals, Louisiana Health and Population Survey, Orleans Parish and St. Bernard Parish Survey Results. www.popest.org.

In 2000, approximately two-thirds of the Orleans Parish population was Black or African-American; 85 percent of St. Bernard Parish residents were White. Table 9 demonstrates the changes to these populations after Hurricane Katrina.

Table 9
Population Changes by Race and Ethnicity

Race or Ethnicity	Orleans Parish			St. Bernard Parish		
	2000	Estimated 2006	Percent Change	2000	Estimated 2006	Percent Change
Black or African American	322,793	103,652	-67.9%	5,109	993	-80.6%
White	128,923	86,451	-32.9%	56,674	12,442	-78.0%
Asian	11,148	7,819	-29.9%	874	0	-100.0%
American Indian	969	223	-77.0%	336	93	-72.3%
Other or None Selected[9]	969	3,127	222.6%	67	993	1376.9%
Two or More Races	4,847	670	-86.2%	740	140	-81.1%
Hispanic (any race)	15,025	21,445	42.7%	3,429	853	-75.1%

Source: U.S. Census Bureau. Census 2000; Louisiana Public Health Institute. 2006. Louisiana Health and Population Survey, Orleans Parish and St. Bernard Parish Survey Results, www.popest.org.

It is estimated that the Black or African American and White populations of Orleans Parish experienced the greatest loss of population in absolute numbers, the first losing over 200,000 persons and the second over 40,000. In St. Bernard Parish, the White population declined by 44,000 persons, by far the greatest change to any of the categories in that parish.

As a consequence of the post-hurricane population losses, the racial and ethnic composition of Orleans Parish has changed notably, with proportionately fewer Blacks or African Americans and proportionately more Whites, Asians, and Hispanics. Only the Hispanic population grew both proportionately and in absolute numbers. In St. Bernard Parish, the loss in population was fairly even across racial and ethnic groups. Therefore, the racial and ethnic composition of the parish was relatively unchanged with approximately 80 percent of the residents belonging to the White category. Chart 1 illustrates the change in racial and ethnic composition.

[9] The category "Other or None Selected" includes a large number of 2006 Louisiana Health and Population Survey respondents who did not answer this question. Therefore, this category is not representative of a racial or ethnic group, but used to adjust the count to 100 percent.

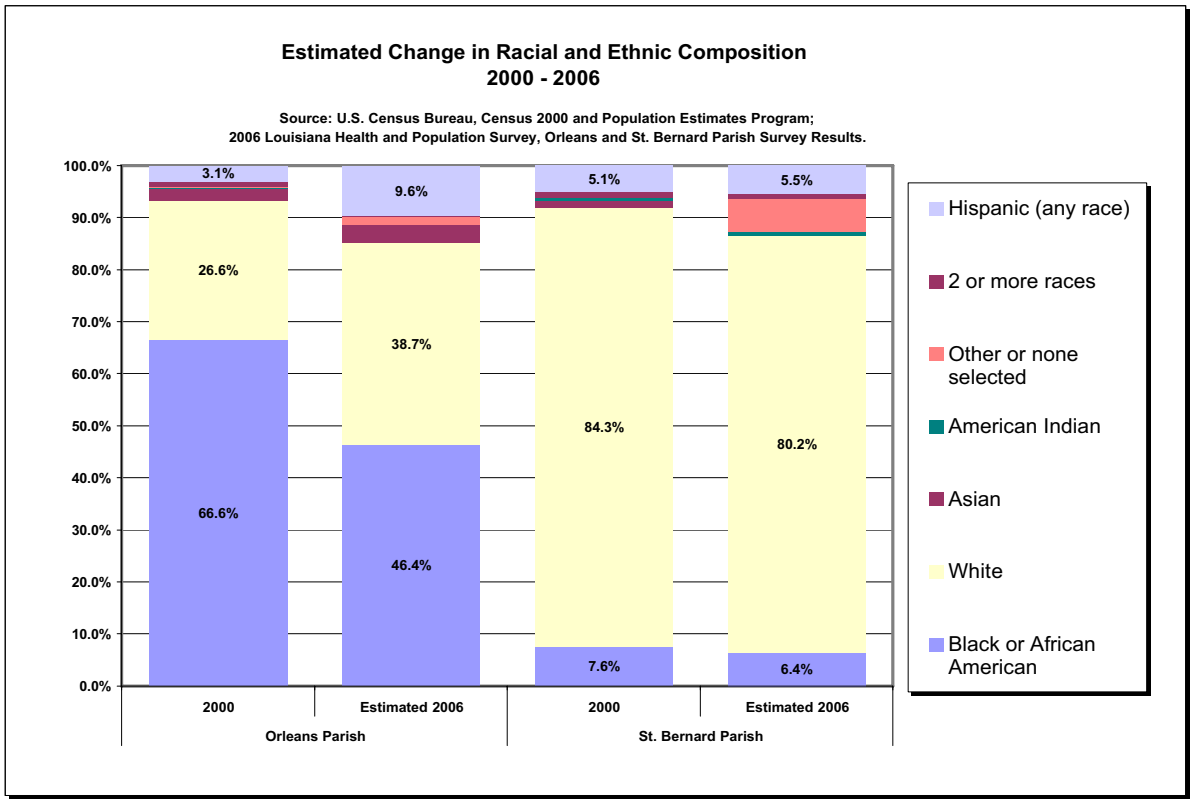

Chart 1 – Racial and Ethnic Composition for Orleans and St. Bernard Parishes.

According to the 2000 Census, the median household income in Orleans Parish was $27,133. As shown in table 10, there were almost 40,000 households in Orleans Parish with annual incomes of less than $10,000. This was the largest group of all pre-Katrina income categories. After Katrina, the Louisiana Health and Population Survey indicates that the population losses were most pronounced in households in the lower income brackets, raising the median household income of the households who responded to this question to somewhere between $35,000 and $49,999.

The median income in St. Bernard Parish was $35,939 in 2000 and the largest groups fell in the mid-range of household incomes. After Katrina, the survey reported that median income for respondent households in 2006 was slightly lower than in 2000, ranging between $25,000 and $34,999.

Table 10
Household Income Distribution and Changes between 2000-2006 for Orleans and St. Bernard Parishes

Household Income Distribution	Orleans Parish			St. Bernard Parish		
	2000	Estimated 2006	Change	2000	Estimated 2006	Change
Total Households	188,365	76,352	-112,013	25,065	9,951	-15,114
Less than $10,000	39,557	6,108	-84.6%	2,807	896	-68.1%
$10,000 – 14,999	18,083	2,749	-84.8%	2,406	428	-82.2%
$15,000 – 24,999	29,762	5,803	-80.5%	3,659	1,383	-62.2%
$25,000 – 34,999	25,429	4,123	-83.8%	3,735	836	-77.6%
$35,000 – 49,999	26,371	7,482	-71.6%	4,186	1,333	-68.1%
$50,000 – 74,999	23,734	6,566	-72.3%	5,138	1,323	-74.2%
$75,000 – 99,999	10,737	4,657	-56.6%	2,181	299	-86.3%
$100,000 – 149,999	7,911	2,978	-62.4%	1,028	239	-76.8%
$150,000 – 199,999	2,637	2,062	-21.8%	150	0	-100.0%
$200,000 or more	4,144	1,374	-66.8%	150	0	-100.0%
Not indicated	NA	32,373	NA	NA	3,214	NA

Source: U.S. Census Bureau, Census 2000; Louisiana Public Health Institute. 2006. Louisiana Health and Population Survey, Orleans and St. Bernard Parish Survey Results, www.popest.org.

Poverty status was determined by the U.S. Census Bureau in 2000 for Orleans and St. Bernard Parishes for most of the residents. Persons below the poverty level at that time represented 27.9 and 10.9 percent of Orleans and St. Bernard Parish populations, respectively, compared to 19.6 percent of the Louisiana population. These persons generally correlate to the households in table 10 that earned an income of $10,000 or less.

The change in the number of individuals in the labor force did not change from 2000 to 2006 to the same degree that the population decreased. In Orleans Parish, the number of people in the labor force declined by 26.9 percent (table 11) compared to an estimated 50 percent decline in total population. The number of employed persons dropped by about the same percentage, but the number of unemployed dropped slightly more, bringing the overall unemployment rate in 2006 down to 4.7 percent compared to 5.1 percent in 2000. In St. Bernard Parish, the labor force was reduced by about 25 percent compared to an approximate 75 percent decline in population. Notably, the number of unemployed in 2006 is almost 55 percent less than in 2000. This explains the decline in unemployment by 2 percentage points. The need for workers resulting from the hurricanes of 2005 has also had an impact on state unemployment, which also declined between 2000 and 2006.

Table 11
Labor Force and Employment Changes for
Orleans Parish, St. Bernard Parish and Louisiana

Change in Annual Non-Rounded Not Seasonally Adjusted Labor Force, Employment and Unemployment									
	Orleans Parish			St. Bernard Parish			Louisiana		
	2000	2006	Change	2000	2006	Change	2000	2006	Change
Civilian Labor Force	210,684	154,041	-26.9%	32,177	23,991	-25.4%	2,031,292	1,990,120	-2.0%
Employment	199,940	146,817	-26.6%	30,535	23,245	-23.9%	1,930,662	1,910,348	-1.1%
Unemployment	10,744	7,224	-32.8%	1,642	746	-54.6%	100,630	79,772	-20.7%
Unemployment Rate (%)	5.1%	4.7%	-0.4%	5.1%	3.1%	2.0%	5.0%	4.0%	1.0%

Source: Louisiana Department of Labor. Labor Market Statistics, Local Area Unemployment Statistics Program.

A review of the Monthly Employment by Industry Sector data provided by the Louisiana Department of Labor (2007b) revealed that Orleans Parish had sustained a loss of 11.1 percent of its employers in the third quarter of 2006 compared to the first quarter of 2001. This loss translated into a 41.7 percent decrease in jobs in the same period. Although the number of establishments in the two sectors of Educational Services and Accommodation Services increased, the actual number of employed persons decreased significantly.

St. Bernard Parish lost almost half its jobs in the 2001 to 2006 period and 15.8 percent of its employers. Mining and Construction were the only sectors to show a positive percent change in the number of jobs, although the increase of 691 did little to compensate for the overall losses. The Retail Trade Sector, which had been the parish's largest employer in terms of the number of establishments as well as the number of jobs, experienced the greatest losses.

3.3.1.2 Discussion of Impacts

No-action Alternative

Direct and Indirect Impacts on Human and Economic Resources. The existing HPS will be improved under this alternative, but not to the level of protection from storm events with a 1 percent chance of occurring in any year (100-year level of protection).

The extent to which economic resources are invested in real estate and development is highly correlated with the perceived level of risk from future storm events. Risk is mitigated by the ability, in the first instance, to protect property against physical damage, and secondarily, to hedge the economic costs of replacement or rebuilding in the event of damage. The no-action alternative represents the least level of protection from flooding of all the alternatives considered for the study area. Adding the difficulty in securing insurance coverage to a

lower level of physical protection could increase the risk to an unacceptable level that could affect their willingness to maintain and increase their investment in the study area. Without the economic investment in this sector, the local economy could stall and full recovery of the area could be jeopardized.

A poor economy could change the population numbers and ethnic distribution, income levels and income distribution, the quantity and type of available jobs, and public revenues. Changes to these features could indirectly reduce the demand for and quality of public services, infrastructure, and publicly supported recreational and cultural resources.

Traffic congestion and accessibility impacts from the no-action alternative would be temporary, lasting only for the duration of construction activities. Other short-term impacts could include slight increases in population from construction workers, demand for temporary housing, and additional traffic congestion. Demand for public services such as hospital care from construction-related injuries and police and fire protection could stress the emergency response systems, which have not yet fully recovered from Hurricane Katrina.

Cumulative Impacts on Human and Economic Resources. Cumulatively, the temporary impacts from construction of all present and future projects at the same time could make the study area extremely noisy, congested, and generally uncomfortable. The incremental addition from the no-action alternative could be the least intense and could add the fewest inconveniences. However, they would be dispersed over the entire study area as opposed to most of the other alternatives, which have localized areas of construction.

Proposed Action

Borgne 1

Direct and Indirect Impacts on Human and Economic Resources. By providing the 100-year level of protection from storm surge, the Borgne 1 could promote the confidence necessary for residents to continue the rebuilding process. Continued eligibility for National Flood Insurance Program (NFIP) coverage for properties in the study area could also encourage long-term investment of economic resources and cause the rate of recovery of population and the local economy to be more robust and sustainable than with the no-action alternative. The intensive use of human and economic resources required by the construction projects of the proposed action could also increase the number of jobs and employers. An increased demand for workers could further increase population and could stimulate a rise in wages for the duration of the construction phase of the project. These changes are benefits that could ripple through other economic sectors and could facilitate the re-establishment of community, government, and neighborhood institutions. The higher level of protection could benefit social and community resources, particularly in areas that have been slower to recover such as St. Anthony, Pontchartrain Park, Desire Area, Venetian Isles, and the Lower Ninth Ward (GCR 2007).

A possible temporary adverse impact could be an untimely spike in demand for housing and public services such as hospital care from construction-related injuries and police and fire protection could stress the housing market and emergency response systems, which have not yet recovered from the effects of Hurricane Katrina. However, the economic stimulus and

improved protection that this alternative could offer could accelerate complete restoration of these and other essential community facilities.

The proposed action does not require the taking of any buildings, facilities, structures, or residential properties. Some vacant land on the shores of the IHNC, GIWW, and MRGO may be used for construction of the tie-ins for the gates, but the structures would mostly be built in open water. The Borgne 1 side of the proposed action could require relocation of utility ROW, but would not likely impact any major roads or railroads.

Unlike the no-action alternative and the raise existing HPS alternative, the areas of construction of the proposed action would not be dispersed throughout the study area, but would be limited to the immediate area of structure locations. The surge protection features of the proposed action could likely result in more direct impacts to human resources in these immediate areas during the construction phase than the other storm surge alternatives because the physical location Borgne 1 would be closer to populated areas.

Shipping interests along the GIWW could be disrupted during construction activities. Adjacent commercial facilities accessed by road could also be temporarily impacted.

Cumulative Impacts on Human and Economic Resources. The cumulative effect of the proposed action combined with all the other projects in the study area on human, economic, and community resources could be beneficial because the risks of flood damage from storm surge were reduced and both the natural and built environments were improved. Extreme peaks in demand for workers, housing, and services could strain public systems still in recovery, but these could adjust as the projects moved forward. Noise, traffic, and other effects from the large number of simultaneous construction projects could make the city uncomfortable, but the overall economy could benefit from such growth. These accumulated inconveniences and benefits are not particular to the proposed action, but could be the same for any of the structural alternatives considered.

<u>Pontchartrain 2</u>

Direct and Indirect Impacts. The impacts associated with Pontchartrain 2 could be similar to those from Borgne 1. Additionally, some infrastructure such as utilities or a portion of the road or railroad at or near the construction sites on the IHNC may have to be permanently relocated or rerouted as a result of construction of Pontchartrain 2, but these impacts could be much less than with the raise existing HPS alternative.

Temporary impacts from access, noise, and traffic issues during construction activities in the area of the Pontchartrain 2 surge protection feature could occur to residential and commercial areas. Shipping interests along the IHNC could be disrupted during construction activities. Adjacent commercial facilities accessed by road could also be temporarily impacted.

Cumulative Impacts on Human and Economic Resources. The cumulative effect of the Pontchartrain 2 combined with all the other projects in the study area on human, economic, and community resources would be the same as that for Borgne 1.

Alternatives to the Proposed Action

Raise Levees and Floodwalls to the 100-Year Level of Protection

Direct and Indirect Impacts on Human and Economic Resources. By providing the 100-year level of protection, this alternative could preserve FEMA certification and access to NFIP coverage for properties in the study area. This could facilitate recovery of population and the local economy and generate economic benefits similar to those discussed for the proposed action. Temporary impacts from an acute need for workers, housing, and public services would also be similar.

As illustrated on figure 21, the proposed levee footprint could require taking approximately 130 single-family residences in the Orleans East Bank Sub-basin and 22 in the Orleans Parish portion of the Chalmette Loop Sub-basin. The number of takings was estimated by overlaying the typical footprint required to raise the levees or levees and floodwalls to the height that would provide the 100-year level of protection on the 2005 Digital Ortho Quarter Quad aerial photography and counting the residential roof tops. Subsequent to 2005, some of the structures counted may have been demolished and removed; therefore, this count represents the highest possible number of residences directly impacted. These takings would be the only direct adverse impacts to residents from this alternative, but the acquisition would be fully compensated in accordance with the Relocation Assistance Act guidelines. The relocation process would include real estate services to help find replacement homes and financial assistance for relocating personal effects, if needed. If the residence is a rental unit, the occupants would receive real estate and moving assistance to relocate them to a similar or better unit.

This alternative is the only one that could cause direct impacts by the takings of industrial structures. The number of possible takings was estimated using the same methodology described above. Of the approximately 121 industrial structures that could be taken, 18 are located in the Orleans East Bank Sub-basin, 6 are within the Chalmette Loop Sub-basin, and the remaining 97 are located in the New Orleans East Sub-basin (figure 21). Many of the structures are outbuildings and warehouses that could be relocated on site or within the general area. In accordance with the Relocation Assistance Act, businesses would receive compensation for the taking of property and would receive assistance in finding a new business location and moving equipment, inventories, and other business-related properties. Traffic congestion and accessibility impacts during the construction phase would be temporary, but could last longer than those from the no-action alternative because the larger footprints could necessitate longer construction durations.

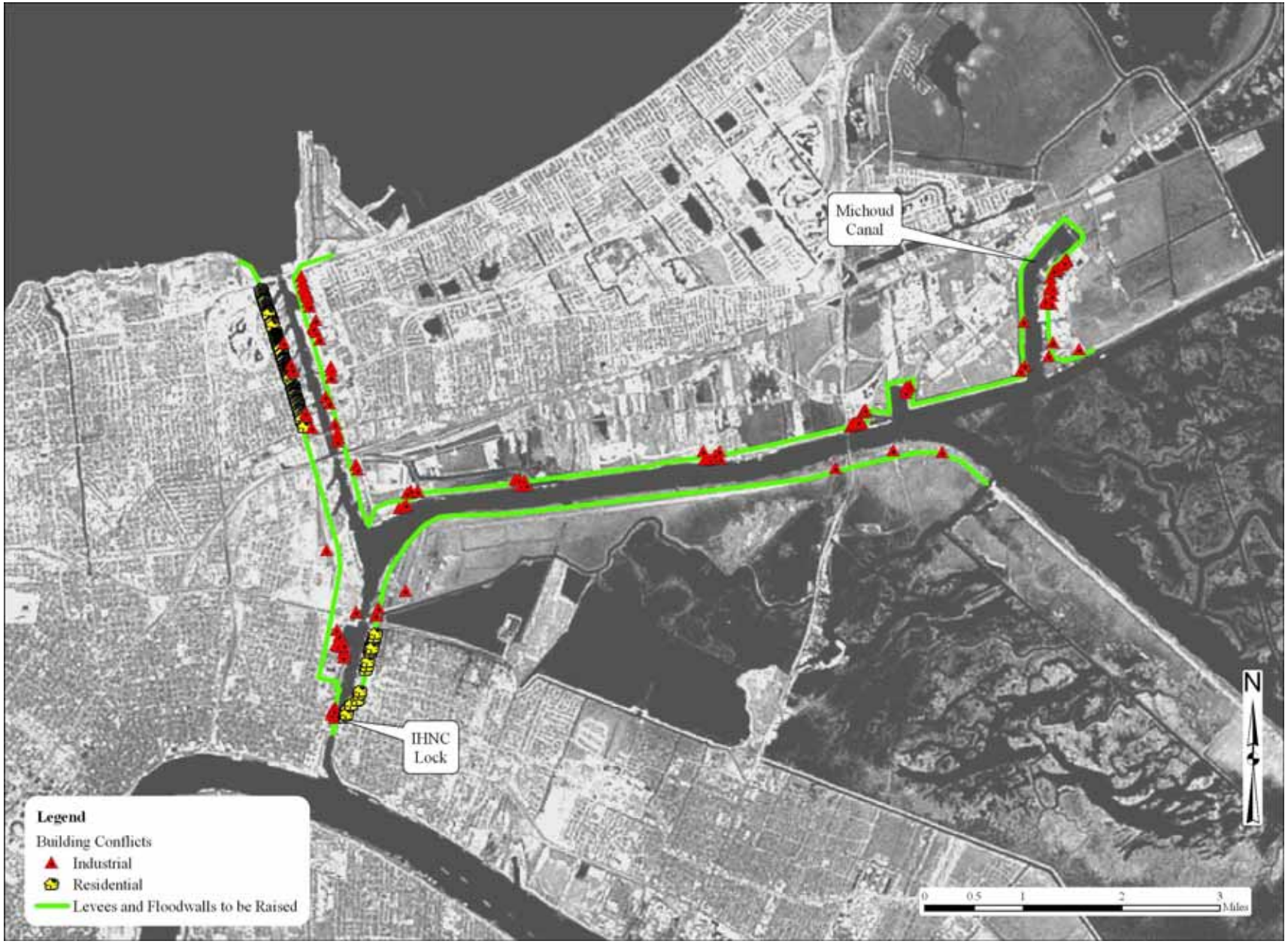

Figure 21 – Structures Impacted by Raise Existing HPS to 100-year Level of Protection Alternative.

Access to businesses could also be temporarily interrupted during the construction phase, particularly those outside the floodwalls along the IHNC, but a spike in employment in the construction and professional/technical sectors could more than offset these short-term negative impacts to the economy.

The raise existing HPS alternative could require relocation of infrastructure such as roads, railroads, utility lines, and telecommunication structures, particularly along the IHNC. Temporary disruptions to roads, railroads, and utilities could likely result from construction activities, particularly in commercial areas near the IHNC.

Cumulative Impacts on Human and Economic Resources. Cumulative impacts from this alternative would be similar to those of the proposed action, but would disperse the traffic, noise, and access inconveniences over a wider extent of the study area.

Borgne 2, Borgne 3, and Pontchartrain 1

Direct and Indirect Impact on Human and Economic Resources. The positive impacts on the human and economic resources of the study area–direct, indirect, and cumulative–from these alternatives would be equivalent to the proposed action because all these structures are designed to provide storm surge protection from a storm with a 1 percent chance of occurring in any given year (100-year level of protection).

Adverse impacts to human resources from construction of the Borgne 2, Borgne 3, and Pontchartrain 1 alternatives would be less than from the proposed action because they are located farthest from populated areas. Most of the impacts would be construction related and therefore temporary; access, noise, and congestion issues would occur predominantly at the points where the structures tie into the shore.

Cumulative Impact on Human and Economic Resources. Cumulative impacts on human, economic, and community resources would be the same as the proposed action.

3.4 ENVIRONMENTAL JUSTICE

Environmental justice analysis was developed following the requirements of:

- Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Population and Low-Income Populations," 1994)
- "Department of Defense's Strategy on Environmental Justice" (March 24, 1995).

Following the above directives, environmental justice analysis will identify and address, as appropriate, human health or environmental effects of the HPS project on minority and low-income populations. The methodology to accomplish this includes identifying low-income and minority populations within the study area by demographic analysis followed by drive-by surveys. Interested citizens have had the opportunity to comment on environmental justice issues during 37 public meetings held during 2007. Additional small-group meetings

will be held to allow minority and low-income people the opportunity to participate in the decision-making process for the HPS.

Census Block Group statistics from the 2000 Census and Environmental Systems Research Institute (ESRI) 2007 data layers were utilized for environmental justice data analysis.

Detailed discussion of demographic and income data along with pertinent maps, tables and photographs are available and will be included in the Comprehensive Environment Document (CED) and on the website www.nolaenvironmental.gov .

3.4.1 Existing Conditions

According to the 2000 Census and 2007 ESRI estimates, the area within a one-mile radius of the project's footprint, in various reaches of the project work, includes low income or minority communities. The minority population is greater than 50 percent, and is not substantially different than the percentage of minorities within Orleans Parish. Similarly, the percentage of the population living below the poverty line was comparable to the parish figure and significantly lower than the state figure for 2000. Reaches of the project adjoin St. Bernard Parish near the junction of the GIWW and the MRGO, near the Bayou Bienvenue Floodgate. Areas in St. Bernard Parish within a one-mile radius of the project footprint are uninhabited.

3.4.2 Discussion of Impacts

The following analysis is based on available descriptions of the project and work locations in the preliminary IER #11 document. As the project planning process advances, any potential environmental justice impacts will be analyzed further when additional project planning data become available and will be addressed in the Tier 2 NEPA document and the CED.

Some reaches of this project in both Orleans and St. Bernard Parishes include uninhabited land only. However, it is noted that both 2000 Census data and 2007 ESRI estimate show presence of significant minority and low-income population within the project area of the IHNC and GIWW and vicinity.

Aerial photos were utilized to confirm the presence of habitation in the various reaches, and are utilized in environmental justice analysis. Therefore, environmental justice impacts are being considered in the area of concern shown by 2007 ESRI estimate.

No-action Alternative

Direct and Indirect Impacts on Environmental Justice. The no-action alternative represents an improved level of protection compared to what was in place in August 2005. Raising project levees and floodwalls to the authorized grade would reduce the probability of overtopping, and improvements made in accordance with new design guidelines will reduce the probability of foundation failure. Yet, the level of protection afforded by the no-action alternative protection system would be closest to the pre-Katrina condition compared to other possible alternatives. Future catastrophic flooding could result in major economic and social

effects to the area including loss of homes and destruction of important recreation areas and businesses.

Under the no-action alternative, the impacts of 100-year storm could be borne by a significant minority and low-income population, but the impacts are not considered to be disproportionately borne by such populations. Therefore, no environmental justice issues are anticipated for this alternative.

Cumulative Impacts. Details on cumulative, adverse environmental justice impacts will be analyzed when further project planning data become available at conclusion of environmental justice public meetings and will be included in the Comprehensive Environmental Document (CED).

Proposed Action

Borgne 1

Direct and Indirect Impacts on Environmental Justice. Due to the general absence of human habitation near this work in both Orleans and St. Bernard Parishes in the area encompassed by the Borgne 1 location range, there would not be a direct, high human health or environmental impact on minority or low-income populations. Implementation of Borgne 1 would not result in any significant, direct change to environmental resources that individuals involved in subsistence fishing or hunting utilize. Also, construction of Borgne 1 is not anticipated to involve the release of hazardous, toxic, or radioactive materials to which minority or low-income populations could be exposed. As such, implementation of Borgne 1 would not create disproportionately high human health or environmental effects on low-income populations, minority populations, or Native American tribes. Therefore, this proposed action would not raise any direct environmental justice issues.

Due to the general absence of human habitation near this work (or within the possible alignments within Borgne 1 and the area encompassed by the range of possible alignments), this alternate is not anticipated to exert indirect impacts from either the installed alignment or temporary construction related environmental pollution issues; therefore no environmental justice issues would be anticipated.

Cumulative Impacts. The impacts caused by the proposed action would have positive cumulative effect on low-income and minority individuals by preventing flooding.

Pontchartrain 2

Direct and Indirect Impacts on Environmental Justice. This Alternative does not require any takings of residential properties. Therefore, implementing Pontchartrain 2 would not result in direct impacts such as the taking of residences or businesses to construct the alignment.

There could be some temporary indirect impacts stemming from the construction activities, such as noise and air quality issues associated with construction equipment, material

deliveries, and other construction activities in the vicinity of a minority and low-income population. However, the area surrounding Pontchartrain 2 is already highly industrialized, and the noise and air quality conditions would return to normal after the construction. Environmental justice issues associated with these impacts would be addressed at small stakeholder group meetings to be held with the residents of the area. Low-income and minority individuals will have an opportunity to express their concerns about the impacts of the project. Their concerns would be considered during project planning.

Cumulative Impacts. The impacts caused by the proposed action for this proposal would have a positive cumulative effect on low-income and minority individuals by reducing the risk of flooding. While this project may temporarily impact a minority and low-income population, when considered cumulatively with the numerous 100-year level of protection projects which could cause similar temporary impacts throughout the New Orleans metro area, these temporary impacts would not be considered to be disproportionately borne by a minority and low-income population.

Alternatives to the Proposed Action

Raise Existing HPS to 100-year Level of Protection Alternative

Direct and Indirect Impacts on Environmental Justice.

GIWW – North Side Reach

The vicinity of the reach along the north side of the GIWW from the intersection with the IHNC to the east side of the Michoud Canal is an area of heavy industry, commercial, auto scrap yards, and solid waste disposal sites. This work does not involve taking of any minority or low-income residential property. Therefore, this levee work would not exert direct impacts from the proposed alignment.

There would be some minor indirect environmental impacts associated with the construction activities at the reach. There could be temporary noise and air quality issues because of the construction equipment, material deliveries, and other construction activities. However, the conditions would become normal after the construction. This alternative would not be anticipated to create any environmental justice issues.

GIWW – South Side Reach

Due to the absence of human habitation in the vicinity of the reach along the south side of the GIWW to the MRGO near the Bayou Bienvenue Floodgate, this work will not exert direct impacts from the proposed alignment.

There would be some minor indirect impacts associated with the construction activities at the reach. There could be temporary noise and air quality issues because of the construction equipment, material deliveries, and other construction activities. However, the conditions would become normal after the construction. This action would not be anticipated to create any environmental justice issues.

IHNC – East Side & West Side Reaches
The vicinity of the reach along the east and west sides of the IHNC, from the Ted Hickey Bridge near Lake Pontchartrain to the IHNC lock near the Mississippi River, is an area of heavy industry and maritime interests on the flood side of the protection system with residential areas adjoining on the protected side. Because the enlargement of this HPS in this area would require an enlarged footprint, some homes could be impacted. These homes (as shown in Figure 22) comprise minority and low-income neighborhoods. Therefore, there is the potential for direct, adverse impacts associated with this alternative could create potential environmental justice issues.

Secondly, temporary construction related environmental pollution problems such as noise and air quality could impact significant minority and low-income population in nearby or adjacent communities that may pose indirect impacts, which could create potential environmental justice issues.

Cumulative Impacts. The impacts caused by the proposed action for this particular reach would have positive cumulative effect to protect low-income and minority individuals from flooding.

<u>*Borgne 2*</u>

Direct and Indirect Impacts on Environmental Justice. Due to the absence of human habitation in the vicinity of this location range, this alternate is not anticipated to exert direct or indirect impacts from either the installed alignment or temporary construction related environmental pollution issues. Therefore, this alternative would not be anticipated to create any environmental justice issues.

Cumulative Impacts. The impacts caused by the proposed action for this proposal would have positive cumulative effect on low-income and minority individuals by preventing flooding.

<u>*Borgne 3*</u>

Direct and Indirect Impacts on Environmental Justice. Due to the absence of human habitation near this work, this alternate is not anticipated to exert direct or indirect impacts from either the installed alignment or temporary construction related environmental pollution issues. Therefore, this alternative would not be anticipated to create any environmental justice issues.

Cumulative Impacts. The impacts caused by the proposed action for this proposal would have positive cumulative effect on low-income and minority individuals by preventing flooding.

<u>*Pontchartrain 1*</u>

Direct and Indirect Impacts on Environmental Justice. This alternative does not require any takings. Therefore, implementing the alternative would not result in direct, adverse

environmental justice impacts such as the taking of residences or businesses to construct the alignment. Because the project site is located in Lake Pontchartrain, this alternative is not anticipated to exert direct or indirect impacts from either the installed alignment or temporary construction related environmental pollution issues. Therefore, this alternative would not be anticipated to create any environmental justice issues.

Cumulative Impacts. The impacts caused by the proposed action for this proposal would have positive cumulative effect on low-income and minority individuals.

3.5 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The USACE is obligated under ER 1165-2-132 to assume responsibility for the reasonable identification and evaluation of all HTRW contamination within the vicinity of the proposed action. ER 1165-2-132 identifies CEMVN HTRW policy to avoid the use of project funds for HTRW removal and remediation activities. Costs for necessary special handling or remediation of wastes (e.g., Resource Conservation and Recovery Act [RCRA] regulated), pollutants, and other contaminants, which are not regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), will be treated as project costs if the requirement is the result of a validly promulgated Federal, state, or local regulation.

An ASTM International E 1527-05 Phase I Environmental Site Assessment (ESA) was completed for the project area(s). A copy of the Phase I ESA will be maintained on file at CEMVN. The Phase I ESA documented the Recognized Environmental Conditions (RECs) for the proposed project areas, and a Phase II was conducted to further analyze suspected contaminants. If a REC cannot be avoided, due to construction requirements, CEMVN may further investigate the REC to confirm the presence or absence of contaminants, and actions to avoid possible contaminants. Federal, state, or local coordination may be required. Because CEMVN plans to avoid RECs, the probability of encountering HTRW in the project area is low.

An ASTM E 1903-97 Phase II ESA was completed to further verify the nature of sediments at proposed construction footprint(s) of the closure gates in the proposed action area(s). The Phase I and Phase II ESAs referenced below will be maintained on file at CEMVN and are incorporated herein by reference. Copies of the reports are available by requesting them from CEMVN, or accessing them at www.nolaenvironmental.gov.

The following Phase I and Phase II ESAs were prepared for CEMVN in November 2006 (Phase I ESAs) and December 2007 (Phase II ESA) in accordance with ASTM International E 1527-05, ASTM E 1903-97 and USACE ER 1165-2-131 (Materials Management Group 2006a; b; c; 2007):

- Final Phase I ESA – Seabrook Site, New Orleans, Louisiana.

- Final Phase I ESA – GIWW and MRGO Option 1 Corridor (East of Michoud Canal and East of Bayou Bienvenue), New Orleans, Louisiana.

- Final Phase I ESA – GIWW and MRGO Option 2 Corridor (Chef Menteur Area and East of Bayou Dupre), New Orleans, Louisiana.

- Final Phase II ESA – Proposed Closure Structures – Seabrook, GIWW-MRGO, Michoud Slip, New Orleans, Louisiana.

These ESAs are located within the study area. Relevant and significant findings and recommendations are summarized below.

3.5.1 Final Phase I ESA – Seabrook Site, New Orleans, Louisiana

The site investigated under this ESA is located at the confluence of Lake Pontchartrain and the IHNC. Following the USEPA's All Appropriate Inquiry (AAI) and ASTM Phase 1 guidelines, there are no RECs identified at the site. It should be noted however that LDEQ required a residential deed restriction, due to the rupture of a used oil tank in 1998, on a property on the west bank of the IHNC.

3.5.2 Final Phase I ESA – Option 1 Corridor

The site investigated under this ESA includes locations of proposed gate east of the Michoud Canal and closure east of Bayou Bienvenue as well as the corridor connecting these two proposed gates. The Phase 1 ESA revealed one REC including five barges (with two sunken) located approximately 200 yards east of the Michoud Canal at the Borgne 1 proposed action area. At the time of site investigation in October 2006, one barge was surrounded by a boom. Any contamination associated with the barges at their location within the GIWW has been investigated and results are included in section 3.5.4.

3.5.3 Final Phase I ESA – Option 2 Corridor

The site investigated under this ESA includes locations of proposed gate at the Chef Menteur area along GIWW and closure at the Bayou Dupre along the MRGO. The site investigation also includes the corridor between Chef Menteur, and by following the USEPA's All Appropriate Inquiry (AAI) and ASTM Phase 1 guidelines, the ESA revealed no evidence of RECs that could potentially impact the study area.

3.5.4 Final Phase II ESA – Proposed Closure Structures – Seabrook, GIWW-MRGO, Michoud Slip

The possible construction sites of the proposed action(s) investigated under this ESA are: (a) at the confluence of the IHNC and Lake Pontchartrain (near Seabrook Bridge); (b) at the confluence of the MRGO and the GIWW (east of the Bayou Bienvenue-Michoud Canal corridor) as well as the former barge area near the Michoud Canal; and (c) east of the Michoud Slip. The phase II ESA investigated baseline conditions of the project area.

Based on sampling and testing of sediments collected from a total of 21 boring locations, if sediments at possible construction footprint(s) of the proposed action(s) or closure gates were excavated or dredged and subject to land management and disposal, only one location with unacceptable concentrations of contaminants was located. Two contaminants of concern (barium and lead) are present in the sediment above the LDEQ Risk Evaluation/Corrective Action Program (RECAP) standards at this one location in the canal at Seabrook (i.e.

Pontchartrain 2 proposed action). However, these results are below what is considered hazardous waste as defined by CFR 261.24 for barium (see:http://www.epa.gov/epaoswer/hazwaste/id/hwirwste/hwirprop.txt), and appears to be an isolated occurrence because concentrations of the same contaminants (i.e. barium and lead) in samples from adjacent sediment boring locations in the canal at Seabrook, including the Lake location (i.e. Pontchartrain 1 alternative location) are significantly lower. Concentrations of all other contaminants tested including but not limited to volatiles, semi-volatiles, PCB, herbicides and pesticides are below risk levels.

The Tier 2 NEPA document will further investigate alternative alignments within the selected location range of Pontchartrain 2 and Borgne 1 to avoid encountering any RECs and hazardous waste during construction activities. Based on the Phase 1 ESA reports of the project area(s) as well as the results of Phase II ESA verification sampling and testing, and because CEMVN plans to avoid RECs during any stage of the implementation of the proposed action, the probability of encountering HTRW in the project area is low.

4. CUMULATIVE IMPACTS

This section describes the cumulative impact analysis methodology, details the projects that comprise the past, present, and future actions considered in the analysis, and provides a summary of the cumulative impacts that were discussed in section 3.2.

4.1 METHODOLOGY

To successfully assess cumulative impacts, a broad range of activities and patterns of environmental changes that are occurring in the vicinity of the project were considered. The following items were guidelines for the cumulative impact analyses in this document.

- the proximity of the projects to each other either geographically or temporally.
- the probability of actions affecting the same environmental resource, especially systems that are susceptible to development pressures.
- the likelihood that the project will lead to a wide range of effects or lead to a number of associated projects.
- whether the effects of other projects are similar to those of the project under review.
- the likelihood that the project will occur.
- temporal aspects, such as the project being imminent (Klein and Kingsley 1994).

4.2 DESCRIPTIONS OF PROJECTS CONSIDERED

4.2.1 CEMVN HPS IERs

The Metropolitan New Orleans HPS is divided into three authorized project areas: LPV; West Bank and Vicinity (WBV); and New Orleans to Venice (NOV). The set of projects for

improved protection on the IHNC that is the subject of this analysis are located in the LPV; therefore, projects within the WBV and the NOV areas have not been included in the cumulative analyses because they are not within the geography of the study area and are not expected to cause an effect, cumulative or otherwise, on the majority of the significant resources addressed in IER #11. However, the WBV and NOV projects would be expected to have a cumulative effect on regional resources such as transportation networks, medical and other regional facilities, and the economy of the area.

CEMVN has proposed numerous projects to improve the LPV HPS to the 100-year level of hurricane protection. All of these 100-year level of hurricane protection projects are currently in the planning and design stages and impacts from these component projects will be addressed in separate IERs (figure 22). These projects all occur within the greater New Orleans area, within the Lake Pontchartrain Basin, and within the designated coastal zone for Louisiana, so these projects were considered collectively (as appropriate) for the evaluation of cumulative impacts.

Additionally, CEMVN is planning 2 large-scale mitigation IERs to plan mitigation for impacts caused by these hurricane protection projects as well as numerous IERs evaluating the impacts of borrow acquisition projects to support the LPV and WBS HPS projects.

A summary of the project features that fall within the Orleans East Bank, New Orleans East and Chalmette Loop sub-basins is provided below.

- **IER #4 - Lake Pontchartrain and Vicinity, Orleans East Bank, New Orleans Lakefront Levee, West of IHNC to East bank of 17th St. Canal, Orleans Parish, Louisiana** – investigates improvement of the levee, floodwall and Bayou St. John Sector Gate HPS extending from the 17th Street Canal to the IHNC.

- **IER #5 - Permanent Protection System for Outfall Canals, 17th Street Canal, Orleans Avenue Canal and London Avenue Canal, Orleans and Jefferson Parishes, Louisiana** – investigates a range of alternatives to protect Orleans and Jefferson Parish from storm surge induced flooding through the 17th Street, Orleans Avenue, and London Avenue Outfall Canals, while not impeding the ability of the area's internal drainage system to remove stormwater. The alternatives under evaluation include improvement of floodwalls along these canals to the 100-year level of protection or providing a closure structures and pump stations at or near Lake Pontchartrain. Some possible locations being considered for these pump stations could include construction in Lake Pontchartrain.

- **IER #6 - Lake Pontchartrain and Vicinity, New Orleans East, New Orleans Lakefront Levee to Citrus Lakefront Levee, N.O. Airport Floodwall to Paris Road, Orleans Parish, Louisiana** – investigates improvement of approximately 6 miles of levees, floodwalls, and floodgates that extend from the IHNC and the New Orleans Lakefront Airport east to Paris Road – locally known as the Citrus Lakefront. Foreshore protection enhancements along this reach could include the dredging of access channels in Lake Pontchartrain.

- **IER #7 - Lake Pontchartrain and Vicinity, New Orleans East, New Orleans East Lakefront Levee to New Orleans East Back Levee, Paris Road to East bank of Michoud Canal, Orleans Parish, Louisiana** – investigates improvement of approximately 19.3 miles of levee and three floodgates stretching from the New Orleans East Lakefront Levee to New Orleans East Back Levee – CSX Railroad to Michoud Canal. This portion of the LPV HPS encompasses a large portion of the Bayou Sauvage NWR. Alternative alignments under consideration include realignment along the Maxent Canal east of Bayou Sauvage NWR. The northern portion of this reach could include foreshore protection enhancements requiring dredged access channels in Lake Pontchartrain.

- **IER #8 - Lake Pontchartrain and Vicinity, Bayou Bienvenue and Bayou Dupre Control Structures, St. Bernard Parish, Louisiana** – involves improvement or replacement of the Bayou Bienvenue and Bayou Dupre Floodgates Alternatives under consideration include the construction of new structures on either the flood side or protected side of the existing floodgates.

- **IER #9 - Lake Pontchartrain and Vicinity, Caernarvon Floodwall, St. Bernard Parish, Louisiana** – evaluates a range of alignments as part of improvements to the Caernarvon floodwall. Depending on the chosen alignment there could be major impacts to infrastructure, residences, and wetlands; however, the proposed action alignment would seek to minimize these impacts.

- **IER #10 - Lake Pontchartrain and Vicinity, Chalmette Loop Levee, St. Bernard Parish, Louisiana** – evaluates alternatives for improving the Chalmette Loop HPS, including flood side and protected side shifts of the existing alignments. The CEMVN is also considering improvement of the non-Federal, or Forty Arpent Canal, levee in lieu of raising the existing Federal levee along the MRGO.

- **IER #18 - Government Furnished Borrow Material, Jefferson, Orleans, Plaquemines, St. Charles and St. Bernard Parishes, Louisiana and IER 19 - Contractor Furnished Borrow Material, Jefferson, Orleans, St. Bernard, Iberville, and Plaquemines Parishes, Louisiana, and Hancock County, Mississippi** - Two borrow IERs are currently under evaluation by the CEMVN. The purpose of these two IERs is to identify borrow areas that contain suitable material that can be excavated to supply clay material to Federal HPS levee and floodwall projects.

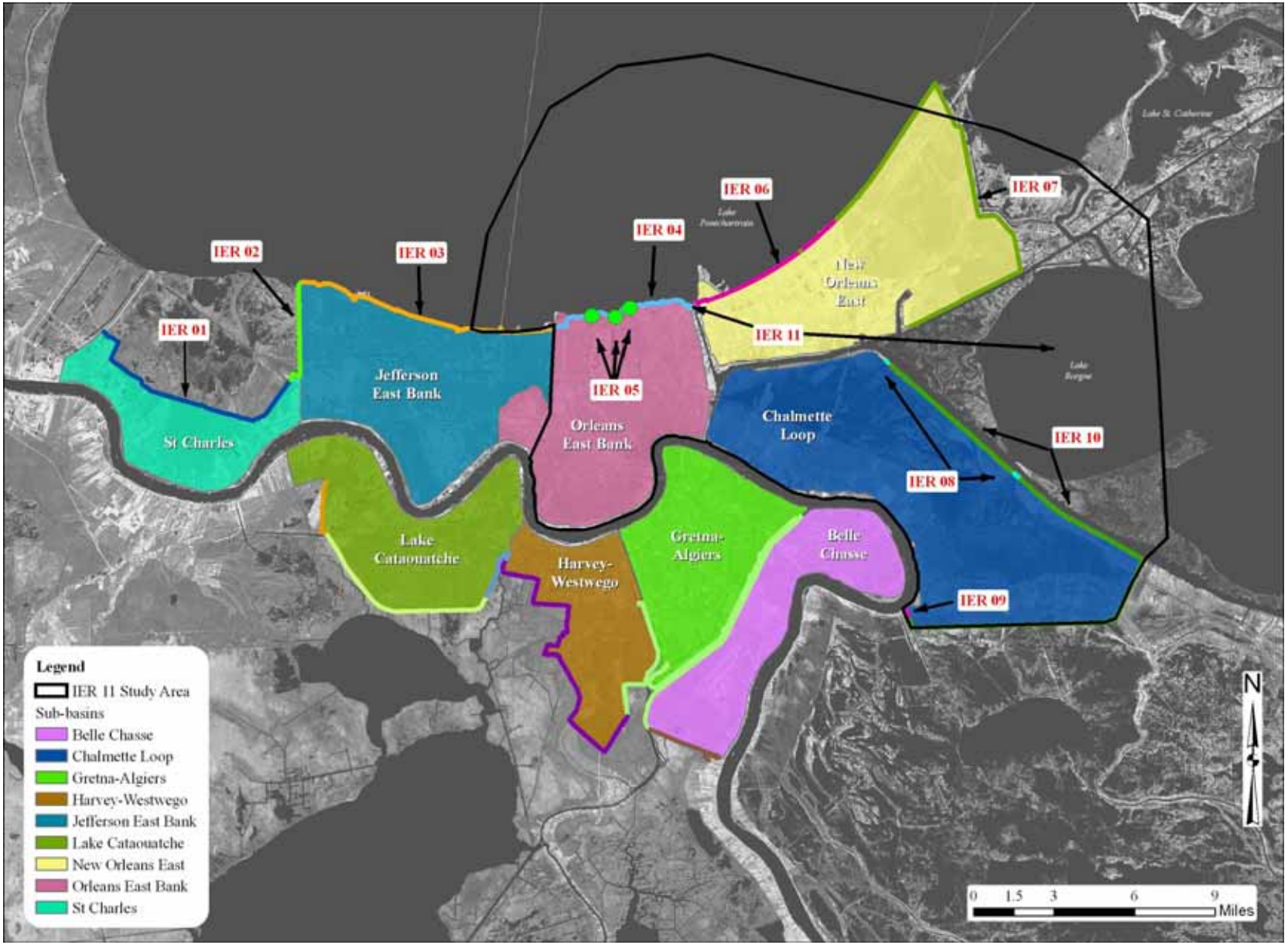

Figure 22 –CEMVN Proposed LPV IER Project Locations.
Source: www.nolaenvironmental.com

- **IER #20 - Lake Pontchartrain and Vicinity Hurricane Protection Project– Mitigation: Manchac Wildlife Management Area Shoreline Protection Modification, St. John the Baptist Parish, Louisiana**. This mitigation IER will be completed when unavoidable impacts are identified within the study area from the resulting actions of the aforementioned IERs 4 – 10, as well as IER 11.

4.2.2 Other CEMVN-Sponsored Projects

The LACPR effort involves comprehensive planning for protection and restoration for all of coastal Louisiana. The study is evaluating a number of projects and alternatives but none have yet been authorized or funded. The CEMVN has also produced a Legislative Environmental Impact Statement (LEIS) to address the deauthorization of the MRGO channel. The replacement of the lock structure at the IHNC and integration of the new lock structure into the flood protection system are some of the CEMVN projects still in the planning stages.

4.2.2.1 Mississippi River Gulf Outlet and Lake Borgne Wetland Creation and Shoreline Stabilization

These measures are being developed to meet the Congressional directive to construct or repair measures to protect, restore or increase wetlands, to prevent saltwater instruction or storm surge under the heading "Operation and Maintenance" in Title I, Chapter 3 of Division B of Public Law 109-148, as modified by Section 2304 in Title II, Chapter 3 of Public Law 109-234. Two projects are currently under construction, and an Environmental Impact Statement is currently being developed for the remainder of the proposed work. One of the projects under construction provides a breakwater along the southern Lake Borgne shoreline from Doullut's Canal to Jahnke's Ditch. The second project under construction involves foreshore protection along the north bank of the MRGO between river miles 39.9 and 44.4. Future projects could involve wetland creation through the placement of material dredged from the water bottoms of Lake Borgne and the construction of retention dikes, where needed, to contain the hydraulically dredged material and facilitate stacking to an elevation supportive of wetland vegetation while minimizing adverse impacts to water quality. If required, material for retention dikes will be obtained from within the wetland creation cell so that the dredged slurry could refill those borrow areas. In areas where retention will not be necessary, material will be allowed to flow into and over existing fragmented wetlands to provide nourishment. The acreage of wetlands to be created and nourished varies from site to site, and within sites, depending upon other alternative features. Several shoreline protection features considered include vegetative plantings along the shoreline and placement of rock or other material either directly on the shoreline or immediately offshore. Shoreline protection features considered for the preliminary screening were designed to provide effective stabilization of the existing Lake Borgne and MRGO shorelines.

4.2.2.2 IHNC Lock Replacement Project

The IHNC Lock Replacement Project is currently being reevaluated. If authorized and approved for construction, the project would be located in New Orleans, Louisiana, within the IHNC, which is often referred to locally as the Industrial Canal. The lock is projected to

be replaced with a larger, more modern lock because the existing lock is too small and causes delays to inland navigation traffic such as barges and towboats. The IHNC is one of the nation's most congested canals with average delays in transiting the lock of 10 hours that have often extended from 24 to 36 hours. This project would provide an increase in lock chamber capacity almost three fold larger than the old lock's capacity (USACE 2007i).

4.2.2.3 Task Force Guardian Repairs to Levees and Floodwalls

Existing levees and floodwalls that were damaged by Hurricane Katrina have since been repaired. Repairs within the vicinity of this project include:

- Replacement of approximately 4,000 linear feet of concrete I-wall flood barrier along the east side of the IHNC between North Claiborne Avenue and Florida Avenue with a concrete T-wall, supported on H-piles and sheet piling.

- Removal of approximately 1,300 linear feet of the damaged concrete I-wall along France Road and replacement of the damaged section of wall with new concrete L-wall. The new wall is supported by steel H-piles and longer steel sheet piles.

- Replacement of the existing levee and concrete floodwall that extends from the vicinity of the France Road ramp toward the IHNC with a new concrete T-wall.

4.2.2.4 Mississippi River Gulf Outlet Deep-Draft Deauthorization

This project has evaluated potential modifications to the current uses of the MRGO with the intent of determining if any uses should be maintained. The evaluation included information presented in stakeholder meetings, data gathered through a maritime business survey, and government statistics of annual channel utilization. Based on the process outlined previously, several options were identified for development of the MRGO Deep-Draft Deauthorization Plan with the selected alternative being a complete closure of the channel with a rock plug at the Bayou La Loutre Ridge. WRDA 07 provided for the deauthorization of the MRGO, and CEMVN has proposed the construction of a rock dike, or "plug" on the channel at Bayou La Loutre. A Legislative EIS has been completed for this proposed project, and its construction has been authorized in the WRDA, although a final Record of Decision has not yet been signed. The MRGO will be officially deauthorized upon the submittal of the MRGO Deauthorization Chief's Report to Congress..

4.2.3 Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) program projects

CEMVN as well as other Federal and state agencies participate in coastal restoration projects through the CWPPRA, also known as the Breaux Act. These are specific prioritized restoration projects implemented coast-wide by LDNR, Coastal Restoration Division in cooperation with Federal agencies. Within the Lake Pontchartrain Basin there are 14 projects proposed, constructed, or authorized for construction under CWPPRA that are designed to restore, enhance or build, and prevent erosion of marsh habitat. The CWPPRA process involves implementation of numerous protection and restoration techniques, including rock armored shoreline protection breakwaters, dredge material marsh construction, marsh

terracing and planting, freshwater and sediment diversion projects, and modification or management of existing structures (Green 2006).

- **MRGO Disposal Area Marsh Protection, St. Bernard Parish** – The objective of this project is to protect and preserve vegetated wetlands by repairing the lateral and rear dikes of the MRGO disposal areas. Repairs to a 28,000-linear-foot dike, in conjunction with the installation of metal box weirs with a single 40-inch pipe, are used to control and divert water flow to prevent the perched marshes from draining. Construction of this project was completed in 1999 with the number of acres benefited approximated at 755.
- **Bayou Chevee Shoreline Protection, Orleans Parish** – The project is designed to protect currently exposed wetland areas from erosive wave energy from Lake Pontchartrain and to enhance the establishment of SAV in the ponds behind the rock dikes. This is accomplished by constructing a 2,870-linear-foot rock dike across the mouth of the north cove of Bayou Chevee and a 2,820-linear-foot rock dike, tying into an existing USFWS rock dike, across the south cove. Construction of this project was completed in 2001 with the number of acres benefited approximated at 75.
- **Bayou Sauvage NWR Hydrologic Restoration, Phase 1, Orleans Parish** – The Lake Pontchartrain hurricane protection levee isolated Units 3 and 4 of the Bayou Sauvage NWR from the surrounding marsh complex and established a large freshwater impoundment. The project utilizes pumps to remove the excess water during the spring and summer. Construction of this project was completed in 1996 with the number of acres benefited approximated at 1,550.
- **Bayou Sauvage NWR Hydrologic Restoration, Phase 2, Orleans Parish** – The hurricane protection levee system has impounded the marsh in the project area. The project increases the drainage capacity of the system to reduce water levels in the project area. Project features consist of two 36-inch pumps that operate to maintain water levels at 0.5 foot above or below marsh elevation. Construction of this project was completed in 1997 with the number of acres benefited approximated at 1,280.
- **Hopedale Hydrologic Restoration, St. Bernard Parish** – This project is designed to abate site-specific wetland loss by replacing collapsed culverts installed in the 1950s near Yscloskey, Louisiana. The project involves refurbishment and construction of a water control structure designed to prevent tidal surges and reduce wetland deterioration within the project site. Replacement of this structure would allow more rapid drainage of the area, improve fisheries access, reduce wetland loss rates, and protect approximately 3,086 acres of marsh. A claim was submitted to FEMA to repair damage to this project caused by Hurricane Katrina. The claim has been approved. Construction of this project was completed in 2004 with the number of acres benefited approximated at 134.
- **Chandeleur Islands Marsh Restoration, St. Bernard Parish** – This project is intended to accelerate the recovery period of barrier island areas overwashed by Hurricane Georges in 1998 through vegetation plantings. The overwash areas, which encompass 364 acres, are located at 22 sites along the Chandeleur Sound side of the island chain and were planted with smooth cordgrass (*Spartina alterniflora*). Construction of this project was completed in 2001 with the number of acres benefited approximated at 220.

4.2.4 Other Agency Projects

Although the CEMVN is not the Federal sponsor for the following projects, they are one of the Federal partners or a cooperating agency.

- **Proposed Violet Canal Freshwater Diversion Enhancements** – WRDA 2007 calls for the design and implementation of a freshwater diversion project near Violet, Louisiana that would reduce salinities in the Western Mississippi Sound, with further goals of enhancing oyster production and promoting coastal wetland sustainability. Previous feasibility studies regarding this issue have proposed the enlargement of the Violet Canal or construction of another canal to convey water from the Mississippi River into the Central Wetlands. A large-scale freshwater diversion project in the vicinity of Violet could greatly increase fine sediment transport and deposition into the marshes located between the Mississippi River and the MRGO. It is unlikely that sediments would be transported across the MRGO into Lake Borgne and the Biloxi Marshes because the deep water MRGO would trap most of these sediments.

  The introduction of large volumes of freshwater from the Mississippi River could substantially lower salinity in the Central Wetlands. Some freshwater from a diversion near Violet would likely cross the more dense saline waters of the MRGO and reduce salinity in Lake Borgne and the Biloxi Marshes. Coastal marsh vegetation to the east of the diversion could greatly benefit from the influence of freshwater, sediment, and nutrients. Some new marsh creation and reduction of future wetlands loss could occur as a result of the freshwater diversion. However, the construction of a conveyance channel would cause direct loss of coastal wetlands.

  A hydrodynamic and salinity modeling assessment of freshwater diversions at Violet with MRGO modifications was conducted by Georgiou et al. (2007) with the focus of the study on the response of salinity in Lake Borgne, the Biloxi Marshes, and the Mississippi, Chandeleur, and Breton Sounds.

  Diversion ranges of 5,000 to 15,000 cubic feet per second were investigated using the unstructured 3-D Finite Volume Coastal Ocean Model. Model runs simulated spring discharge conditions with representative tides and tributary flows that correspond to the time when the Mississippi River is at maximum annual stage, thus providing the greatest potential hydraulic gradient and highest flow through a given structure.

  A base condition simulating existing conditions with no diversion was compared to diversion flow ranges. In all of the diversion scenarios, the MRGO was constricted by approximately 90 percent at a location near Bayou La Loutre. Theoretical response times of Lake Borgne for the 5,000, 10,000, and 15,000 cfs diversion flows were 4, 2, and 1.3 months, respectively. The corresponding response times for Lake Pontchartrain for the same diversions at the Bonnet Carré are 16, 8, and 5 months. Model simulations show that saltwater inflow along the channel and into Lake Borgne was significantly reduced when MRGO is constricted.

Secondly, diversions in the range of 10,000 to 15,000 cfs were effective in lowering the mean salinity in the Biloxi Marsh area by 3 to 5 ppt after 60 days of the effective flow diversion. The influx of fresh water via the Violet Canal shifted the mean 10 and 15 ppt isohalines toward the Gulf of Mexico by approximately 12 miles (20 km). The model results indicate that modification of the MRGO and the introduction of freshwater at the Violet Diversion can significantly change the present salinity regime in Lake Borgne and eastern Lake Pontchartrain.

The simulations did not include wind shear, atmospheric pressure, or Gulf of Mexico water fluctuations, none of which would tend to increase mixing in the Estuary, resulting in short-term upstream and seaward translations of the isohalines. The study also did not address availability of head in the Mississippi River for the diversion flows used in the simulations. The model domain did not include the interior wetlands, and therefore it does not address hydro-periods and flooding of the interior Violet wetlands and associated benefits/impacts. No attempt was made in this study to assess the environmental impacts of introducing Mississippi River water to Lake Borgne via the Violet Diversion.

- **Florida Avenue Bridge and Expressway Project** – This project is planned to provide access between Paris Road in St. Bernard Parish and Orleans Parish across the IHNC. This project includes a four-lane, high-level bridge constructed over the IHNC, a two-lane elevated bridge section built 10 feet above open water outside the St. Bernard back levee, and a four-lane roadway section built to grade connecting the two bridges. Construction of this expressway is scheduled for completion in 2011.
- **Lake Borgne Shoreline Protection (PO-30/31)** – The Lake Borgne Shoreline Protection (PO-30) project is located in St. Bernard Parish. The project is the result of merging two separate CWPPRA projects located at Shell Beach (PO-30) and at Bayou Dupre (PO-31) and is adjacent to the CEMVN-sponsored MRGO-Lake Borgne Wetland Creation and Shoreline Stabilization project discussed in section 4.2.2.1. The two projects were combined into one concerted effort to maintain the integrity of the narrow strip of marsh that separates Lake Borgne from the MRGO, halt direct marsh loss, restore saline marsh habitat, re-establish a sustainable lake rim, and enhance fish and wildlife habitat. The project is not expected to cause adverse environmental impacts requiring compensatory mitigation. This project was approved for construction in 2005 with the number of acres benefited approximated at 167.
- **Violet Siphon Diversion, St. Bernard Parish, Fresh Water Diversion (State)** – The purpose of this project is to return into operation the existing siphon and to enlarge the size of the diversion so that more sediment and fresh water are available to offset marsh subsidence and saltwater intrusion. A claim has been submitted to FEMA to repair damage to this project caused by Hurricane Katrina. Construction of this project was completed in 1992 with the number of acres benefited approximated at 84.
- **Bayou Chevee, Orleans Parish, Shoreline Protection (State)** - This project installed 2,000 feet of brush fences at the mouth of Bayou Chevee. Construction of this project was completed in 1994 with the number of acres benefited approximated at 75.

- **Central Wetlands Pump Outfall, St. Bernard Parish, Fresh Water Diversion (State)** - This project was designed to provide freshwater, nutrients, and sediment associated with storm water runoff to an area of marsh near the Violet Siphon (PO-01). Construction of this project was completed in 1992 with the number of acres benefited approximated at 300.
- **Crab Pond, Orleans Parish, Shoreline Protection (Parish Coastal Wetlands Restoration Program [PCWRP])** – The Crab Pond, an open-water area adjacent to Chef Menteur Pass, is located within the Bayou Sauvage NWR. Christmas tree fences were constructed to prevent Chef Menteur Pass from eroding farther into the Crab Pond. The brush fences at the Crab Pond were either destroyed as a result of the 2005 hurricanes or later removed because of hurricane damage. Fences were originally constructed and filled in 1991, and maintenance was performed in 1994 and 1997 benefiting 1 acre of land.
- **Blind Lagoon, Orleans Parish, Shoreline Protection (PCWRP)** – Christmas tree fences were placed in a wind-row manner to trap sediment and provide wildlife habitat in the Bayou Sauvage NWR. Fences were originally constructed and filled in 2000, and maintenance was performed in 2001, 2004, 2005, and 2006 with the number of acres benefited approximated at 9.
- **Bayou Bienvenue, Shoreline Protection (PCWRP)** – Approximately 400 feet of brush fence were constructed in 2001 to the southwest of Bayou Gauche to slow tidal-influenced water exchange, trap sediment, and protect vegetation along Bayou Bienvenue with the number of acres benefited approximated at 1. Maintenance was performed in 2002 and 2004.
- **MRGO, St. Bernard Parish, Vegetation Planting (Vegetation)** – A total of 1,500 one-gallon containers of smooth cordgrass were used along the MRGO in order to create marsh and to provide shoreline protection along Bayou Dupre. Construction of this project was completed in 1995 with the number of acres benefited approximated at 17.
- **Bayou Bienvenue, St. Bernard Parish, Vegetation Planting (Vegetation)** – A total of 430 "trade"[10] gallons of black mangrove trees and 688 trade gallons of smooth cordgrass were used on Bayou Bienvenue along the levee and along an interior borrow canal in order to decrease shoreline erosion. Construction of this project was completed in 1996 with the number of acres benefited approximated at 13.
- **St. Bernard Wetlands Foundation, St. Bernard Parish, Vegetation Planting (Vegetation)** – A total of 150 feet of coconut fiber mats impregnated with smooth cordgrass were planted to demonstrate the effectiveness of coconut fiber materials in a saline marsh. Construction of this project was completed in 2004 with the number of acres benefited approximated at 1.

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[10]A trade gallon is a term used to denote the sizes of standard plant containers in horticultural industries. A trade gallon is equal to approximately 0.71 liquid gallon.

- **MRGO 06, St. Bernard Parish, Vegetation Planting (Vegetation)** – A total of 1,200 smooth cordgrass plugs were planted along 3,000 feet of interior marsh to vegetate newly deposited dredged material. Construction of this project was completed in 2006 with the number of acres benefited approximated at 3.
- **MRGO (1999), Mile 14 to 11**, **St. Bernard Parish, Beneficial Use of Dredge Material (Section 204/1135)** – This project provided for the unconfined placement of 3,468,901 cubic yards of material into shallow water adjacent to the south jetty at about mile 15.3. The material was dredged from miles 14.0 to 11.0 of the MRGO navigation channel and placed to an elevation conducive to marsh vegetation establishment. Construction of this project was completed in 1999 with the number of acres benefited approximated at 50.
- **MRGO, Mile 14 to 12 (2002)**, **St. Bernard Parish, Beneficial Use of Dredge Material (Section 204/1135)** – The project involved pumping approximately 1.6 million cubic yards to create some 50 acres of marsh behind the MRGO jetty. This project was fast tracked due to the impact of Hurricane Lili and Tropical Storm Isidore. Construction of this project was completed in 2002 with the number of acres benefited approximated at 50.
- **MRGO, Mile 14 to 12 (2003)**, **St. Bernard Parish, Beneficial Use of Dredge Material (Section 204/1135)** – This project involved pumping 4.3 million cubic yards of sediments to create 113 acres of marsh. The material was dredged from miles 14.0 to 12.0 of the MRGO navigation channel and placed at an elevation conducive to marsh vegetation establishment. Construction of this project was completed in 2003 with the number of acres benefited approximated at 113.

4.3 SUMMARY OF CUMULATIVE IMPACTS

This analysis was meant to establish the magnitude and significance of cumulative impacts by comparing the existing environment with the expected impacts of the alternative considered in the proposed action when combined with the impacts of other proximate actions.

The primary hydrologic impact of the HPS projects is that low-lying areas on the protected side of the HPS would experience reduced storm surge inundation impacts. The MRGO and Lake Borgne Wetland Creation and Shoreline Stabilization Project would alter sheet flows from Lake Borgne into adjacent emergent wetlands with minimal impact to existing natural channels. Additionally, foreshore protection measures on Lake Pontchartrain, Lake Borgne, and the MRGO are expected to reduce erosion in those vicinities and could encourage some sediment deposition in those areas.

The Violet Canal Freshwater Diversion is the only project expected to have a significant effect on the large-scale water quality conditions in the study area through increased fine sediment transport and deposition into the marshes located between the Mississippi River and the MRGO, substantially lowering salinity in the Central Wetlands. Some of the fresh water from the diversion would likely cross the more dense saline waters of the MRGO and potentially reduce salinity in Lake Borgne and the Biloxi Marshes but it is not expected that

these benefits will result in observable large-scale improvements in water quality parameters in those marshes.

Construction of levees, gates, and onshore breakwaters could cause direct marsh, upland, and terrestrial habitat loss. However, the opportunity to beneficially use dredged material from access channels to create marsh or as nourishment for nearby marshes could mitigate the damages from construction. Introduction of fresh nutrient-rich and sediment-laden water from the Mississippi River along with proper operation of gates on the IHNC and GIWW and plugging the MRGO could potentially offset some salinity damage and increase biological productivity within the study area thus minimizing losses due to construction activities.

Shoreline stabilization measures could alter existing shoreline habitat and block access to interior wetlands. Impacts to EFH could occur as a result of construction activities and access dredging but should return to pre-construction levels once those activities have ceased. Marsh areas with greater heterogeneity and interspersion and lower salinity levels could be a byproduct of implementing the Violet Canal Freshwater Diversion, MRGO-Lake Borgne Wetland Creation and Shoreline Protection projects and the MRGO deauthorization closure structure, and could greatly benefit all wildlife resources in the long-term.

Cumulative adverse impacts to human populations within the study area are not expected to be permanent; however, there would be temporary adverse impacts from the increased traffic, detours, road closures, and noise associated with construction activities that could occur 24 hours a day, seven days a week for several years. It is expected that the temporary cumulative impacts to social and community facilities would result in permanent benefits because the threat to flood-prone areas would be reduced by the increased flood protection provided by area projects. Construction of these projects could cause temporary and localized decreases in air quality that would mainly result from the emissions of construction equipment during dredging and construction but should return to pre-construction conditions shortly after construction completion. The proposed actions are not anticipated to have any impacts on the presence of HTRW in the study area. The accumulated projects would provide long-term and sustainable beneficial impacts to the communities within the study area by reducing the risk of damage within flood-prone areas and by generating economic growth that could attract displaced residents and new workers, and encourage repopulation within the New Orleans metropolitan area.

5. SELECTION RATIONALE

The proposed action, construction of storm surge protection structures, is the alternative most responsive to the project's purpose and need. It is an effective engineering solution that minimizes uncertainty and risk to acceptable levels in a reasonable period of time. It is economically efficient, balancing costs and impacts among significant resources, making it environmentally and socially acceptable. In addition, the selection process considers a sequencing process of avoidance, minimization, and mitigation, so that any and all adverse impacts to significant resources are reduced to the maximum extent practicable. Finally, the

proposed action is compatible and works in concert with other projects that have been completed, are in progress, or will be implemented to improve the damage reduction provided by the HPS.

Within the proposed action, several alternate location ranges for protective structural barriers were considered. The Borgne 1 location range was selected because it provides opportunities to protect Michoud Canal and Bayou Bienvenue while minimizing impacts to the Lake Borgne wetlands complex. Furthermore, the Borgne 1 location range has a greater potential than Borgne 2 for investigation of alternative alignments to further seek to avoid or minimize impacts to wetlands in the Tier 2 NEPA document. The Borgne 2 location range would involve more extensive impacts to the wetlands complex without providing additional protection benefits. The Borgne 3 location range is not a complete solution and would have to be augmented with other structures within one of the other location ranges, although at a reduced scale. Furthermore, its potential impacts to Gulf sturgeon critical habitat was deemed unacceptable.

The Pontchartrain 2 location range was chosen over the Pontchartrain 1 range because constructing a protective barrier at this location would avoid unfavorable foundation conditions and likely impacts to Gulf sturgeon critical habitat.

The no-action alternative does not meet the project's purpose and need of providing the 100-year level of hurricane protection to the sub-basins. Therefore, it did not compare favorably with the proposed action, which is a reliable, stand-alone solution to 100-year protection in the study area.

The Raise Existing HPS to 100-Year Level of Protection Alternative would meet the project's purpose and need and it is compatible with other proposals to improve the damage reduction provided by the HPS. However, the expanded levees and floodwalls impact numerous homes and businesses and, despite using stricter design standards, this alternative would still be subject to subsidence and sporadic damage from storm surges. Therefore, the damage reduction provided by raising levees and floodwalls would continue to be undermined, raising the level of risk and uncertainty as time passes, with catastrophic consequences if any of the structures failed. Therefore, providing structural barriers as a first line of defense to protect the existing levee/floodwall system from storm surge damage is the preferred alternative.

Table 12 summarizes the alternatives considered in detail and their respective impacts to each significant resource in the project study area.

6. COORDINATION AND CONSULTATION

6.1 PUBLIC INVOLVEMENT

Extensive public input has been sought in preparing this report. The proposed action analyzed in this IER was publicly introduced in the Federal Register on 13 March 2007 and further described on the website www.nolaenvironmental.gov. As they were developed, alternatives to the proposed action were made public on the website and through the public

meeting process. Scoping for this project was initiated on 12 March 2007 through placing advertisements and public notices in USA Today and The New Orleans Times-Picayune. Nine public scoping meetings were held between 27 March and 12 April 2007 throughout the New Orleans Metropolitan Area to explain the NEPA process and the Alternative Arrangements for implementing it. After the scoping meetings, a 30-day period was open for public comment submission. Since then, CEMVN has been hosting monthly public meetings to keep the stakeholders advised of project status. The public is able to provide verbal comments during the meetings and written comments after each meeting in person, by mail, and via www.nolaenvironmental.gov.

Table 12 – Impacts to Significant Resources.

Significant Resource	No-action	Raise Levees and Floodwalls	Storm Surge Protection Structures				
			Pontchartrain		Borgne		
			1	2	1	2	3
Hydrology	Minimal beneficial.	Substantially beneficial.	Substantially beneficial/ Negligible adverse	Substantially beneficial/ Negligible adverse	Substantially beneficial/ Minimal adverse.	Substantially beneficial/ Substantial adverse.	Minimal beneficial/ Minimal adverse.
Water Quality	Insignificant	Insignificant	Minimal adverse	Negligible adverse	Minimal adverse	Minimal adverse	Minimal beneficial/ Negligible adverse
Wetlands (Marsh)	Negligible adverse	Negligible adverse	No effect	No effect	Negligible beneficial/ Substantial adverse	Negligible beneficial/ Substantial adverse	No effect
Marsh lost	*10 acres*	*10 acres*	*0 acres*	*0 acres*	*Up to 346 acres*	*Up to 844 acres*	*0 acres*
Wetlands (Bottomland Forest)	Minimal adverse	Minimal beneficial/ Substantial adverse	Minimal beneficial	Minimal beneficial	Minimal beneficial/ Minimal adverse	Minimal beneficial/ Minimal adverse	
Bottomland forest lost	*75 acres*	*200 acres*	*0 acres*	*Up to 39 acres*	*Up to 39 acres*	*0 acres*	*0 acres*
Wetlands (Cypress Tupelo)	No effect	Minimal beneficial	Minimal beneficial	Minimal beneficial	Minimal beneficial	Minimal beneficial	No effect

Significant Resource	No-action	Raise Levees and Floodwalls	Storm Surge Protection Structures				
			Pontchartrain		Borgne		
			1	2	1	2	3
Cypress-tupelo lost	*0 acres*	*0 acres*	*0 acres*	*0 acres*	*0 acres*	*0 acres*	*0 acres*
Aquatic	Insignificant.	Insignificant.	Negligible adverse	Insignificant adverse	Minimal adverse	Minimal adverse	Minimal adverse
Open water habitat lost	*0 acres*	*0 acres*	*76 acres*	*5 acres*	*Up to 296 acres*	*Up to 320 acres*	*Up to 153 acres*
Fisheries and Essential Fish Habitat (EFH)	Insignificant	Insignificant	Negligible adverse	Insignificant adverse	Negligible beneficial/ substantial adverse	Negligible beneficial/ substantial adverse	Negligible beneficial/ substantial adverse
Essential Fish Habitat lost	*0 acres*	*0 acres*	*Up to 202 acres open water/ benthic habitat*	*Up to 5 acres open water/ benthic habitat*	*Up to 346 acres marsh; up to 296 acres mud bottom/open water*	*Up to 844 acres marsh; up to 320 acres mud bottom/open water*	*Up 153 acres mud bottom/open water; 100 acres oyster bed*
Terrestrial and Upland	Minimal adverse	Minimal beneficial/ Substantial adverse	Minimal beneficial/ Insignificant adverse	Minimal beneficial/ Insignificant adverse	Minimal beneficial/ Negligible adverse	Minimal beneficial/ Negligible adverse	No effect
Acreage lost	*100 acres upland scrub-shrub*	*300 acres scrub-shrub; 250 acres urban area*	*0 acres*	*0 acres*	*Up to 56 acres upland scrub-shrub lost*	*Up to 56 acres upland scrub-shrub lost*	*0 acres*
Wildlife	Minimal adverse	Substantial adverse	Insignificant	Insignificant	Minimal adverse	Substantial adverse	Insignificant

Significant Resource	No-action	Raise Levees and Floodwalls	Storm Surge Protection Structures				
			Pontchartrain		Borgne		
			1	2	1	2	3
Threatened and Endangered Species	No effect	No effect	Minimal adverse	Insignificant	Insignificant	Insignificant	Substantial adverse
Recreation	Negligible beneficial / Minimal adverse	Substantial beneficial /Minimal adverse	Negligible beneficial/ Minimal adverse	Negligible beneficial / Negligible adverse	Negligible beneficial / Negligible adverse	Negligible beneficial / Minimal adverse	Minimal beneficial / Negligible adverse
Noise	Minimal adverse	Minimal adverse	Minimal adverse	Minimal adverse	Minimal adverse	Insignificant	Insignificant
Air Quality	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Aesthetics	Insignificant	Insignificant	Negligible adverse	Insignificant	Minimal adverse	Substantial adverse	Insignificant
Cultural Resources	No effect	Substantial beneficial/ Minimal adverse	Substantial beneficial	Substantial beneficial/	Substantial beneficial/ Negligible adverse	Substantial beneficial/ Substantial adverse	Negligible beneficial/ Substantial adverse
Human and Economic	Substantial adverse	Substantial beneficial/ Substantial adverse	Substantial beneficial/ Insignificant adverse	Substantial beneficial/ Negligible adverse	Substantial beneficial/ Negligible adverse.	Substantial beneficial/ Insignificant adverse	Negligible beneficial/ Insignificant adverse
Environmental Justice	Substantial adverse	Substantial beneficial/ Minimal adverse	Substantial beneficial	Substantial beneficial/ Minimal adverse	Substantial beneficial	Substantial beneficial	Negligible beneficial

Significant Resource	No-action	Raise Levees and Floodwalls	Storm Surge Protection Structures				
			Pontchartrain		Borgne		
			1	2	1	2	3
Hazardous, Toxic, and Radioactive Waste	Low risk of encountering.	Low risk of encountering.	Low risk of encountering.	Low risk of encountering.	Low risk of encountering.	Low risk of encountering.	Low risk of encountering.

6.2 AGENCY COORDINATION

Preparation of this IER has been coordinated with appropriate congressional, Federal, state, and local interests, as well as environmental groups and other interested parties. An interagency environmental team was established for this project in which Federal and state agency staff played an integral part in the project planning and alternative analysis phases of the project (members of this team are listed in appendix D). This interagency environmental team was integrated with the CEMVN PDT to assist in the planning of this project and to consider mitigation needs resulting from the potential direct and indirect impacts of the proposed action. Monthly meetings with resource agencies were also held concerning this and other CEMVN IER projects. Coordination activities associated with satisfying the requirements of specific environmental protection statutes presented below cannot be finalized until a detailed project description is developed by the proposed action's design-build project delivery contractor. The project's Tier 2 NEPA compliance document will address the compliance requirements identified by ongoing coordination. The following agencies, as well as other interested parties, are receiving copies of this draft IER:

U.S. Department of the Interior, Fish and Wildlife Service

U.S. Department of the Interior, National Park Service

U.S. Environmental Protection Agency, Region 6

U.S. Department of Commerce, NOAA National Marine Fisheries Service

U.S. Department of Agriculture, Natural Resources Conservation Service

Louisiana Advisory Council on Historic Preservation

Governor's Executive Assistant for Coastal Activities

Louisiana Department of Wildlife and Fisheries

Louisiana Department of Natural Resources, Coastal Management Division

Louisiana Department of Natural Resources, Coastal Restoration Division

Louisiana Department of Environmental Quality

Louisiana State Historic Preservation Officer

The USFWS has reviewed the proposed action and in a letter dated December 6, 2007, concurred with CEMVN's determination that the proposed action is not likely to adversely affect the brown pelican. Because of manatee protective measures included in the CEMVN's construction contracts, the USFWS also concurs that the construction of the proposed project features in IERs #5-#11are not likely to adversely affect the manatee.

NOAA NMFS is currently reviewing the proposed action. CEMVN found that the proposed action would not adversely affect the Gulf sturgeon or its critical habitat and anticipates concurrence with this finding prior to completion of the Tier 2 NEPA document.

In compliance with the Coastal Zone Management Act, CEMVN has coordinated with LDNR for consistency with the Louisiana Coastal Resource Program (LCRP). CEMVN has submitted a draft Phased Consistency Determination on the proposed action described in this IER. LDNR responded by email dated 25 January 08 that it meets the requirements for a Phased Consistency Determination application as described in 15 CFR Section 930.36 (d). Coordination will continue until the second tier concept that includes more detailed design information, alternatives, and specific footprint impact data is available.

Water Quality and Air Quality certifications will be applied for with LDEQ once the design-build project delivery contractor has designed the project to the point where it can be further described in the Tier 2 NEPA document. A decision on these two certifications will be made by LDEQ at that time.

Section 106 of the National Historic Preservation Act, as amended, requires consultation with the Louisiana SHPO and Native American tribes. When a more detailed project description is available from the design-build project delivery contractor, the SHPO will review the proposed action and determine its potential effect on cultural resources. Eleven Federally recognized tribes that have an interest in the region will be given the opportunity to review the proposed action.

The USFWS reviewed the proposed action in accordance with the Fish and Wildlife Coordination Act (FWCA) and provided programmatic recommendations, in accordance with the Fish and Wildlife Coordination Act (FWCA), in the "Draft Fish and Wildlife Coordination Act Report for the Individual Environmental Reports (IER), Public Law 109-234, Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (Supplemental 4)" in November 2007. The uncertainties in the project design prohibit a complete evaluation of the impacts to fish and wildlife species and the reporting responsibilities under Section 2(b) of the FWCA (48 Stat. 401, as amended: 16 U.S.C. 661 et seq.). Therefore, a subsequent final supplemental report will be provided by the USFWS during the Tier 2 NEPA document process.

The USFWS programmatic recommendations applicable to providing improved protection on the IHNC will be incorporated into project design studies to the extent practicable, consistent with engineering and public safety requirements. The project-specific recommendations that will be provided by USFWS in the subsequent final supplemental report will be addressed in the Tier 2 NEPA document for this proposed action. The USFWS programmatic recommendations, and CEMVN's response to them, are listed below:

Recommendation 1: Flood protection features will be located to ensure no (or minimal) destruction of wetlands and non-wet bottomland hardwoods.

CEMVN Response 1: The design-build solicitation included a design parameter to minimize the overall project footprint and minimize impacts to wetlands.

Secondly, the Tier 2 NEPA document would investigate alternative alignments for the proposed action, and would further seek to avoid or minimize impacts to wetlands in the final design of the project.

Recommendation 2: Enclosure of wetlands with new levee alignments will be minimized. When enclosing wetlands is unavoidable, non-development easements on those wetlands will be acquired, and hydrologic connections with adjacent, un-enclosed wetlands will be maintained in order to minimize secondary impacts from development and hydrologic alteration.

CEMVN Response 2: The design-build solicitation included a design parameter to minimize impacts to the natural hydraulic regimes of wetlands. Secondly, the Tier 2 NEPA document would investigate alternative alignments for the proposed action, and would further seek to avoid or minimize impacts to wetlands in the final design of the project.

Recommendation 3: Adverse impacts to bald eagle nesting locations and wading bird colonies will be avoided through careful design of project features and timing of construction.

CEMVN Response 3: This recommendation will be addressed in the Tier 2 NEPA document, and the design of the project will incorporate this recommendation.

Recommendation 4: Forest clearing associated with project features will be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

CEMVN Response 4: This recommendation will be addressed in the Tier 2 NEPA document, and will be considered in the design of the project. However, given the time constraints associated with completing this project prior to the onset of the 2011 hurricane season, further coordination with USFWS may be necessary.

Recommendation 5: The project's first Project Cooperation Agreement (or similar document) will be drafted to include the local-cost sharer's responsibility to provide operational, monitoring, and maintenance funds for mitigation features.

CEMVN Response 5: Concur.

Recommendation 6: Design Documentation Report, Engineering Documentation Report, Plans and Specifications, etc will be coordinated with the USFWS, NMFS, LDWF, USEPA, and LDNR.

CEMVN Response 6: Concur.

Recommendation 7: Impacts to public lands shall be avoided, else coordination with agencies managing public lands should be established and maintained until construction of that feature is complete and prior to any subsequent maintenance.

CEMVN Response 7: This recommendation will be addressed in the Tier 2 NEPA document. If any actions are proposed that could cause impacts to public lands, such actions will be coordinated with the appropriate agency.

Recommendation 8: A "General Plan", if appropriate will be prepared along with the USFWS, and the managing natural resource agency in accordance with Section 3(b) of the FWCA for mitigation lands.

CEMVN Response 8: Concur. The necessity of a "General Plan" will be determined through the Tier 2 NEPA document process.

Recommendation 9: Mitigation lands (if purchased for inclusion within a NWR), shall meet the requirements mentioned in the USFWS Programmatic Report (Nov 2007).

CEMVN Response 9: Concur. Mitigation requirements would be established during the Tier 2 NEPA document phase and will be planned through the appropriate Mitigation IER.

Recommendation 10: Coordination with USFWS will be reinitiated if a proposed project feature is changed significantly or is not implemented within one year of the date of the Endangered Species Act consultation letter in order to ensure that the proposed project would not adversely affect any federally listed threatened or endangered species or their habitat.

CEMVN Response 10: Concur.

Recommendation 11: As part of hurricane protection structure design, as many openings as practicable (in number, size, and diversity of locations) will be incorporated to enable estuarine dependent fishery migration.

CEMVN Response 11: The design-build solicitation included design parameters to address fish migration. Secondly, the Tier 2 NEPA document would investigate alternative designs for the proposed action, and would further seek to address this recommendation.

Recommendation 12: To the maximum extent practicable, dimensions (width and depth) of flood protection structures in watercourses (especially the ones in tidal passes) shall be maintained.

CEMVN Response 12: The design-build solicitation included design parameters to address this recommendation. Secondly, the Tier 2 NEPA document would investigate alternative designs for the proposed action, and would further seek to address this recommendation.

Recommendation 13: Flood protection structures in canals, bayous, or navigation channels that do not maintain the pre-project cross section shall be designed and operated with multiple openings (near both sides of the channel, in the channel center that extends to the bottom within the structure).

CEMVN Response 13: The design-build solicitation included design parameters to address the maintenance of pre-project water flow capacity. Secondly, the Tier 2 NEPA document would investigate alternative designs for the proposed action, and would further seek to address this recommendation.

Recommendation 14: The number and locations of openings in flood protection levees shall be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.

CEMVN Response 14: The design-build solicitation included design parameters to minimize migratory distance from opening to enclosed wetland habitats. Secondly, the Tier 2 NEPA document would investigate alternative designs for the proposed action, and would further seek to address this recommendation.

Recommendation 15: Flood protection structures shall remain completely open except during storm events. Management plan for the structures shall be developed in coordination with the USFWS, NMFS, LDWF, and LDNR.

CEMVN Response 15: Any flood protection structure will remain completely open except during storm events, and a management plan for the structures will be developed in coordination with these agencies once a final design is developed.

Recommendation 16: Flood protection structures within a waterway shall include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage.

CEMVN Response 16: The design-build solicitation included design parameters to minimize the creation of steep environmental gradients. Secondly, the Tier 2 NEPA document would investigate alternative designs for the proposed action, and would further seek to address this recommendation.

Recommendation 17: To the maximum extent practicable, structures shall be designed and/or selected and installed such that average flow velocities during peak flood or ebb tides do not exceed 2.6 fps with the exception of tidal passes or major exchange points.

CEMVN Response 17: The design-build solicitation included design parameters to address this recommendation. Secondly, the Tier 2 NEPA document would investigate alternative designs for the proposed action, and would further seek to address this recommendation.

Recommendation 18: To the maximum extent practicable, culverts (round or box) shall be selected, designed, and installed such that the invert elevation is equal to the existing water depth. The culvert shall be sized to maintain sufficient flow to prevent siltation.

CEMVN Response 18: If culverts are a proposed element of the forthcoming design, this recommendation will be incorporated.

Recommendation 19: Culverts shall be installed in construction access roads based on the guidelines provided by USFWS, unless otherwise recommended by the natural resource agencies.

CEMVN Response 19: This recommendation will be incorporated as necessary into the design of this project.

Recommendation 20: Water control structures shall be designed to allow rapid opening in the absence of an offsite power source after a storm passes and water levels return to normal.

CEMVN Response 20: The design-build solicitation included a design parameter to address this recommendation.

Recommendation 21: Levee alignments and water control structure alternatives shall be selected to avoid the need for fishery organisms to pass through multiple structures (i.e., structures behind structures) to access an area.

CEMVN Response 21: This recommendation will be addressed in the Tier 2 NEPA document.

Recommendation 22: Operational plans for water control structures shall be developed to maximize the cross-sectional area open for as long as possible.

CEMVN Response 22: Any water control structure will remain completely open except during storm events.

Recommendation 23: All unavoidable losses of wetland habitat or nonwet bottomland hardwoods caused by project features shall be fully compensated.

CEMVN Response 23: Concur.

Recommendation 24: Acquisition, habitat development, maintenance and management of mitigation lands shall be allocated as first-cost expenses of the project, and shall be the local project-sponsor's responsibility. If the local project-sponsor is unable to fulfill the financial mitigation requirements for operation, then the Corps shall provide the necessary funding to ensure mitigation obligations are met on behalf of the public interest.

CEMVN Response 24: This project is 100% federally funded; therefore, acquisition of lands and habitat development for mitigation is the responsibility of the government. However, costs for maintenance and management would be the responsibility of the local sponsor.

Recommendation 25: Any proposed change in mitigation features or plans shall be coordinated in advance with the USFWS, NMFS, LDWF, EPA and LDNR.

CEMVN Response 25: Mitigation for the impacts caused by this project will be coordinated through a Mitigation IER. Any changes to the mitigation plan in this IER would be coordinated in advance.

Recommendation 26: A report explaining the status of mitigation implementation, maintenance, future management activities, and any proposed changes to the existing management plan shall be prepared every three years by the managing agency and provided to the Corps, USFWS, NMFS, EPA, LDNR and LDWF.

CEMVN Response 26: Concur.

7. MITIGATION

Quantitative analysis by existing methodologies for water resource planning will be used to identify the acreages and habitat types for the direct or indirect impacts of implementing the proposed action. Any mitigation needs identified based upon the detailed project description to be provided by the proposed action's design-build project delivery contractor will be reported in the Tier 2 NEPA compliance document.

A complementary comprehensive mitigation IER will be prepared documenting and compiling these unavoidable impacts and those for all other proposed actions within the LPV Hurricane Protection Project that are being analyzed through other IERs. Mitigation planning is being carried out for groups of IERs, rather than within each IER, so that large

mitigation efforts could be taken rather than several smaller efforts, increasing the relative economic and ecological benefits of the mitigation effort.

This forthcoming mitigation IER will implement compensatory mitigation as early as possible. All mitigation activities will be consistent with standards and policies established in the Clean Water Act Section 404 and the appropriate USACE policies and regulations governing this activity.

8. COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

Construction of the proposed action would not commence until the proposed action achieves environmental compliance with all applicable laws and regulations, as described below.

Environmental compliance for the proposed action will be achieved upon coordination of this IER and a Tier 2 NEPA compliance document with appropriate agencies, organizations, and individuals for their review and comments; USFWS and NMFS confirmation that the proposed action would not be likely to adversely affect any threatened and endangered species, or completion of Endangered Species Act Section 7 consultation; LDNR concurrence with the determination that the proposed action is consistent, to the maximum extent practicable, with the LCRP; coordination with the SHPO; receipt and acceptance or resolution of all FWCA recommendations; and receipt and acceptance or resolution of all LDEQ comments on the water quality and air quality impact analysis.

9. CONCLUSIONS

9.1 INTERIM DECISION

The proposed action consists of construction of storm surge protection structures to protect the IHNC from storm surges. To address surges from the GIWW-MRGO-Lake Borgne complex, one storm surge protection feature would be constructed within the Borgne 1 location range which extends from just west of the Paris Road Bridge on the GIWW to just east of the Michoud Canal on the GIWW and just south of Bayou Bienvenue on the MRGO. To address storm surge originating from Lake Pontchartrain, a storm surge protection feature would be built within the Pontchartrain 2 location range which extends from the Seabrook Bridge to 2,500 feet south of the bridge on the IHNC. An exact alignment for these storm surge protection features will be determined through a Tier 2 NEPA document which will analyze a range of potential alignments within each of these location ranges.

CEMVN has assessed the greatest possible environmental impacts that could occur under the proposed action on significant resources. These are listed in table 13.

Table 13
Impacts from the proposed action

Significant Resource	Impacts of Pontchartrain 2	Impacts of Borgne 1
Hydrology	Flow redirection	Decrease of sheet flow through marsh, reduced circulation and sediment flow.
Water Quality	Temporary increases in turbidity; decreases in DO; influx of nutrients due to disturbance of 5 acres of channel bottom	Temporary increases in turbidity; decreases in DO; influx of nutrients due to disturbance of up to 642 acres of construction footprint
Wetlands	No significant impacts.	Loss of up to 346 acres of brackish marsh lost, up to 39 acres of bottomland forest, decreased circulation but increased protection of up to 2,786 acres of marsh.
Aquatic	Temporary increased turbidity, temperatures, nutrient availability; lower DO; temporary impacts to plankton. Loss of 5 acres of open water.	Up to 296 acres of open water habitat lost. Temporary declines in plankton and long-term redistribution. Reduced conversion of marsh into open water habitat.
Fisheries and Essential Fish Habitat	Temporary decrease in quality of EFH; adverse impacts to benthic resources in up to 5 acres.	Temporary dispersal of adult fish. Up to 346 acres of marsh EFH lost; up to 296 acres of mud bottom/open water lost; reduced access to 4,257 acres of nursery EFH.
Terrestrial/ Upland	No high quality terrestrial habitat impacted.	Up to 56 acres of upland lost.
Wildlife	Minor temporary displacement impacts to amphibians, reptiles, birds and mammals.	Minor temporary displacement impacts; loss of up to 642 acres of brackish and open water habitat.
Threatened and Endangered Species	Not likely to adversely affect.	Not likely to adversely affect.
Recreation	Could impact lakefront recreation facilities temporarily or permanently.	Impacts to wetlands could impact recreational fishing.
Noise	Elevated noise levels.	Elevated noise levels.
Air Quality	Temporary and localized decrease in air quality.	Temporary and localized decrease in air quality.
Aesthetics	Insignificant as project area visually contains similar elements.	Depends on location; Scenic River permit may be required if barrier crosses scenic portion of Bayou Bienvenue.
Cultural	Likelihood for intact and undisturbed cultural resources considered minimal.	Two known archeological sites and three high potential areas exist in location range; further investigation and coordination needed in Tier 2 to avoid, minimize or mitigate.
Human and Economic	Minor temporary impacts from construction. Some utilities or infrastructure may be relocated. Long-term positive impacts from better flood protection.	Minor temporary impacts from construction. Long-term positive impacts would be repopulation of affected neighborhoods.

Significant Resource	Impacts of Pontchartrain 2	Impacts of Borgne 1
Environmental Justice	Temporary indirect impacts from construction related activities.	No environmental justice issues
HTRW	Low risk of encountering.	Low risk of encountering.

9.2 PREPARED BY

The point of contact and responsible manager for the preparation of this IER is Laura Lee Wilkinson, CEMVN, Hurricane Protection Office. The address of the preparer is: U.S. Army Corps of Engineers, New Orleans District; Planning, Programs, and Project Management Division, CEMVN-PM; P.O. Box 60267; New Orleans, Louisiana 70160-0267. Table 14 lists the preparers of the various sections and topics in this IER.

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Appendix A: Species in the Study Area

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Appendix A: Species in the Study Area

Table A-1. Freshwater Marsh Species

Scientific Name	Common Name
Birds	
Botaurus lentiginosus	American Bittern
Nyctanassa violacea	Yellow-crowned Night-Heron
Mycteria Americana	Wood Stork
Anas fulvigula	Mottled Duck
Anas acuta	Northern Pintail
Aythya valisineria	Canvasback
Aythya Americana	Redhead
Aythya affinis	Lesser Scaup
Haliaeetus leucocephalus	Bald Eagle
Circus cyaneus	Northern Harrier
Coturnicops noveboracensis	Yellow Rail
Laterallus jamaicensis	Black Rail
Rallus longirostris obsoletus	Clapper Rail
Rallus elegans	King Rail
Grus Canadensis	Sandhill Crane
Grus Americana	Whooping Crane
Limosa fedoa	Marbled Godwit
Calidris alpina	Dunlin
Limnodromus griseus	Short-billed Dowitcher
Gelochelidon nilotica	Gull-billed Tern
Hydroprogne caspia	Caspian Tern
Sterna hirundo	Common Tern
Sterna forsteri	Forster's Tern
Asio flammeus	Short-eared Owl
Cistothorus platensis	Sedge Wren
Lanius ludovicianus	Loggerhead Shrike
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow

Table A-1. Freshwater Marsh Species (Continued)

Butterflies	
Nastra neamathla	Neamathla Skipper
Euphyes dion	Dion Skipper
Ascia monuste	Great Southern White
Reptiles	
Chelydra serpentina	Snapping Turtle
Apalone spinifera aspera	Spiny Softshell Turtle
Malaclemys terrapin	Diamondback Terrapin
Macrochelys temminckii	Alligator Snapping Turtle
Fish	
Micropogonias undulatus	Croaker
Cynoscion sp.	Seatrout
Pogonias cromis	Blackdrum
Paralichthys lethostigma	Flounder

Table A-2. Brackish-Intermediate Marsh Species

Scientific Name	Common Name
Birds	
Calidris alpina	Dunlin
Limnodromus griseus	Short-billed Dowitcher
Gelochelidon nilotica	Gull-billed Tern
Hydroprogne caspia	Caspian Tern
Sterna hirundo	Common Tern
Sterna forsteri	Forster's Tern
Aythya americana	Redhead
Asio flammeus	Short-eared Owl
Cistothorus platensis	Sedge Wren
Lanius ludovicianus	Loggerhead Shrike
Circus cyaneus	Northern Harrier
Haliaeetus leucocephalus	Bald Eagle
Aythya affinis	Lesser Scaup
Limosa fedoa	Marbled Godwit
Grus canadensis	Sandhill Crane
Rallus elegans	King Rail
Rallus longirostris obsoletus	Clapper Rail
Laterallus jamaicensis	Black Rail
Aythya valisineria	Canvasback
Anas acuta	Northern Pintail
Anas fulvigula	Mottled Duck
Nyctanassa violacea	Yellow-crowned Night-Heron
Egretta rufescens	Reddish Egret
Botaurus lentiginosus	American Bittern
Pelecanus occidentalis	Brown Pelican
Grus americana	Whooping Crane

Table A-2. Brackish-Intermediate Marsh Species (Continued)

Butterflies	
Nastra neamathla	Neamathla Skipper
Euphyes dion	Dion Skipper
Panoquina panoquinoides	Obscure Skipper
Cladium jamaicense	Palatka Skipper
Ascia monuste	Great Southern White
Brephidium exile	Western Pygmy-Blue
Reptiles	
Malaclemys terrapin pileata	Mississippi Diamondback Terrapin

Table A-3. Saline Marsh Species

Scientific Name	Common Name
Birds	
Egretta rufescens	Reddish Egret
Nyctanassa violacea	Yellow-Crowned Night-Heron
Circus cyaneus	Northern Harrier
Laterallus jamaicensis	Black Rail
Grus Americana	Whooping Crane
Rallus longirostris obsoletus	Clapper Rail
Haematopus palliates	American Oystercatcher
Limosa fedoa	Marbled Godwit
Calidris alpina	Dunlin
Limnodromus griseus	Short-billed Dowitcher
Gelochelidon nilotica	Gull-billed Tern
Hydroprogne caspia	Caspian Tern
Thalasseus maximus	Royal Tern
Thalasseus sandvicensis	Sandwich Tern
Sterna hirundo	Common Tern
Sterna forsteri	Forster's Tern
Rynchops niger	Black Skimmer
Asio flammeus	Short-eared Owl
Ammodramus maritimus	Seaside Sparrow
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow
Cistothorus palustris	Marsh Wren
Ajaia ajaja	Roseate spoonbill
Mycteria americana	Wood Stork
Anas fulvigula	Mottled Duck
Aix sponsa	Wood Duck

Table A-3. Saline Marsh Species (Continued)

Butterflies	
Nastra neamathla	Neamathla Skipper
Euphyes dion	Dion Skipper
Panoquina panoquinoides	Obscure Skipper
Ascia monuste	Great Southern White
Brephidium exile	Western Pygmy-Blue
Reptiles	
Alligator mississippiensis	American Alligator
Malaclemys terrapin pileata	Mississippi Diamondback Terrapin
Fish	
Litopenaeus setiferus	White Shrimp
Farfantepenaeus aztecus	Brown Shrimp
Callinectes sapidus	Blue Crab
Menippe mercenaria	Gulf Stone Crab

Table A-4. Bottomland Forest Species

Scientific Name	Common Name
Birds	
Nyctanassa violacea	Yellow-crowned Night-Heron
Mycteria americana	Wood Stork
Elanoides forficatus	Swallow-tailed Kite
Haliaeetus leucocephalus	Bald Eagle
Scolopax minor	American Woodcock
Coccyzus americanus	Yellow-billed Cuckoo
Hylocichla mustelina	Wood Thrush
Vireo flavifrons	Yellow-throated Vireo
Parula americana	Northern Parula
Protonotaria citrea	Prothonotary Warbler
Limnothlypis swainsonii	Swainson's Warbler
Seiurus motacilla	Louisiana Waterthrush
Oporornis formosus	Kentucky Warbler
Wilsonia citrina	Hooded Warbler
Spizella pusilla	Field Sparrow
Euphagus carolinus	Rusty Blackbird
Icterus spurius	Orchard Oriole
Amphibians	
Desmognathus auriculatus	Southern Dusky Salamander
Plethodon kisatchie	Louisiana Slimy Salamander
Pseudacris streckeri	Strecker's Chorus Frog
Scaphiopus holbrookii	Eastern Spadefoot
Rana areolata areolata),	Southern Crawfish Frog
Reptiles	
Macrochelys temminckii	Alligator Snapping Turtle
Carphophis vermis	Western Worm Snake
Farancia erytrogramma erytrogramma	Common Rainbow Snake
Crotalus horridus	Timber Rattlesnake

Table A-4. Bottomland Forest Species (Continued)

Mammals	
Sorex longirostris	Southeastern Shrew
Myotis austroriparius	Southeastern Myotis
Ursus americanus luteolus	Louisiana Black Bear
Mustela frenata	Long-tailed Weasel
Spilogale putorius	Eastern Spotted Skunk
Butterflies	
Amblyscirtes celia	Celia's Roadside Skipper
Anthocharis midea	Falcate Orangetip
Phyciodes texana	“Seminole” Texan Crescent

Appendix B: List of Acronyms and Definitions of Common Terms

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Appendix B: List of Acronyms and Definitions of Common Terms

°C	Degrees Celsius
°F	Degrees Fahrenheit
µg/L	Microgram per liter
BMPs	Best Management Practices
CEMVN	USACE Mississippi Valley Division, New Orleans District
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
Citywide Plan	Citywide Strategic Recovery and Rebuilding Plan
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
CWR	Center for Wetland Resources
DCED	Draft Comprehensive Environmental Document
EA	Environmental Assessment
EDR	Environmental Data Resources, Inc.
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ER	Engineer Regulation
ERDC	Engineer Research and Development Center
ESA	Environmental Site Assessment
FCED	Final Comprehensive Environmental Document
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
fps	Foot Per Second
ft/yr	Feet Per Year
FWCA	Fish and Wildlife Coordination Act
GIWW	Gulf Intracoastal Waterway
GNIS	Geographic Names Information System
HPS	Hurricane Protection System
HTRW	Hazardous, Toxic, and Radioactive Waste
HUD	U.S. Department of Housing and Urban Development
Hwy	Highway
ICS	Interim Control Structure
IER	Individual Environmental Report
IHNC	Inner Harbor Navigation Canal
IPET	Interagency Performance Evaluation Taskforce
LACPR	Louisiana Coastal Protection and Restoration
LCRP	Louisiana Coastal Resource Program
LCWCRTF	Louisiana Coastal Wetlands Conservation and Restoration Task Force
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources

LDWF	Louisiana Department of Wildlife and Fisheries
LEIS	Legislative Environmental Impact Statement
LPV	Lake Pontchartrain and Vicinity
mg/L	Milligrams Per Liter
mL	Milliliter
mm	Millimeter
MPN/COL/100 mL	Most Probable Number of Colonies per 100 Milliliters
MRGO	Mississippi River Gulf Outlet
NAAQS	National Ambient Air Quality Standard
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOV	New Orleans to Venice
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
PA	Programmatic Agreement
PCWRP	Parish Coastal Wetlands Restoration Program
PDT	Project Delivery Team
P.L.	Public Law
ppt	Parts Per Thousand
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Conditions
RECAP	Risk Evaluation/Corrective Action Program
ROD	Record of Decision
ROW	Right-of-Way
SAV	Submerged Aquatic Vegetation
SHPO	State Historic Preservation Officer
SIR	Supplemental Information Report
SPH	Standard Project Hurricane
s.u.	Standard Units
SWB	Sewerage and Water Board
SWPPP	Stormwater Pollution Prevention Program
TMDL	Total Maximum Daily Load
USACE	U.S. Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WBV	West Bank and Vicinity
WCRA	Wetlands Conservation and Restoration Authority
WRDA	Water Resource Development Act

Appendix C: Public Comment and Responses Summary

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Appendix C: Public Comment and Responses Summary

This section will be completed following receipt of public comments and preparation of responses.

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Appendix D: Members of Interagency Environmental Team

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Appendix D: Members of Interagency Environmental Team

Kyle Balkum	Louisiana Department of Wildlife and Fisheries
Jeff Harris	Louisiana Department of Natural Resources
Catherine Breaux	U.S. Fish and Wildlife Service
David Castellanos	U.S. Fish and Wildlife Service
Frank Cole	Louisiana Department of Natural Resources
John Ettinger	U.S. Environmental Protection Agency
Brian Marcks	Louisiana Department of Natural Resources
Richard Hartman	NOAA National Marine Fisheries Service
Jeffrey Hill	NOAA National Marine Fisheries Service
Christina Hunnicutt	U.S. Geologic Survey
Barbara Keeler	U.S. Environmental Protection Agency
Kirk Kilgen	Louisiana Department of Natural Resources
Tim Killeen	Louisiana Department of Natural Resources
Brian Lezina	Louisiana Department of Wildlife and Fisheries
David Muth	U.S. National Park Service
Clint Padgett	U.S. Geologic Survey
Jamie Phillip	Louisiana Department of Environmental Quality
Manuel Ruiz	Louisiana Department of Wildlife and Fisheries
Angela Trahan	U.S. Fish and Wildlife Service
David Walther	U.S. Fish and Wildlife Service
Patrick Williams	NOAA National Marine Fisheries Service

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Appendix E: Agency Coordination Documentation

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Appendix E: Agency Coordination Documentation

The following items are NEPA compliance documentation and will be completed when the design-build contractor develops a detailed project description:

- USFWS Threatened and Endangered Species Concurrence
- NMFS Threatened and Endangered Species Concurrence
- LDNR LCRP Consistency Determination
- LDEQ Water Quality Certification
- LDEQ Air Quality Certification
- LSHPO Cultural Resource Concurrence
- Tribe Concurrence
- USFWS Fish and Wildlife Coordination Act Report

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506
December 6, 2007

Colonel Jeffery Bedey
Hurricane Protection Office (HPO)
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Bedey,

Please reference the November 7, 2007, letter, and November 11, 2007, electronic mail from Laura Lee Wilkinson requesting our review of the U.S. Army Corps of Engineers' (Corps) proposed 100 Year Hurricane Protection Projects for Individual Environmental Reports (IER) 5-11 in Orleans, Jefferson, and St. Bernard Parishes and concurrence with determinations on effects to Federally Listed Species. That project would involve improvements to levees, floodwalls, floodgates, and construction of new barriers, closure structures, navigable gates and/or permanent pump stations in the New Orleans East Bank, New Orleans East and Chalmette Loop sub basins. These improvements are necessary to provide 100-year level flood protection for the New Orleans Metropolitan area. The U.S. Fish and Wildlife Service (Service) has reviewed the information provided, and offers the following comments in accordance with the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d), Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The projects included in IERs 5-11 span a large geographic area and have unique components, but the number of potentially impacted threatened or endangered species is small; therefore, the IERs will be grouped according to potentially affected species.

Federally listed as an endangered species, West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., June through September). Manatee occurrences appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. They have also been occasionally observed elsewhere along the Louisiana Gulf coast. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

Some or all of the proposed project features, including alternatives, of IERs 5, 6, 7, 8, and 11 (especially the dredging of access channels for IERs 6 and 7), could potentially impact the manatee. The Corps has incorporated the following protective measures into its construction

contracts; therefore, the Service concurs with your determination that construction of the proposed project features is not likely to adversely affect the manatee.

All contract personnel associated with the project should be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. All construction personnel are responsible for observing water-related activities for the presence of manatee(s). Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed. Any manatee sighting should be immediately reported to the Service's Lafayette, Louisiana Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).

The Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwanee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain basin, and adjacent estuarine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

On March 19, 2003, the Service and the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. Portions of the Pearl and Bogue Chitto Rivers, Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, The Rigolets, Lake St. Catherine, and Lake Borgne within Louisiana were included in that designation. The primary constituent elements essential for the conservation of Gulf sturgeon are those habitat components that support feeding, resting, sheltering, reproduction, migration, and physical features necessary for maintaining the natural processes that support those habitat components.

In that critical habitat designation, responsibility for consultation with specific Federal agencies was also identified for the Service and for the NMFS. For estuarine and marine waters in Louisiana, the NMFS is responsible for consultations regarding impacts to the sturgeon and its

critical habitat with all Federal agencies, except the Department of Transportation, the Environmental Protection Agency, the U.S. Coast Guard, and the Federal Emergency Management Agency, which consult with the Service. Therefore, please contact Dr. Stephania Bolden (727/824-5312) in St. Petersburg, Florida, for information concerning that species and its critical habitat. Should the proposed project directly or indirectly affect the Gulf sturgeon or its critical habitat in Louisiana, further consultation with that office will be necessary.

The pallid sturgeon (*Scaphirhynchus albus*) is an endangered fish found in both the Mississippi and Atchafalaya Rivers (with known concentrations in the vicinity of the Old River Control Structure Complex). The pallid sturgeon is adapted to large, free-flowing, turbid rivers with a diverse assemblage of physical characteristics that are in a constant state of change. Habitat loss through river channelization and dams has adversely affected this species throughout its range. According to the information provided, the construction of the proposed project features, including alternatives, of IERs 5-11 would not impact the Mississippi River, therefore we concur that they are not likely to adversely affect the pallid sturgeon.

The project-area forested wetlands may provide nesting habitat for the bald eagle (*Haliaeetus leucocephalus*), which has officially been removed from the List of Endangered and Threatened Species as of August 8, 2007. Bald eagles nest in Louisiana from October through mid-May. Eagles typically nest in mature trees (e.g., bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water in the southeastern Parishes. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead).

The Service developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations regarding how to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the Bald and Golden Eagle Protection Act. A copy of the NBEM Guidelines is available at:
http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf. The construction of the proposed project features, including alternatives, of IERs 7, and 10 may potentially impact the bald eagle. If the Corps determines that construction activities will be located at or closer than 660 feet from a nest tree, the Service recommends that the Corps contact this office to aid in determining the appropriate size and configuration of buffers or the timing of activities in the vicinity of the nest to cause the least impact.

Federally listed as an endangered species, brown pelicans (*Pelecanus occidentalis*) are not currently known to nest in the project vicinity. Brown pelicans feed along the Louisiana coast in shallow estuarine waters, using sand spits and offshore sand bars as rest and roost areas. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance. The Service concurs that construction of the proposed project features is not likely to adversely affect the brown pelican.

Federally listed as a threatened species, the piping plover (*Charadrius melodus*), as well as its designated critical habitat, occur along the Louisiana coast. Piping plovers winter in Louisiana, and may be present for 8 to 10 months annually. They arrive from the breeding grounds as early

as late July and remain until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Plovers move among sites as environmental conditions change, and studies have indicated that they generally remain within a 2-mile area. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation. The Service concurs that construction of the proposed project features is not likely to adversely impact the piping plover or its critical habitat because they are not known to occur in the project area.

The project area is located where colonial nesting waterbirds may be present. LDWF currently maintains a database of these colonies locations. That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work sites for the presence of undocumented nesting colonies during the nesting season (e.g. February through September depending on the species). If colonies exist, work should not be conducted within 1,000 feet of the colony during the nesting season

Several portions of the project area are located within or will require access through the Service's Bayou Sauvage National Wildlife Refuge. The National Wildlife Refuge System Improvement Act of 1997 authorized that no new or expanded use of a refuge may be allowed unless it is first determined to be compatible. A compatibility determination is a written determination signed and dated by the Refuge Manager and Regional Refuge Chief, signifying that a proposed or existing use of a national wildlife refuge is a compatible use or is not a compatible use. A compatible use is defined as a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the national wildlife refuge. A compatibility determination is only required when the Service has jurisdiction over the use. For example, proposed uses that deal exclusively with air space, navigable waters or overly refuges where another Federal agency has primary jurisdiction over the area, would not be subject to compatibility.

Federal agencies proposing a project that includes features on a national wildlife refuge are encouraged to contact the Refuge Manager early in the planning process. The Refuge Manager will work with the project proponent to determine if the proposed project constitutes a "refuge use" subject to a compatibility determination. If the proposed project requires a compatibility determination, a concise description of the project (refuge use) including who, what, where, when, how and why will be needed to prepare the compatibility determination. In order to determine the anticipated impacts of use, the project proponent may be required to provide sufficient data and information sources to document any short-term, long-term, direct, indirect or cumulative impacts on refuge resources. Compatibility determinations will include a public review and comment before issuing a final determination.

All construction or maintenance activities (e.g., surveys, land clearing, etc.) on a National Wildlife Refuge (NWR) will require the Corps to obtain a Special Use Permit from the Refuge

Manager; furthermore, all activities on that NWR must be coordinated with the Refuge Manager. Therefore, we recommend that the Corps request issuance of a Special Use Permit well in advance of conducting any work on the refuge. Please contact Kenneth Litzenberger, Project Leader for the Service's Southeast National Wildlife Refuges and Jack Bohannan (985) 822-2000, Refuge Manager for the Bayou Sauvage National Wildlife Refuge for further information on compatibility of flood control features, and for assistance in obtaining a Special Use Permit. Close coordination by both the Corps and its contractor must be maintained with the Refuge Manager to ensure that construction and maintenance activities are carried out in accordance with provisions of any Special Use Permit issued by the NWR.

Based on our review, the Service concurs with your determinations that the construction of the proposed project features in IERs 5-11 is not likely to adversely affect the pallid sturgeon, brown pelican, bald eagle, and piping plover. Because of manatee protective measures included in the Corps' construction contracts, the Service also concurs that the construction of the proposed project features in IERs 5-11 is not likely to adversely affect the manatee. The Service recommends that the Corps contact NMFS regarding impacts to the Gulf sturgeon and its critical habitat and implement the above mentioned survey and protection measure to protect colonial nesting birds.

We appreciate the opportunity to review the Proposed 100 Year Hurricane Protection Projects for IERs 5-11. If you need further assistance or have questions regarding this letter, please contact David Castellanos (337/291-3112) of this office.

Sincerely,

James F. Boggs
Acting Field Supervisor
Louisiana Field Office

cc: NOAA, St. Petersburg, FL
Laura Lee Wilkinson, CEMVN, New Orleans, LA
LDWF, Natural Heritage, Baton Rouge, LA