# FINAL

# ENVIRONMENTAL ASSESSMENT

# FRESHWATER INTRODUCTION SOUTH OF LA HIGHWAY 82 PROJECT

# (ME-16)

**CAMERON AND VERMILION PARISHES, LOUISIANA**

**U.S. FISH AND WILDLIFE SERVICE**

**ECOLOGICAL SERVICES**

**LAFAYETTE, LOUISIANA**

**March 2005**

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**Cameron and Vermilion Parishes, Louisiana**


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**Cameron and Vermilion Parishes, Louisiana**

# SECTION 1.0 PURPOSE AND NEED FOR PROPOSED ACTION

## SECTION 1.1 INTRODUCTION

The rapid conversion of Louisiana's coastal marshes to open-water has been reported by Gagliano et al. (1981), Gosselink (1984), Turner and Cahoon (1987), Britsch and Kemp (1990), Dunbar et al. (1992), and others. Since the 1950s, the average loss rate for those wetlands has been 25 to 35 square miles (16,000 to 22,400 acres) per year. That loss is of national concern; an estimated 69 percent of the coastal marshes adjacent to the Gulf of Mexico occur in Louisiana (West 1977).

Coastal Louisiana includes nine hydrologic basins (Louisiana Coastal Wetlands Conservation and Restoration Task Force 1993*a*); two of those basins (i.e., the Calcasieu-Sabine Basin and the Mermentau Basin) comprise the Louisiana portion of the Chenier Plain. The Mermentau Basin, located in southwestern Louisiana, has been divided into three Subbasins: Upland, Lakes, and Chenier Subbasins. The Lakes Subbasin extends from Freshwater Bayou Canal westward to Louisiana Highway 27, north to the inland limit of the coastal zone, and south to Louisiana Highway 82 (LA Highway 82) and the Pecan Island and Grand Chenier ridges (Figure 1). The Chenier Subbasin extends from LA 82 south to the Gulf of Mexico and from Freshwater Bayou Canal westward to the Mermentau River.

The Lakes Subbasin's natural drainage has been interrupted by manmade features. The major source of hydrological change has been the conversion of two estuarine lakes (i.e., Grand and White Lakes) into freshwater reservoirs for agricultural (rice) irrigation. This was done through a series of locks and water control structures installed by the U.S. Army Corps of Engineers (Corps) to control water levels and prevent saltwater intrusion. Other activities that have also interrupted the natural drainage of the subbasin are related to navigation improvements (i.e., Gulf Intracoastal Waterway, Mermentau River Gulf of Mexico Navigation Channel), flood control measures (levees and drainage ditches), oil and gas exploitation (channels and facilities), and road construction (i.e., LA Highway 82). The locks and gates and LA Highway 82 form a hydrologic barrier between the two Subbasins (Louisiana Department of Natural Resources 2003), impounding water higher than historical levels in the Lakes Subbasin. Current water management regimes maintain average water levels approximately 0.5 feet above marsh level [marsh level is equal to 1.08 feet North American Vertical Datum 1988 (NAVD 88) and water levels average 1.6 ft NAVD] (Lonnie Harper and Associates 2000).

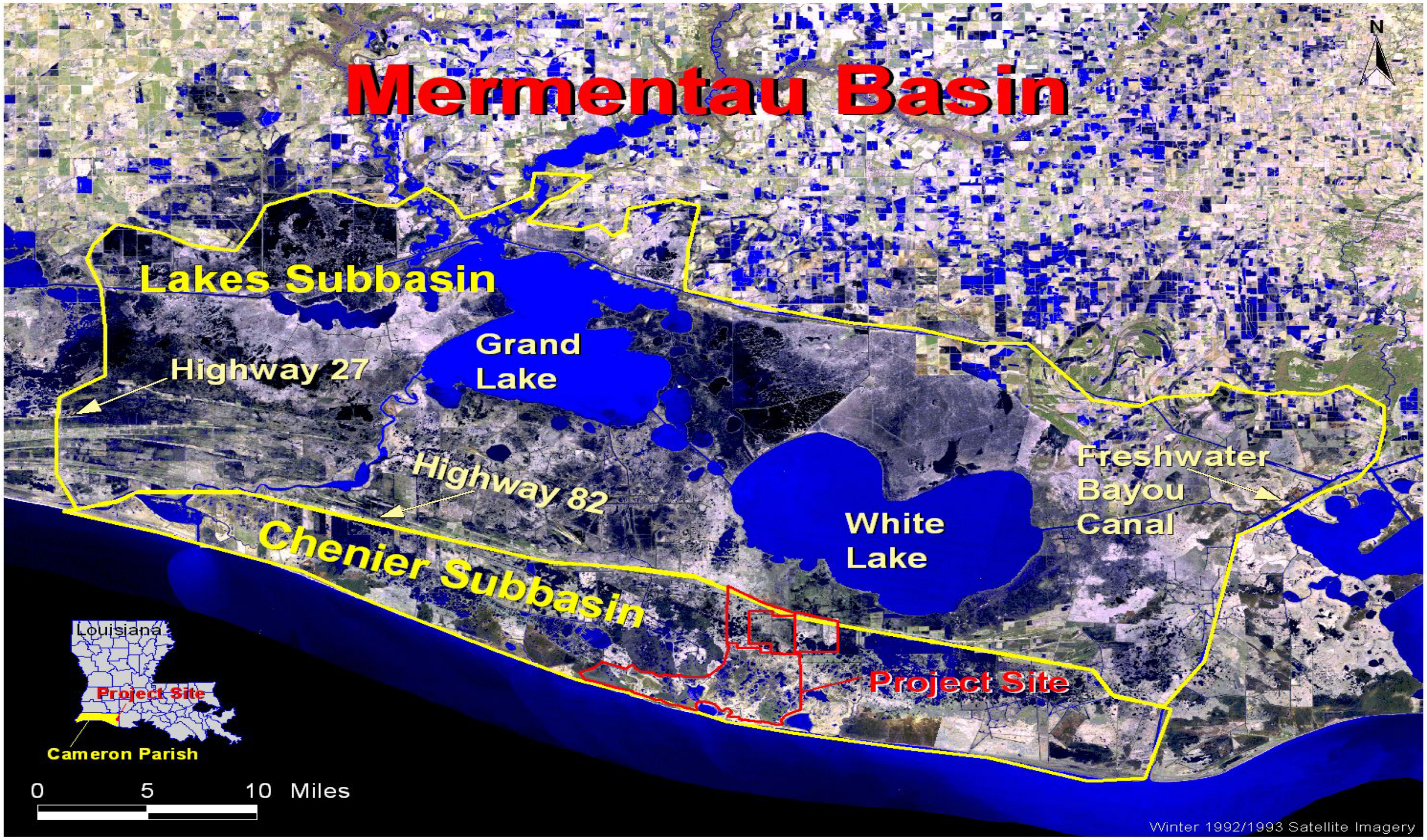


Figure 1. Mermentau Basin including Lakes and Chenier Subbasins.

Historical drainage of the Lakes Subbasin was southward through rivers, bayous, and sheet flow to the Chenier Subbasin. As a result of the man-made changes, freshwater drainage is now predominantly southwesterly via the Mermentau River and east/west via the Gulf Intracoastal Waterway (GIWW), bypassing the marshes in the Chenier Subbasin (LCWCRTF 2002). The reduction in freshwater input into the Chenier Subbasin has permitted increased saltwater intrusion into the Chenier Subbasin through canals and bayous. These hydrologic alterations have contributed to significant marsh loss in both subbasins, through water-logging of marsh vegetation erosion of lake shorelines in the northern subbasin, and increased saltwater intrusion in the Chenier subbasin.

## SECTION 1.2 PROJECT AREA

The project area is located in the central and eastern portions of the state-owned Rockefeller Wildlife Refuge and Game Preserve (Rockefeller Refuge), on the eastern end of the Grand Chenier ridge, approximately 10 miles east of the community of Grand Chenier in Cameron and Vermilion Parishes, Louisiana. It is bounded to the west by a canal west of Little Constance Bayou and south of Deep Lake, to the south by the Gulf of Mexico shoreline, to the east by Rollover Bayou, and to the north by LA Highway 82 (Figure 2). The project area comprises approximately 24,874 acres, consisting of 20,529 acres (83%) of intermediate, brackish and saline marsh, and 4,345 acres (17%) of open-water.

## SECTION 1.3 PURPOSE OF PROPOSED ACTION

The project would channel excess freshwater from an area of surplus water (Grand and White Lakes of the Lakes Subbasin) to an area in need of freshwater (Chenier Subbasin) to reduce marsh loss due to elevated salinities. The project would help to restore drainage of excess fresh water from the Lakes Subbasin to the Chenier Subbasin, and would reduce saltwater impacts to the brackish and intermediate marshes south of LA Highway 82 and in the south-central and southeastern portion of the Rockefeller Wildlife Refuge and Game Preserve. The project features include water control structures to improve southward freshwater flow across LA Highway 82 and into the refuge, and marsh restoration via the construction of vegetated earthen terraces.

## SECTION 1.4 NEED FOR PROPOSED ACTION

The Chenier Subbasin brackish and intermediate marshes, south of LA Highway 82, are in need of major freshwater inputs due to increased marsh loss caused by a lack of freshwater flow that would moderate elevated Gulf salinities in those marshes. Major hydrological changes in the Mermentau Basin occurred with the construction of LA Highway 82, the impoundment of Grand and White Lakes in the Lakes Subbasin via locks and gates, and the construction of the Mermentau River-Gulf of Mexico Navigation Channel, oil and gas navigation channels, and levees. Historically, excess freshwater from Grand and White Lakes and the Mermentau River was able to flow southward into the Chenier Subbasin through natural bayous (i.e., Floating Turf Bayou in the project area). Today much of the north-to-south flow across LA Highway 82 is restricted by that highway, navigation canals and levees. To provide a freshwater reservoir for agriculture and to ensure adequate water levels are maintained in the GIWW, the Corps of Engineers, in the 1950s, constructed four large water control structures on the Mermentau River

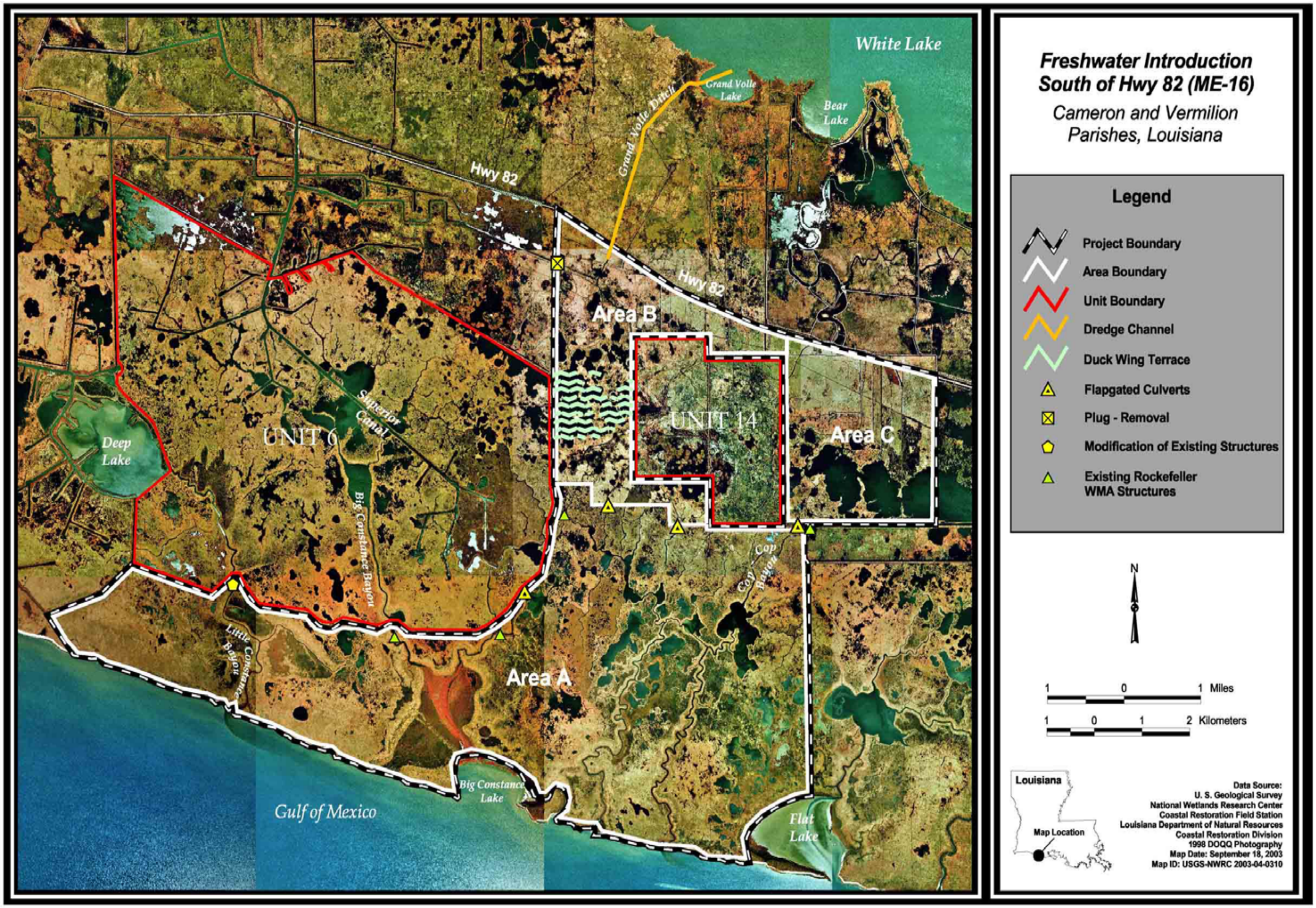


Figure 2. General Features of the Freshwater Introduction South of LA Highway 82 Project.

(Catfish Gate Control Structure), Schooner Bayou Canal (Schooner Bayou Control Structure), and the GIWW (Leland-Bowman Locks west of Intracoastal City, and the Calcasieu Locks southeast of Lake Charles). Construction of these water control structures has partially impounded the Lakes Subbasin and has slowed the movement of freshwater southward to the Mermentau River and marshes south of LA Highway 82 (Louisiana Coastal Wetlands Conservation and Restoration Task Force 1993b, Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998). The construction of the Mermentau River Gulf of Mexico Navigation Channel (15 feet deep by 300 feet wide) caused saltwater intrusion into the Hog Bayou and Little Pecan Bayou Watersheds west of Rockefeller Refuge, accelerated freshwater flows to the Gulf (thus reducing inflows into adjacent marshes), and increased tidal amplitude. Little Pecan Bayou, north of Grand Chenier, was historically a low-salinity Mermentau River estuary.

Elevated salinities and Gulf shoreline erosion are thought to be the leading cause of wetland losses in the Chenier Subbasin. Historically, the Chenier Subbasin and project area have experienced coastal wetland losses of over 30 percent from 1932 to 1990; thus there is a need to reduce the ongoing conversion of marsh to open-water that has resulted from human hydrologic alterations and natural causes (i.e., wave action and subsidence; Table 1). The 734,090-acre Mermentau Basin contained 550,000 acres of coastal wetlands in 1932 (Louisiana Coastal Wetlands Conservation and Restoration Task Force 1993b). Since then, that basin has experienced a marsh loss of over 104,000 acres or 19 percent (Dunbar et al. 1992). The 200,000-acre Chenier Subbasin lost over 50,748 acres of marsh (31 percent) since 1932 due to human-induced (i.e., channelization) and natural causes (i.e., Gulf shoreline loss) (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998).

Within the 24,874-acre Freshwater Introduction South of LA Highway 82 Project area, marsh losses were 12.6, 1.2, and 0.9 percent for the periods 1956 to 1974, 1974 to 1983, and 1983 to 1990, respectively, for a total of 22 percent wetland loss within that area from 1932 to 1990 (Table 2). Project-area 1983-to-1990 land loss rates were 0.13 percent/year (Dunbar et al. 1992). If this modest rate is projected to the year 2050, another 1,371 acres (7.8 percent) could be lost from the project area (a 30 percent loss from 1932 to 2050; Table 2).

Table 1: Chenier Subbasin Marsh Loss Rates from 1933 to 1990

| Period | Acres Lost | Period Percent Loss | Annual Percent Loss |
|---|---|---|---|
| 1933-1955 | 15,576 | 9.5 | 0.43 |
| 1955-1974 | 23,617 | 15.8 | 0.83 |
| 1974-1983 | 5,598 | 4.4 | 0.49 |
| 1983-1990 | 5,957 | 5.0 | 0.71 |
| Total (1933-1990) | 50,748 | 31 | 0.61 |

Note : The Chenier subbasin totals approximately 200,000 acres; Chenier subbasin wetland area totaled 130,000 acres in 1990. The Mermentau Basin contained 450,000 acres of wetlands in 1990. (modified from Dunbar et al. 1992; Louisiana Coastal Wetlands Conservation and Restoration Task Force 1993*b*)

Table 2: Freshwater Introduction South of LA Highway 82 Project Area Marsh Loss from 1932 to 2050

| Year Period/Category | Wetland Acres | Acres Lost | Percent Loss | Annual Percent Loss |
|---|---|---|---|---|
| 1932-1956 | 22,279 | 1,925 | 8.7 | 0.36 |
| 1956-1974 | 20,354 | 2,565 | 12.6 | 0.70 |
| 1974-1983 | 17,789 | 208 | 1.2 | 0.13 |
| 1983-1990 | 17,581 | 160 | 0.9 | 0.13 |
| **Totals (1932-1990)** | | **4,858** | **21.8** | **0.38** |
| Projected 1990-2050 | | 1,371 | 7.8 | 0.13 |

(modified from Dunbar et al. 1992 and USGS 1999 and 2004)

## SECTION 1.5 REQUIRED DECISIONS

This document would assist the lead Federal project sponsor, the U.S. Fish and Wildlife Service, in coordination with the Louisiana Department of Natural Resources co-sponsor, in the implementation of the Preferred Alternative, or a modification of that alternative, based on comments received. The final preferred alternative selection was made after a thorough public review of the project design and permit application, and after fully considering all comments on this Environmental Assessment. The LDNR coastal zone consistency determination was issued on June 3, 2004, and modified on February 16, 2005. The Corps permit public notice period ended on July 25, 2004, and the draft permit was issued on February 23, 2005.

## SECTION 1.6 COORDINATION AND CONSULTATION

A list of alternatives to the Preferred Alternative as well as several design modifications has undergone an extensive CWPPRA pre-selection process. That process included public reviews and hearings, agency and peer reviews, and final selection by the CWPPRA Planning and Evaluation Subcommittee, the Technical Committee, and the Louisiana Coastal Wetlands Conservation and Restoration Task Force (Task Force). The project was nominated at the January 25, 1999, CWPPRA Region 4 Regional Planning Team public meeting held at Rockefeller Refuge. It was subsequently selected as a candidate project in May 1999, was reviewed in more detail by CWPPRA agencies in 1999, and was finally selected by the Task Force for Phase I, engineering and design funding in January 2000.

The CWPPRA project selection criteria for the 9th Priority Project List consisted of the potential project's degree of compliance with regional Coast 2050 strategies, its cost-effectiveness, fulfillment of an area of need or opportunity, and degree of compliance with the Coast 2050 Criteria. The Coast 2050 Criteria included measures of a potential project's sustainability (elevation, structural framework), ecosystem benefit area, degree of loss rate reduction, primary production, organism and material linkages, wildlife habitat, infrastructure and economic benefits, Coast 2050 habitat objectives, and opportunity to provide coastal wetland benefits.

An initial project implementation meeting was held in April 2000; field trips were held in May and June 2000. The FWS/LDNR Cost Share Agreement was signed on September 12, 2000. A hydrologic study of the project area entitled, "Analysis of Water Level Data from Rockefeller Refuge and the Grand and White Lakes Basin" was completed in October 2001. That report concluded that a "precipitation-induced" water level gradient (0.6 feet or greater 50% of the time) existed north to south of LA Highway 82 to enable freshwater to flow to the Rockefeller Refuge target marshes south of that highway (Swenson 2001). A 1-dimentional hydrodynamic modeling study began on January 28, 2002 and was completed in September 2003 (Fenstermaker and Associates 2003). The modeling study included a model set-up interagency meeting (May 24, 2002), model calibration and verification meetings (November 21, 2002, and December 12, 2002, respectively), and a draft modeling report meeting (April 2003). The model indicated that the project, with a number of original features removed or reduced, would significantly flow freshwater south of LA Highway 82 to reduce salinities within the project area. The incorporation of these recommendations significantly reduced the original conceptual project costs.

Favorable 30% and 95% Design Review meetings, including project partners, other CWPPRA agencies, and major landowners, were held on May 14, 2003 and August 11, 2004, respectively with indications from all participants to proceed toward construction. The Corps and LA Department of Natural Resources permit and consistency applications were submitted on January 30, 2004, for public review. LDNR issued Coastal Zone Consistency Determinations on March 11, 2004, June 3, 2004, and February 23, 2005. Corps Section 404 permit public notices were issued on June 18, 2004; the draft permit was issued on February 23, 2005. LA Dept. of Transportation letters of no objection were received on October 2, 2003, February 2, 2004, and April 19, 2004. The LA Department of Culture, Recreation and Tourism cultural resources clearance was issued on August 19, 2004. The LA Department of Environmental Quality Water Quality Certification was issued on August 17, 2004.

The NRCS Overgrazing and Corps CWPPRA Section 303(e) Determinations were received December 1, 2003, and May 6, 2004, respectively. Landrights were certified by the LDNR as completed on May 10, 2004. The Ecological Review concluded that the project will likely achieve its desired ecological goals. A preliminary review by the FWS LA Field Office contaminants specialist concluded that there are no known hazardous sites within the project area. Phase II construction funding approval will be sought at the October 2004 CWPPRA Task Force meeting.

As indicated above, this project was coordinated with the CWPPRA Task Force, its agencies, the Louisiana Department of Natural Resources, the LA Department of Wildlife and Fisheries, the

LA Division of Administration - Office of State Lands, the LA Department of Transportation and Development, the LA Department of Environmental Quality, the LA Department of Culture, Recreation and Tourism, the Cameron and Vermilion Parish governments, area pipeline companies, and affected landowners. Project implementation would fulfill a regional strategy (move water from north to south across LA Highway 82 with associated drainage improvements south of LA Highway 82) recommended for the Mermentau Basin in the Coast 2050 Plan, which was developed by the Task Force and the Wetlands Conservation and Restoration Authority (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998).

# SECTION 2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

## SECTION 2.1 ALTERNATIVE 1 - NO ACTION

Under this alternative, no action would be taken to reduce elevated salinities and shoreline and interior marsh erosion other than the current Miami Corporation and Rockefeller Wildlife Refuge and Game Preserve management and mitigation activities.

## SECTION 2.2 ALTERNATIVE 2 - PREFERRED ALTERNATIVE

The Preferred Alternative for the Freshwater Introduction South of LA Highway 82 Project would reduce interior marsh loss and restore/create marsh south of LA Highway 82 on Miami Corporation property and the eastern portion of Rockefeller Wildlife Refuge and Game Preserve. The Preferred Alternative consists of enlargement of existing channels north and south of LA Highway 82, installing water control structures to facilitate the movement of freshwater and nutrients from the Grand-White Lake area in the Mermentau Lakes subbasin southward, and the construction of vegetated earthen terraces to protect and restore marshes in the Chenier subbasin. The Preferred Alternative would include the installation and maintenance of the following features as shown on Figure 2.

Project components include:

I. Components that move freshwater from White Lake across LA Highway 82: 1) enlarge the trenasse (boat trail) connecting the Superior Canal to the east-west oil and gas canal to the LA Highway 82 northern borrow canal (20-foot bottom width, 4-foot depth, 3:1 side slope, and top width of 44 feet); and, 2) connect the Grand Volle Ditch to Grand Volle Lake of White Lake and enlarge it from Grand Volle Lake to LA Highway 82 (4-foot bottom width, 4-foot depth, 3:1 side slope, and top width of 28 feet).

II. Components that move freshwater from LA Highway 82 to target marshes south of that highway: 1) Remove the plug at the Rockefeller Refuge Boundary Line Canal east of Superior Canal and adjacent to Unit 13; 2) Modify the Little Constance Bayou structure by installing three 10-foot by 10-foot flap gates on the south side, with stop logs on the northern (Unit 6) side to allow fresh water to flow when conditions permit; 3) Install the New Dyson Bayou water control structure consisting of four, 48-inch diameter culverts with stop logs on the north side and flap gates on the south side located approximately 1,000 feet north of Dyson Bayou; 4) Install the New Cop Cop Bayou water control structure consisting of four, 48-inch diameter culverts with stop logs on north side and flap gates on the south side adjacent to the existing Cop-Cop Bayou control structure; and, 5) Install water control structures consisting of three, 48-inch diameter culverts with stop logs on north side and flap gates on the south side, at each of Sites 10 and 12, in the Boundary Line Levee between Rockefeller Refuge's Units 6 and 14.

III. Marsh Restoration through Earthen Terraces: 1) Construct and re-vegetate approximately 26,000 linear feet by 24-foot-wide duck-wing shaped earthen terraces in open-water between Rockefeller Refuge's Units 6 and 14 to restore about 14 acres of marsh in shallow open-water. See Appendix C, Table C-1, for a detailed description of Preferred Alternative components.

Benefits and Impacts

Total open-water excavation would be 60.2 aces (243,390 cubic yards), open-water fill would be 23.8 acres (114,319 cubic yards), wetland fill would be 0.49 acres (3,996 cubic yards), and total wetland excavation would be 3.6 acres (16,040 cubic yards), for a total wetland impact of 4.1 acres (20,036 cubic yards). A total of 50.6 wetland acres would be filled to a height of 10 inches, but no wetland impacts are anticipated. Marsh restoration project benefits would equate to 14 acres (101,000 cubic yards) from terrace construction, 0.5 acres from outlet channel marsh creation, and 262 acres protected, for a total net wetland benefit of 272 acres protected and restored (See Table 9).

**Existing and Preferred Alternative Water Control Structure Operation Plan**

<u>Existing Project Area Rockefeller Refuge Structure Management</u>

The present Rockefeller Refuge control structure management plan goals consist of maintaining salinities at or below 10 parts per thousand (ppt) at the Superior Canal Bridge (for Unit 6), and 6 ppt at the Unit 14 station for Areas B and C (north of the Boundary Line Canal), and maintaining minimum water levels of slightly lower than marsh level [approximately 0.75 feet North American Vertical Datum (NAVD) 88]. The Rockefeller Refuge management goal includes providing estuarine organism access into Unit 6 and the marshes north of the Boundary Line Canal if salinity and water level target levels are not exceeded.

The existing management plan prevents saltwater intrusion in the Mermentau Lakes Subbasin as well as excessive drying of the marshes within Unit 6 and project Areas B and C. Grand Lake salinities cannot exceed 25 grains per gallon (0.4 ppt) according to the salinity agreement between the Corps of Engineers and the Vermilion Parish Rice Growers Association.

The following management plan incorporates the operation of the existing structures located in the southern and eastern boundary of Unit 6 (north and west of Area A), at the Boundary Line Canal at Cop Cop and Rollover Bayous. That plan involves completely opening the Big and Little Constance structures (each structure is equipped with three 10-foot-wide x 8-foot-deep concrete bays with radial arm gates) when salinities are below 5 parts per thousand (ppt) at the intersection of the Superior Canal and LA Highway 82. When salinities reach 5 ppt at that location, 2 of the 3 radial arm gates are closed at each of those structures. When salinities reach 10 ppt at the Superior Canal Bridge, all bays are closed at both structures.

The radial arm gates and the flapgated Dyson and Cop Cop Bayou structures are operated to flow freshwater from Unit 6 (an extension of the Mermentau "Lakes" Subbasin) and Areas B and C (west and east of Unit 14), when water levels exceed marsh level (i.e., > 1.0 feet NAVD 88). When water levels fall below marsh level (i.e., < 1.0 feet NAVD), the Big and Little Constance radial arm gated structures are closed and the stoplogs are set between marsh level to 0.5 feet below marsh level (0.75 feet NAVD); the other stoplog structures (Dyson, Josephine, and Cop-Cop structures) are adjusted to maintain acceptable marsh water levels (Table 3).

Table 3: Existing Rockefeller Refuge Unit 6 and Boundary Canal Water Control Structure Operational Scheme

| **Control Structure** | **Structure Type** | **Area Controlled** | **Salinity Target Level** | **Water Target Level** | **Operation** |
|---|---|---|---|---|---|
| | | | | | |
| Little & Big Constance Control Structures | Three 10-foot-wide x 8-foot-deep radial arm gates each | Unit 6 and Area A Unmanaged unit | 5/10 ppt @ Superior Canal-Hwy 82 Bridge | 3 inches below marsh level (0.75 feet NAVD) | Maintenance – All bays are opened when the target levels are not exceeded.<br>Salinity Target – 2 bays closed when 5 ppt salinity target level reached; all bays closed when 10 ppt salinity reached<br>Water Level Target – Bays closed when water levels are less than target |
| Dyson Bayou and Bayou Josephine Control Structures | Four 48-inch-diameter culverts with flapgates on south and stop logs on north (Unit 6) side. | Unit 6 and Area A | 5/10 ppt @ Superior Canal-Hwy 82 Bridge | 3 inches below marsh level (0.75 feet NAVD) | Maintenance – All flapgates are down and flapping, stop logs set at 2 feet below marsh level<br>Water Level Target – Stop logs set at marsh level to 0.5 feet below marsh level when water levels approach marsh level (1.0 foot NAVD) @ Superior Canal. |
| Cop-Cop Bayou Control Structures | Four 48-inch-diameter culverts with flapgates on south and stop logs on north side. | Area A and Areas B and C | 6 ppt @ Area A at Unit 14 station | 3 inches below marsh level (0.75 feet NAVD) | Maintenance – All gates are down and flapping at all times except "ingress period", stop logs at 2 feet below marsh level<br>Ingress Period (May-June) – Flapgates raised; Stop logs at 2 feet below marsh level or lower<br>Water Level Target – Stop logs set at marsh level to 0.5 feet below marsh level when water levels approach marsh level (1.0 feet NAVD) @ Superior Canal. |

Proposed Project Area Rockefeller Refuge Structure Management Plan

The structure goals and operation plan would be essentially the same as the current plan (Table 3) with the exception that more freshwater would be able to flow south of Unit 6 and the Boundary Line Canal into Area A, due to modifications to the Little Constance Bayou structure and the installation of additional structures (New Dyson, New Cop Cop, and Structures 10 and 12). The current overall management goal to allow estuarine organism access into Unit 6 and the marshes north of the Boundary Line Canal, within its salinity and water level target constraints, would continue. Likewise, the structure operation would be the same as in the present plan; that is, the salinity maximum target levels of 10 ppt at the Superior Canal Bridge and 6 ppt at the Unit 14 station, with maintenance of minimum water levels slightly lower than marsh level. Saltwater intrusion into the Mermentau Lakes Subbasin and excessive drying of the marshes within Unit 6 and project Areas B and C would be prevented. For the existing structures in areas B and C (north of the Boundary Line Canal), the operational scheme includes a 6 parts per thousand salinity cut-off, with a target water level of 3 inches below marsh level. The operational scheme is presented below, and in Table 4.

Existing Cop Cop, Dyson and Josephine Structures - Set stop logs 2 feet below marsh elevation (- 1.0 foot NAVD). Flapgates are down all year at the Dyson and Josephine Bayou Control Structures to flow water out of Unit 6. For the Cop Cop Structure, flapgates are down except during May and June, when flapgates are usually raised for estuarine organism ingress until a salinity of 6 ppt is recorded at the Unit 14 station. (Note this schedule is for a normal to higher salinity year. The Cop Cop structure was opened for a longer period during 2002, which was a lower-than-normal salinity year.)

New Boundary Line Canal Water Control Structures No. 10 and No. 12, New Dyson and New Cop Cop Bayou Structures - Set stop logs 2 feet below marsh elevation as long as the water level target (0.75 feet NAVD) is not exceeded; flapgates are always down (flapping). Existing levees at proposed structure locations currently block water flow.

Little Constance Bayou Control Structure Operation

The existing Little Constance Bayou control structure would be modified to remove the radial gates and place three flapgates on the southern (Gulf) side and three stop log bays on the north side of that structure. The flapgates on the modified structure would be operated to allow water to flow south to Area A, whenever water levels are greater in Unit 6 compared to Area A provided the water level target (0.75 feet NAVD) is not exceeded. Water levels would not be allowed to fall below the target level of 3 inches below marsh elevation (i.e., 0.75 feet NAVD). In that case, stop logs on the northern side of these structures would be set at marsh level to 0.5 feet below marsh level (1.0 feet to 0.5 feet NAVD) to maintain favorable water levels within Unit 6. Note that the Big Constance structure would not be modified as part of the LA Highway 82 project and its radial arm gates would be operated as described above in the existing structure operation plan (Table 3).

Normal Structure Operation - The normal operating condition, when water levels exceed the target level (i.e., > 0.75 feet NAVD), would consist of the flapgates opened (up position) and the stop logs set at 6 feet below marsh level (- 5 feet NAVD).

Water Levels Below Target Level (0.75 feet NAVD) - When the water levels are close to or lower than the target level, the stop logs would be maintained at marsh level (1.0 feet NAVD) to 0.5 feet below marsh level (0.5 feet NAVD) until the target water level is reached.

Salinity Target Levels and Operation - When salinities reach 5 ppt at the Superior Canal Bridge, two of the 3 flapgates would be lowered and the stoplogs would be lowered from 0.5 feet to - 5 feet NAVD if the target water level has not been exceeded (i.e., stages are at or above the water level target), or would not be exceeded in the near future. When salinities reach 10 ppt at the Superior Canal Bridge, all flapgates will be lowered and the stoplogs would be lowered from 0.5 feet to - 5.0 feet NAVD if the water level target is not exceeded, or if water levels are not dropping such that target levels would be exceeded in the near future.

Table 4: Proposed Freshwater Introduction South of LA Hwy 82 Project Rockefeller Refuge Unit 6 and Boundary Canal Control Structure Operational Scheme

| **Control Structure** | **Structure Type** | **Area Controlled** | **Salinity Target Level** | **Water Target Level** | **Operation** |
|---|---|---|---|---|---|
| Little Constance Control Structure<br><br>Note: no change to Big Constance Structure | Existing structure modified from 3, 10-foot-wide x 8-foot-deep radial arm gates to flapgates on the south side and stoplogs on the north side. | Unit 6 and Area A Unmanaged unit | 5/10 ppt @ Superior Canal-Hwy 82 Bridge | 3 inches below marsh level (0.75 feet NAVD) | <u>Maintenance</u> – All flapgates are open (up position) and stop logs removed when target levels not exceeded.<br><u>Salinity Target</u> – 2 bays closed (i.e., flapgates lowered) when 5 ppt salinity target level reached, stoplogs removed; all bays closed (all 3 flapgates lowered) when 10 ppt salinity reached, stoplogs removed.<br><u>Water Level Target</u> – Stoplogs set at marsh level to 0.5 feet below marsh level when water levels reach target levels (3 inches BML or 0.75 feet NAVD) or less. |
| Existing Dyson Bayou and Bayou Josephine Water Control Structures | Four, 48-inch-diameter culverts with flapgates on south and stop logs on north (Unit 6) side. | Unit 6 and Area A | 5/10 ppt @ Superior Canal-Hwy 82 Bridge | 3 inches below marsh level (0.75 feet NAVD) | <u>Maintenance</u> – All gates flapping (down), stop logs at 2 feet below marsh level.<br><u>Water Level Target</u> – Stop logs set at marsh level to 0.5 feet below marsh level when water levels approach target levels (0.75 feet NAVD) @ Superior Canal. |
| New Dyson Bayou Water Control Structure | Four, 48-inch-diameter culverts with flapgates on south and stop logs on north (Unit 6) side. | Unit 6 and Area A | 5/10 ppt @ Superior Canal-Hwy 82 Bridge | 3 inches below marsh level (0.75 feet NAVD) | <u>Maintenance</u> – All gates flapping, stop logs at 2 feet below marsh level.<br><u>Water Level Target</u> – Stop logs set at marsh level to 0.5 feet below marsh level (1.0 feet to 0.5 feet) when water levels approach target levels (0.75 feet NAVD) @ Superior Canal. |
| Existing Cop-Cop Bayou Water Control Structure | Four, 48-inch-diameter culverts with flapgates on south and stop logs on north side. | Area A and Areas B and C | 6 ppt @ Area B at the Unit 14 Boatshed station | 3 inches below marsh level (0.75 feet NAVD) | <u>Maintenance</u> – All gates flapping, stop logs at 2 feet below marsh level.<br><u>Ingress Period</u> (May-June) – Flapgates raised; Stop logs at 2 feet below marsh level or lower.<br><u>Water Level Target</u> – Stop logs set at marsh level to 0.5 ft below marsh level (1.0 feet to 0.5 feet) when water levels approach target levels @ Superior Canal. |
| New Cop-Cop Bayou & New No. 10 and No. 12 Water Control Structures | Four, 48-inch-diameter culverts with flapgates on south and stop logs on north side; 3, 48-inch-diameter culverts on Structures No. 10 and 12. | Area A and Areas B and C | 6 ppt @ Area B at the Unit 14 Boatshed station | 3 inches below marsh level (0.75 feet NAVD) | <u>Maintenance (Always)</u> – All gates flapping, stop logs at 2 feet or greater below marsh level.<br><u>Water Level Target</u> – Stop logs set at marsh level to 0.5 feet below marsh level (1.0 feet to 0.5 feet) when water levels approach target levels @ Superior Canal. |

## SECTION 2.3 OTHER ALTERNATIVES CONSIDERED

The other structural alternative considered was similar to the Preferred Alternative, but with additional channel excavation and structures, including: 1) deepening of the Doland-Miller Canal, located north of Unit 14, from 2-feet-deep to 4-feet-deep; 2) enlargement of the Grand Volle Ditch to 20-feet-wide by 4-feet-deep; 3) constructing a 2,441 linear-foot conveyance channel in Grand Volle Lake with rock and earthen terraces lining that channel; 4) installing 150, 200-foot-square checkerboard terrace cells; 5) modifying the existing Big Constance Water Control Structure; and, 6) installing two additional control structures (i.e., Numbers 9 and 11) at the Boundary Line Canal Levee south of Unit 14 (Clark et al. 1999). The Preferred Alternative was selected in part because the hydrodynamic modeling results indicated that the additional channel enlargements and structural features mentioned above would not significantly increase freshwater flow southward to the target marshes higher than the Preferred Alternative features (Fenstermaker and Associates 2003). Several terrace designs were evaluated, including straight linear rows orientated east to west, a modified “V” or “duck-wing,” and checkerboard configurations. Terrace top widths considered ranged from 4-feet to 15-feet, and terrace heights considered ranged from settled marsh level height (1.1 feet NAVD) to 2.2 feet above marsh level (2.5 feet NAVD).

# SECTION 3.0 AFFECTED ENVIRONMENT

## SECTION 3.1 PHYSICAL ENVIRONMENT

### A. Regional Hydrology

Historical drainage in the Mermentau Basin was predominantly from north to south through the Mermentau River, Freshwater Bayou, Bayou Lacassine, and Rollover, Belle Isle, Schooner Bayous. Southerly sheet flow over the marsh occurred between Grand Chenier and Pecan Island ridges and westerly to the Calcasieu/Sabine Basin. Construction activities in the early 1900's related to navigation, flood control, irrigation/agriculture, mineral exploration, and wildlife management significantly altered the hydrology of the Mermentau Basin, resulting in freshwater impoundment in the Lakes Subbasin and increased saltwater intrusion and tidal influence in the Chenier Subbasin. Drainage now occurs primarily from east to west through the GIWW, and southwesterly through the Mermentau River to the Gulf, bypassing the Chenier Subbasin marshes. The loss of freshwater input and increased saltwater intrusion into the Chenier Subbasin, converted the historically low-salinity estuary to a tidally dominated, brackish marsh (Louisiana Coastal Wetlands Conservation and Restoration Task Force 2002).

The Mermentau River and its major tributaries were deepened and straightened to improve drainage of rainwater and agricultural discharge from the Upland Subbasin into the Lakes Subbasin and for navigation. Navigation projects included construction of the GIWW, the Old Inland Waterway, the Freshwater Bayou Canal and Lock, and the Mermentau River to Gulf of Mexico Navigation Channel. Over time, wave erosion breached spoil banks and widened the channels, allowing saltwater to intrude into previously fresh areas and compromising freshwater supplies used for agriculture. Additionally, the Bell City Drainage Canal and the

Warren Canal provided freshwater from the Lakes Subbasin to irrigate crops and drained stormwater and agricultural runoff from the Upland Subbasin.

Construction of water control structures and highways also contributed to the altered hydrologic conditions in the Mermentau Basin. Five water control structures were constructed in the Mermentau Basin between 1950 and 1985 to limit saltwater intrusion from the Gulf of Mexico (south) and Calcasieu Lake (west), and to maintain sufficient water levels for agriculture and navigation. Four of those structures (the Calcasieu Lock, Catfish Point Control Structure, Schooner Bayou Control Structure, and the Leland Bowman Lock) directly regulate water levels and saltwater intrusion at the boundaries of the Lakes Subbasin. Water levels are essentially maintained at 2.0 feet Mean Low Gulf (MLG) which is higher than historic marsh level (Louisiana Coastal Wetlands Conservation and Restoration Task Force 2002). The fifth structure, the Freshwater Bayou Canal and Lock, primarily influences water levels in both the Lakes and Chenier subbasins. Louisiana Highways 27 and 82, completed in 1938 and 1956, respectively, further impounded water in the Lakes Subbasin by obstructing over-marsh sheet flow into both the Chenier Subbasin and the Calcasieu/Sabine Basin.

Prolonged elevation of water levels in marshes adversely impacts their primary productivity and sustainability. Flood tolerance of wetland plants is species-specific and dependent on soil and water chemistry (i.e., salinity, sulfide, and iron concentrations) (LCWCRTF 2002). The LDNR's "Hydrologic Investigation of the Louisiana Chenier Plain" study found one or more prolonged marsh flooding events (defined as water levels above average marsh level for greater than 30 consecutive days) at 3 (Calcasieu Lock and the Catfish Point and Schooner Bayou control structures) of the 5 water control structures between 1987 and 2000. Marshes near the Catfish Point Control Structure exhibited the most dramatic and prolonged flooding, i.e., they were flooded 92 percent of the time between December 1990 and June 1996 (LCWCRTF 2002).

Other hydrologic alterations include: access canals constructed for oil and gas activities, the largest of which include the Superior Canal, North Island Canal, and Humble Canal; smaller canals used by the fur trapping industry; and levees and water control structures used for wildlife management activities on Federal (Lacassine National Wildlife Refuge), state (Rockefeller Wildlife Refuge), and private property. The access canals have facilitated saltwater intrusion into both subbasins, while wildlife management activities have generally improved vegetative and wildlife community structure (Louisiana Coastal Wetlands Conservation and Restoration Task Force 2002). Wildlife managers aim to achieve a balance between reducing wetland plant waterlogging and saltwater intrusion stresses, and providing access for estuarine fish and shellfish organisms to interior marshes during critical life-cycle events.

## B. Water Quality

As part of its surface water quality monitoring program, the Louisiana Department of Environmental Quality (LDEQ) routinely monitors several parameters (Table 5) on a monthly basis at numerous sites. Although there are several long-term monitoring sites on larger water bodies throughout the State, those sites are currently monitored intensively for 1 and 5-year cycles (LDEQ 2002). Based upon those data and fish tissue contaminants data, complaint investigations, and spill reports, etc., LDEQ has assessed water quality fitness for the following uses: agriculture, primary contact recreation (swimming), secondary contact recreation (boating and fishing), fish and wildlife propagation, and drinking water supply. Based on existing data and more subjective information, water quality is determined to either fully, partially, or not support those uses. Water quality in White Lake and Grand Lake is considered by the LDEQ to fully support primary and secondary contact recreation and agricultural use, but does not support fish and wildlife propagation. The Mermentau River is the major source of water entering Grand Lake and is considered by the LDEQ to fully support primary and secondary contact recreation. Fish and wildlife propagation, however, is not supported in the Mermentau River (Lake Arthur to Grand Lake), Grand Lake, and GIWW (Calcasieu River to Vermilion Locks) according to the LDEQ water quality assessments. LDEQ lists water quality for three other sources of water entering Grand Lake (Table 6). Additionally, the estuarine waters of the Mermentau River Basin (coastal bays and Gulf waters to the State three-mile limit) fully support primary and secondary contact recreation and agricultural use, but do not support fish and wildlife propagation (LDEQ 2002).

Table 5. Parameters Monitored for LDEQ's Monthly Ambient Surface Water Quality Network

| | | | |
|---|---|---|---|
| pH and temperature | field conductivity | total suspended solids | lead* |
| dissolved oxygen | specific conductance | arsenic* | total Kjeldahl nitrogen |
| salinity | sodium | cadmium* | nitrate and nitrite |
| alkalinity | chlorides | chromium* | ammonium nitrogen |
| hardness | true color | copper* | total phosphorus |
| Secchi Disk | sulfates | nickel* | total organic carbon |
| turbidity | total dissolved solids | mercury* | coliform bacteria |

* Metals sampling and analysis is done quarterly.

Table 6. Water Quality for Project-area Water Bodies from LDEQ's Monthly Ambient Surface Water Quality Network

| Water Body Name/Description | Primary Contact Recreation | Secondary Contact Recreation | Fish and Wildlife Productivity | Agriculture | Suspected Impairment(s) Associated with each Suspected Source(s) |
|---|---|---|---|---|---|
| Lake Arthur and Lower Mermentau River to Grand Lake | F | F | N | | Turbidity, Nitrogen (N), Ammonia (total), Sedimentation/ Siltation, Total Suspended Solids (TSS) |
| Lacassine Bayou-Headwaters to Grand Lake | F | F | N | F | Dissolved Oxygen (DO) |
| GIWW – From Mermentau River to Leland Bowman Locks (at Intracoastal City) | F | F | N | F | Carbofuran, TSS, Turbidity, Sedimentation/ Siltation, Hg, N (ammonia), |
| White Lake | F | F | N | F | Chloride, Sedimentation/Siltation, Total Dissolved Solids (TDS), TSS, Turbidity |
| Mermentau River – Catfish Point Control Structure to Gulf | F | F | F | | |
| Big Constance Lake and Associated Water bodies | F | F | N | | DO |
| Mermentau River Basin – Coastal Bays and Gulf up to the 3-Mile Limit | F | F | N | F | Carbofuran, Hg |

* Metals sampling and analysis is done quarterly.
F – Fully Supports Use; N – Does not Support Use

Agricultural runoff has increased turbidity in Grand and White Lakes, thereby reducing habitat quality for submerged aquatic vegetation (SAV) and fish species that depend on SAV habitats. Recommended agricultural Best Management Practices (BMPs) focus on allowing sediment to settle out in the rice fields before they are drained. Application of BMPs to reduce turbidity should improve fisheries habitat without increasing saltwater intrusion into the area.

Salinity is an important factor in the Lakes Subbasin because farmers within the area utilize the water to grow rice and crawfish. Salinities in the Lakes Subbasin are generally fresh, but some saltwater intrusion may occur in times of drought, when locking operations allow spikes of salt water into the subbasin and insufficient head differential exists to flush the salt water out. When water levels are low in the subbasin, some salt water from the Gulf of Mexico and brackish water from Vermilion Bay may flow into the subbasin through the Leland-Bowman Lock and the Schooner Bayou Control Structure when the gates are opened for navigational purposes. Storm surges may also introduce excessively saline water into the project area.

**C. Wetland Loss**

Within the 24,874-acre Freshwater Introduction South of LA Highway 82 Project area, marsh losses were 12.6, 1.2, and 0.9 percent for the periods 1956 to 1974, 1974 to 1983, and 1983 to 1990, respectively, for a total of 22 percent wetland loss within that area from 1932 to 1990 (Table 2). The project-area 1983 to 1990 land loss rate was 0.13 percent/year (Dunbar et al. 1992). If this modest rate is projected to the year 2050, another 1,371 acres (7.8 percent) could be lost from the project area (a 30 percent loss from 1932 to 2050; Table 2).

The project area is divided into three subareas, Areas A, B, and C. Land loss rates were calculated separately for each subarea using the most recent data available in 1999 (Dunbar et al 1992; USGS 1999). Current environmental conditions in Area A suggest that the wetland loss data may underestimate erosion rates for that area, and those marshes may be experiencing higher salinities. In September 1999, interstitial soil salinities of 20 ppt were recorded (Foret 1999). The Gulf of Mexico is continuing to erode the shoreline immediately south of Area A, which allows marine processes and saltwater to intrude into the marshes in the northern portion of Area A. This saltwater intrusion process, in addition to reductions in natural freshwater flow from the north, has increased the marine influence in that area; therefore, Area A is in need of freshwater, nutrients and sediment. The current Area A loss rate is probably much greater than the 0.16 percent per year calculated from the 1978-1990 GIS analysis (USGS 1999).

Wetland losses in Areas B and C were calculated by the Corps of Engineers using the most recent (1983 and 1990) aerial photography. The loss rate for Area B during that time frame was 0.24 percent per year or 4.9 acres per year. The loss rate for Area C was 0.56 percent per year or 9.4 acres per year (Dunbar et al. 1992).

## SECTION 3.2 BIOLOGICAL RESOURCES

**A. Plant Communities**

Existing project-area vegetative communities consist of intermediate, brackish and saline marshes and open-water. The project area is divided into three subareas, Areas A, B, and C, containing 19,254 acres; 2,970 acres; and 2,650 acres; respectively. Most of the open-water is shallow (less than 1.5 feet deep) except in the canals and larger lakes. The brackish marshes are dominated by marshhay cordgrass (*Spartina patens*), saline marshes are dominated by smooth cordgrass (*Spartina alterniflora*) and marshhay cordgrass, and the intermediate marshes are predominately vegetated by marshhay cordgrass.

Area A is located in the unmanaged marsh area south of Units 6 and 14 and, in 1990, consisted mostly (> 43 percent) of saline marsh, brackish marsh (40 percent), and open-water (17 percent). This contrasts with the 1978 habitat data which indicated the area contained 70% brackish and only 11% saline marshes (Clark et al. 1999; USGS 1999). However, in 2000, Area A consisted of 47% brackish and 40% saline marshes (USGS 2004). The area has experienced a rapid conversion of brackish marsh to saline marsh and open-water. The remaining Area A brackish marshes are located south of Units 14 and 15 in the northeastern portion of Area A, and consist of broken and dying brackish marshes between the Gulf of Mexico shoreline rim and Unit 6 and the boundary canal south of Unit 14. Healthy brackish and saline marshes are confined to a narrow band of about 500 to 1,000 feet adjacent to the Gulf rim, and natural bayous, as well as along the northern Area A boundary.

Area B, north of the Rockefeller Refuge Boundary Line Canal and west of Unit 14, consists of primarily of intermediate marsh (73 percent) and of open-water habitats (24 percent), with some fresh (< 1 percent) and brackish (< 1 percent) marshes also present. Area B has experienced a “freshening” from 1978 to 1990 with an increase in intermediate marshes from 35 percent in 1978 to 73 percent in 1990, and a concomitant decrease in brackish marsh from 20 percent to only 1% in 1990 (Clark et al. 1999; USGS 1999).

Area C, east of Unit 14, consists primarily of intermediate marsh (71 percent) and open-water (28 percent), with some fresh marsh (< 1 percent). Intermediate marsh coverage in Area C also increased from 53 percent in 1978 to over 71 percent in 1990 (Clark et al. 1999; USGS 1999).

## B. Fish and Shellfish Habitat

Project-area marshes and associated open-water habitats provide important habitat (i.e., nursery, escape cover, feeding grounds) for a variety of freshwater and estuarine-dependent fishes and shellfishes. Most of the economically important saltwater fishes and crustaceans harvested in Louisiana spawn offshore and use estuarine areas for nursery habitat (Herke 1995). Nekton use of estuaries is largely governed by the seasons (Day et al. 1989). Different species use the same locations in different seasons, and different life stages of the same species use different locations. Aquatic species diversity peaks in the spring and summer, and is typically low in the winter. Some marine species which use estuaries as nursery habitat also have estuarine-dependent life stages, typically as larvae and juveniles. Larvae or juveniles immigrate into the project area during incoming tides and take advantage of the high productivity of the estuary.

Species typical of low-salinity areas include largemouth bass, crappie, bluegill, gar, and blue catfish. Species found in higher salinity areas include Atlantic croaker, spot, Gulf menhaden, bay anchovy, red drum, black drum, southern flounder, blue crab, Gulf stone crab, brown shrimp, and white shrimp (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999).

## C. Essential Fish Habitat

The proposed project is located within an area identified as Essential Fish Habitat (EFH) for postlarval, juvenile, and sub-adult life stages of white shrimp, brown shrimp, and juvenile and sub-adult red drum. EFH requirements vary depending upon species and life stage (Table7). Categories of EFH in the project area include estuarine emergent wetlands, marsh edge, estuarine water column, tidal creeks, ponds, submerged aquatic vegetation, and estuarine water bottoms. Detailed information on Federally managed fisheries and their EFH is provided in the 1998 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the Gulf of Mexico Fishery Management Council (GMFMC). That generic amendment was prepared as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

Table 7. Essential Fish Habitat for Federally Managed Species in the Project Area

| Species | Life Stage | EFH |
|---|---|---|
| brown shrimp | post larval/juvenile | marsh edge, submerged aquatic vegetation, tidal creeks, inner marsh |
| | subadult | same as post larval/juvenile |
| white shrimp | post larval/juvenile | marsh edge and ponds, submerged aquatic vegetation, inner marsh |
| | subadult | same as post larval/juvenile |
| red drum | post larval/juvenile | submerged aquatic vegetation, estuarine mud bottoms, marsh/water interface |
| | subadult | mud bottoms, oyster reefs |

In addition to being designated as EFH for white shrimp, brown shrimp, and red drum, aquatic habitats to be affected by this project provide valuable nursery and foraging habitats for other economically important fishery species including Atlantic croaker, striped mullet, Gulf menhaden, and blue crab. Those estuarine-dependent species serve as prey for other species managed under the MSFCMA by the GMFMC (e.g., red drum, mackerels, snappers and groupers) and highly migratory species (e.g., billfishes and sharks) managed by the National Marine Fisheries Service (NMFS).

## D. Wildlife Habitat

Most of the project area lies within the state-owned Rockefeller Wildlife Refuge and Game Preserve, which is one of the most biologically diverse wildlife areas in the country. Located at the termini of the Mississippi Flyway and Central Flyways, south Louisiana winters about 4 million waterfowl annually. The refuge and the project-area marshes provide wintering habitat for 26 species of waterfowl. Recent surveys indicate a wintering waterfowl population on Rockefeller Wildlife Refuge reaching 160,000 birds. Historic numbers have been as high as

400,000 waterfowl. Dabbling ducks, such as mallard, gadwall, American widgeon, pintail, northern shoveler, green-winged teal, and blue-winged teal, utilize marsh and shallow-water habitats within the project area. Diving ducks such as lesser scaup, ring-necked duck, and several species of mergansers, utilize larger ponds and open-water areas. Large populations of wintering white-fronted and snow geese seasonally inhabit the refuge and surrounding marshes as well as a resident Canada goose population established in the 1960s. The refuge also provides breeding and brood-rearing habitat for resident mottled ducks and blue-winged teal.

The project area also provides feeding and nesting habitat for numerous other migratory birds such as American coots, rails, gallinules, bitterns, little blue heron, great blue heron, green-backed heron, yellow-crowned night heron, black-crowned night heron, great egret, snowy egret, white-faced ibis and white ibis. Numerous shorebirds and songbirds either migrate through or overwinter in Louisiana's coastal marshes.

Mammals that inhabit project-area habitats include nutria, muskrat, raccoon, river otter, mink, swamp rabbit, coyote, and white-tailed deer. Reptiles and amphibian species found in the project area include American alligator, western cottonmouth, red-eared turtle, common snapping turtle, softshell turtle, treefrogs, bullfrog and pig frog.

**E. Threatened and Endangered Species**

The endangered brown pelican (*Pelecanus occidentalis*) and the threatened piping plover (*Charadrius melodus*) and its designated critical habitat occur within or adjacent to the proposed project area. In Louisiana, brown pelicans may build nests during winter, spring, or summer in mangrove trees or other shrubby vegetation, although occasional ground nesting may occur. Pelicans are not known to nest in the project area, but may use the area for feeding and/or loafing. 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.

Piping plovers winter in Louisiana and may be present for 8 to 10 months, arriving from the breeding grounds as early as late July and remaining until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sandflats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, as the suitability of a particular site for foraging or roosting is dependent on local weather and tidal conditions. Plovers move among sites as environmental conditions change.

Their designated critical habitat identifies specific areas that are essential to the conservation of the species. The primary constituent elements for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

### SECTION 3.3 CULTURAL AND RECREATIONAL RESOURCES

Various cultural resources, including both prehistoric and historic sites, occur throughout the Louisiana coastal zone. The Louisiana Department of Culture, Recreation and Tourism maintains catalogues of numerous cultural resource sites, but many areas remain unsurveyed, so their significance or eligibility for inclusion if the National Register of Historic Places has not been determined. On August 19, 2004, the Service received confirmation from the Louisiana State Historic Preservation Officer that there were no known archaeological sites or historic properties within the project area.

### SECTION 3.4 ECONOMIC RESOURCES

#### A. Commercial Fish and Wildlife Resources, and Related Land Use/Management

Grand Lake, White Lake, and associated water bodies support the commercial harvest of catfishes, gars, freshwater drum, white shrimp and blue crab. The marshes of the Mermentau Basin also provide high-quality wintering habitat for an abundance of migratory waterfowl important to sport hunters and the hunting-related economy of the region. Alligator and furbearer harvests are also extensive in the basin. Numerous private landowners and leaseholders have implemented plans to maintain and enhance waterfowl habitat values. Landowners obtain substantial revenues from hunting and fishing leases in the Mermentau Basin; thus, numerous hunting and fishing camps are found in the general project vicinity. Project-area marshes support recreational shrimping, crabbing, fishing, and bird-watching, as well as commercial trapping. Hunting is not allowed on the Rockefeller Wildlife Refuge, including the project-area marshes.

#### B. Oil and Gas Activity

The marshes within and adjacent to the project area contain almost 200 active oil and natural gas production facilities, and over 30 miles of oil and gas pipelines (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999). Oil and gas production provides a substantial contribution to the local economy. The project-area marshes also provide important protection of these facilities from storm-associated wind and wave energy.

## SECTION 4.0 ENVIRONMENTAL CONSEQUENCES

### SECTION 4.1 ALTERNATIVE 1 - NO ACTION

**A. Physical Environment**

Under the No Action scenario, marsh loss, salt-water intrusion and tidal amplitude would continue and/or increase. At current loss rates (0.16 to 0.56 percent/year), another 457 acres of wetland loss would occur over the next 20 years (Table 2). With continued marsh loss, interior open-water areas would increase in size. Subsequently, wind and wave erosion would increase, potentially accelerating marsh deterioration rates. Additionally, any increases in salinity levels will result in accelerated deterioration and loss of coastal marsh.

**B. Biological Resources**

**Plant Communities**

Marsh loss from saltwater intrusion and wave energy would continue and probably increase within the project area under the No Action Alternative. The acreage of shallow open-water would increase as over 457 acres of project area marshes are lost. Increased salinity and turbidity levels, due to increased wind fetch and wave action, would inhibit growth of submerged aquatic vegetation in those areas. Existing fresh and intermediate marsh vegetative communities may become dominated by brackish marsh species. Likewise, brackish marsh communities may become dominated by saline species.

**Fisheries**

With the No Action scenario, 457 acres of existing marsh would be transformed to shallow, unvegetated lake bottom within 20 years. Although shallow unvegetated open-water areas can function as nursery habitat for freshwater and estuarine-dependent fish species, the productivity of those waters is substantially less than marsh ponds or marsh edge. Increasing salinity levels and turbidity would reduce the growth of submerged aquatic vegetation and reduce overall project-area fishery habitat values and aquatic production.

**Essential Fish Habitat**

Under the No Action alternative, marsh loss would continue. As existing marsh becomes more fragmented, increased marsh edge would temporarily maintain managed fish species productivity (i.e., post larval/juvenile and subadult brown and white shrimp and post larval/juvenile red drum). An eventual decline in those species/life stages, however, is expected to occur with no action as marsh habitats continue to convert to open-water.

**Wildlife**

With the No Action Alternative, the continued loss of marsh would reduce habitat values for a variety of wildlife species. The migratory and resident ducks and other wetland-associated birds that currently utilize the marsh and shallow-water habitats for food and cover would be negatively impacted, as would game mammals, fur animals, reptiles and amphibians. This loss is viewed as especially significant from the standpoint of waterfowl wintering habitat, given the importance of the project area marshes to wintering ducks and geese on the Rockefeller

Wildlife Refuge and Game Preserve.

**Threatened and Endangered Species**

Under the No Action Alternative, continued loss of marsh would reduce the value of the area as foraging habitat for the endangered brown pelican. Adjacent piping plover habitats (i.e., beaches and flats) would decrease in the future with No Action, as the internal marsh is lost and the Gulf shoreline retreats northward toward LA Highway 82.

**C. Cultural and Recreational Resources**

Any existing archeological sites and shell deposits (possibly middens) located within the project area would face continued erosion threats under the No Action Alternative, because existing shoreline and interior marsh erosion rates would continue or increase.

**D. Economic Resources**

The continued loss of emergent vegetation in the project area would contribute to the decline of recreational activities, as well as commercial trapping that currently occur in the non-refuge portion of the project area. Protection of oil and gas facilities from storm-associated wind and wave energy would also be reduced as marshes deteriorate.

## SECTION 4.2 ALTERNATIVE 2 - PREFERRED ALTERNATIVE

**A. Physical Environment**

Under the Preferred Alternative, sedentary benthic organisms that may be in the immediate vicinity of the dredged material dredging and deposition areas would be impacted. There will also be a temporary, localized increase in turbidity associated with dredging; that increase will have minimal effect on emergent marsh and submerged aquatic vegetation.

The "duck-wing" earthen terraces to be installed south of LA Highway 82 will be adequately vegetated with over 19,000 smooth cordgrass plugs in one row, placed at 3-foot spacings on each terrace side slope. Natural revegetation is expected to occur rapidly thereafter, based on our experience with similar projects. Other dredged material disposal areas within the project are expected to rapidly revegetate naturally.

This project requires some dredged sediment to be: 1) stacked no higher than 10 inches, with vegetated berms constructed between the dredged material and existing water bodies; 2) placed on existing levees with a 20-foot berm; and/or, 3) spray-dredged over existing marsh in portions of the project thereby reducing turbidity and allowing sediment to fall out of suspension. The thinly spread and the spray-dredged material is expected to revegetate quickly by existing vegetation growing through the dredged material. After dewatering and compaction, we estimate the dredged material placed no higher than 10 inches will compact by 30% or more to no higher than 7 inches above existing marsh. Existing marsh vegetation will be able to easily grow through this layer. Material placed on existing levees will be contained by a vegetated berm between the edge of the dredged material and existing water bodies. In addition, the gentle (i.e., greater than 1:3) levee slope will also help to prevent erosion and reduce the rate of dredged material run-off into adjacent waters.

**Hydrodynamic Modeling Study Conclusions**

Fenstermaker and Associates performed a 1-Dimensional Hydrodynamic modeling study of the conceptual and Preferred Alternative project components. That report predicted Preferred Alternative monthly salinity reductions for project target areas, for the April 2002 to October 10, 2002 modeling period (Fenstermaker and Associates 2003).

Table 8: Salinity Difference Ranges for the Freshwater Introduction South of LA Highway 82 Project Target Areas Predicted by the Mike 11 1-Dimensional Hydrodynamic Model from April to October 2002 Continuous Recorder Salinity Data (As Interpreted from Salinity Contour Maps).

| Area/Month | April | May | June | July | August | September | October (10 days) |
|---|---|---|---|---|---|---|---|
| Area A (Big Constance Bayou to Rollover Bayou) | - 1 to - 4 | - 1 to - 4 | 0 to - 3 | - 1 to -4 or -5 | - 1 to - 5 | -1 to - 5 | - 1 to - 5 |
| Area A (west of Big Constance Bayou) | 0 to - 1 | 0 to - 1 | 0 to -1 | + 1 to - 1 | 0 to - 1 | 0 to -1 | 0 to - 1 |
| Area B (west of Unit 14) | - 1 to - 2 | + 2 to - 1 | + 4 to 0 | 0 to - 2 | -1 to -3 | 1 to -1 | - 1 to - 3 |
| Area C (east of Unit 14) | - 1 | - 1 to - 3 | - 1 to - 3 | - 1 to - 3 | - 1 to - 4 | - 1 to - 3 | + 1 to - 2 |

[salinity changes are represented in parts per thousand (ppt)]

The model analysis of predicted project salinity differences indicated the following: 1) the Preferred Alternative predicted that the Area A salinity reduction benefited area extended east of the original project boundary to Rollover Bayou; 2) salinity reductions for Target Area A ranged from - 1 to - 5 ppt; 3) the model predicted only a small (approximately - 1 ppt) Preferred Alternative salinity reduction in the western portion of Area A south of Unit 6; and, 4) monthly average salinity reductions ranged from + 4 to - 3 ppt for Area B and from + 1 to - 4 ppt for Area C. Thus, the hydrodynamic model results predicted that the Preferred Alternative could flow sufficient fresh water southward to significantly reduce target-area marsh salinities from 1 to 5 ppt (Fenstermaker and Associates 2003; Figure D-1).

**B. Biological Resources**

**Plant Communities**

Implementation of the Preferred Alternative is expected to protect 262 acres of brackish and intermediate marshes via freshwater introduction across LA Highway 82, and to convert 14.5 acres of shallow water to marsh via terraces and marsh restoration (Table 9). The Preferred Alternative is expected to deepen an additional 38.5 acres of shallow water to a depth of 4 feet for channel enlargements and water control structure installation. With project implementation, an additional 22 acres of shallow water would be deepened 4.5 to 5.0 feet via terrace construction. A total of 60.2 acres of shallow water would be significantly deepened by the project.

In contrast, the Preferred Alternative will protect approximately 262 acres of intermediate and brackish marsh, will restore 15 acres of intermediate and brackish marsh, and will provide submerged aquatic vegetation (SAV) habitat in shallow water via construction of earthen terraces. Those actions would also facilitate sediment accretion. The Preferred Alternative would impact 4.1 acres of marsh for a net benefit of 272 acres of wetlands protected and restored by the proposed project. Most of the areas where marsh is to be either created or accreted in shallow water were intermediate to brackish marsh 15 to 20 years ago, but those habitats were lost to wave erosion, saltwater intrusion and subsidence. The Preferred Alternative is, therefore, self-mitigating; the benefits of protecting and restoring 272 acres of intermediate to brackish marsh far outweigh the impacts of converting 14.5 acres of shallow open-water to marsh, deepening 60 acres of shallow open-water areas, and impacting 4.1 acres of marsh (Table 9). See Appendix B for a more detailed analysis of project benefits and impacts.

In all, project implantation could result in a net increase of 272 acres of intermediate and brackish marsh over the 20-year project life, compared with the No Action alternative. Submerged and floating-leaved aquatic vegetation coverage would also increase from 35 percent to 40 percent (a 14 percent increase) during the project life, due to decreased turbidity in the shallow waters between the restored and existing marshes (Clark et al. 1999).

Vegetative plantings on the slopes of the proposed Area B terraces would help stabilize terrace material and accelerate marsh establishment. Those terraces would reduce wave energy; thus, they would protect the surrounding edges of interior fringing fresh marsh, and would facilitate additional marsh establishment by enhancing accretion of sediments. Because existing turbidity levels would be reduced in the areas protected by the terraces, growth of submerged aquatic vegetation in adjacent shallow open-water areas would also increase.

**Table 9: Comparison of Preferred Alternative Shallow Water and Wetland Impacts and Benefits**

| Preferred Alternative Component | Shallow Water Excavation/ Fill (Area/Volume) | Wetland Excavation (area/vol) | *Wetland Fill Area/Volume | Marsh Restoration/ Protection |
|---|---|---|---|---|
| Channel Enlargement Benefits/Impacts:<br>1. LA Hwy 82 Channel<br>2. Grand Volle Lake Channel<br>3. Grand Volle Channel North<br>4. Grand Volle Channel South<br>5. Boundary Line Canal | Excavation = 37.6 ac (133,050 cy)<br><br>Fill = 0.9 ac (4,500 cy)<br><br>Total = 38.5 ac/ 137,550 cy. | 2.3 ac<br><br>(9,800 cy) | *0 wetland fill (88,550 cy)<br><br>(*50.1 ac, 88,550 cy of fill in wetlands, but no impacts)<br><br>(Boundary Line Canal Dredged material placed on existing embankment/levee) | |
| Earthen Terraces<br>(26,000 ft X 36.3 ft X 3.5 ft) | Excavation = 21.7 ac (101,000 cy)<br><br>Fill = 21.7 ac (101,000 cy) | | | + 14 ac<br>(24 ft X 26,000 ft) |
| Water Control Structure Installation and Modification<br>1. Earthen Plug Removal<br>2. Little Constance Structure Modification<br>3. New Dyson Bayou Structure<br>4. New Cop-Cop Bayou Structure<br>5. Structure No. 10<br>6. Structure No. 12 | Excavation = 0.87 ac (9,340 cy)<br><br>Fill = 1.19 ac (8,819 cy)<br><br>Total = 2.06 ac (18,159 cy) | 1.27 ac<br>(6,240 cy) | 0.49 ac<br>(3,996 cy) | 0.48 ac<br>(2,244 cy)<br><br>(Outlet channel fill in old Cop Cop Bayou) |
| **Total Impacts = 131.7 ac**<br><br>**Total Wetland Impacts = 54.2 ac** | Total Excavation = 60.2 ac (243,390 cy)<br>Total Fill = 23.8 ac (114,319 cy)<br><br>**Total Excavation/Fill= 84 ac (357,709 cy)** | **3.6 ac**<br>**(16,040 cy)** | ***0.49 ac**<br>**(3,996 cy)**<br><br>**(*Total = 50.6 ac/, 92,546 cy, but only 0.49 ac impacts)** | |
| **Freshwater Introduction Wetland Protection Benefits** | | | | **262 ac** |
| **Wetland Restoration Benefits** | | | | **14.5 ac** |
| **Total Benefits** | | | | **+ 276.5 ac** |
| **Net Wetland Benefits**<br>**(wetland benefits - impacts)** | | | | **+ 272.4 ac** |

* Note: Wetland fill impacts will be significantly reduced because most of the spoil will be thinly spread on marsh to a maximum settled height of 10 inches, or spray-dredged over existing marsh in order to reduce marsh impacts.

## Fisheries

Because vegetated habitats support higher densities of fish and crustaceans than unvegetated habitats (Castellanos and Rozas 2001), fisheries production would benefit from the net protection associated with the projected increase of intermediate and brackish marsh (272 acres) compared to taking no action. Terrace construction on the Sabine NWR has increased sediment deposition, reduced turbidity, increased marsh-edge habitat, and increased overall primary and secondary productivity, while maintaining fish and shellfish access to area marshes (Underwood et al. 1991, LDNR 1993). Areas with similar constructed terraces have been shown to support higher standing crops of most fishery species, compared to shallow marsh ponds of similar size (Rozas and Minello 2001). Grand Volle Lake, LA Highway 82 Borrow Channel, Grand Volle Channel North, Grand Volle Channel South, and the Boundary Line Canal access channel construction and enlargement would deepen the bottom elevations of those channels by 2 to 4 feet over areas 25-to 44-feet-wide (35 acres), and excavation for the terrace construction would deepen the bottom elevation by 3 to 4 feet within an area 34 feet wide (22 acres) (Table 9). Project construction will cause temporary increases in turbidity in shallow open-water areas that will cause fish and shellfish to temporarily avoid the work area. We do not anticipate that these excavated areas would either become anoxic, or produce significantly reduced dissolved oxygen levels than surrounding areas because: 1) Grand Volle Lake is well-mixed due to wave action and shallow depths, and it has a direct connection to White Lake; 2) salinity-related stratification of the borrow areas is unlikely; 3) the decrease in bottom-elevation would be relatively small (less than 4 feet); and, 4) the borrow areas would fill with sediment from the water column and erosion of the borrow area side slopes.

## Essential Fish Habitat

Under the Preferred Alternative, a net increase in high quality fish and shellfish nursery habitats would result from marsh protection and restoration. The preferred alternative is expected to slow or stop interior marsh loss, while maintaining fish and shellfish access to shoreline and interior marshes. Some loss of shallow, open-water bottom habitat would be replaced with other essential fish habitat (i.e., 15 acres of restored marsh). In all, the Preferred Alternative would protect and restore a net 272 acres of marsh over the 20-year project life. Project construction would also increase the acreage of submerged aquatic vegetation in the area south of LA Highway 82 by 14 percent (or more) as a result of reduced wave energy with the project.

The project features are not expected to adversely impact existing marsh or submerged aquatic vegetation over the long term. There will be temporary project construction impacts, consisting of increased turbidity and possibly lowered dissolved oxygen levels, in the water column due channel enlargement, terrace construction and control structure installation. Fish and shellfish access to protected marsh and shallow waters would be provided via the existing Cop Cop Bayou and Big Constance Bayou water control structures, and the modification of the Little Constance Bayou control structure. Modification of the Little Constance structure to remove the gates and replace them with flapgates and stoplogs will not change fish and shellfish access into Unit 6 from the Gulf and unmanaged marshes south of that unit. The proposed modified Little Constance Bayou normal operating condition will mimic the existing operation where the entire 10-foot-wide by 8-foot-deep bays are opened to maintain target salinity and water levels. The Cop Cop Bayou structure is normally opened during the months of May and June to provide estuarine organism ingress until a salinity of 6 ppt is recorded at the Unit 14 Boathouse station. Installing freshwater inflow structures in the Unit 6 eastern levee (New Dyson Structure), and the Boundary Canal Levee (Structure No.'s 10 and 12, and the New Cop Cop structure), will not affect existing fisheries access, because no fisheries access currently occurs through the levees and into Area A except through the existing structures. Therefore, no adverse effects to fisheries are likely to occur as a result of those features. Finally, the earthen terraces are designed with 100-foot-wide gaps between each terrace segment and 500-foot-wide spacings between terrace rows, and additional gaps would be constructed where terrace segments are close to existing marsh. Approximately 15 acres of marsh would be restored and fisheries access would be maintained via earthen terrace construction and Grand Volle Lake marsh restoration. Approximately 52,000 linear feet of additional marsh edge habitat will be produced by terrace construction. Marsh edge is one of the most productive forms of essential fish habitat. Thus the project would increase fisheries productivity by increasing EFH.

**Wildlife**

Implementing the Preferred Alternative would result in a net improvement in habitat for numerous species of wildlife, including migratory and resident waterfowl, wading birds, alligators, game mammals, and furbearers. That alternative would lead to a net increase of 272 acres of intermediate to brackish marsh, and submerged aquatic vegetation is expected to increase by 14 percent. Migratory waterfowl would benefit from a greater food supply from restored marsh and increased submerged aquatic vegetation. The seeds and tubers of marsh plants provide important foods for puddle ducks including mottled duck, mallard, pintail, blue-winged teal, and green-winged teal. The Preferred Alternative is also expected to increase preferred waterfowl food plants such as Walter's millet, fall panicum, and various species of sedges and rushes. Submerged aquatic vegetation, which is expected to increase due to the project, are important food sources for gadwall, American widgeon and northern shoveler (Chabreck et al. 1989). The terraces and marsh restoration would provide 15 acres of additional mottled duck nesting and brood-rearing habitat with protected shallow water and submerged vegetation between the terraces and the shoreline.

Protected shallow water and increased marsh edge habitats would provide increased foraging opportunities for wading birds and, shore birds. The Preferred Alternative would increase marsh edge habitat by 52,000 linear feet (10 miles) via construction of earthen terraces. Marsh edge and submerged aquatic vegetation support greater densities of prey items for wading birds such as the great blue heron, little blue heron, roseate spoonbill, great egret, black-crowned night heron, great egret and snowy egret. Vegetated habitats contain higher densities of fish and crustaceans, important as prey for wading birds, than do unvegetated habitats (Castellanos and Rozas 2001). Furbearers such as nutria and muskrat, which feed on wetland vegetation, would benefit from the net increase in intermediate and brackish marsh. Mink, muskrat, river otter, and raccoon have a diverse diet and feed on a variety of fishes and crustaceans. They feed along vegetated shorelines that provide cover for many prey species. American alligators would likewise benefit from the net increase in intermediate and brackish marsh and shallow, protected, open-water habitats behind the terrace and shoreline protection features, where prey species would be more abundant.

**Threatened and Endangered Species**

Brown pelican populations are expected to benefit from the additional marsh and associated shallow water habitat acreage that would provide increased fisheries populations upon which this species depends for food. The proposed project would not affect the piping plover nor its critical habitat because that habitat includes beaches and mudflats adjacent to the Gulf, but not in the project area. The Service will conduct an intra-service Section 7 Endangered Species Act consultation prior to signing the FONSI and issuing the final EA

**C. Cultural and Recreational Resources**

The project would provide wave protection to any archeological sites and other sites within the project area through terrace construction and protection of 272 acres of marsh; however those sites, if any, would continue to experience moderate shoreline and interior marsh erosion. The Louisiana Office of Cultural Resources, State Historic Preservation Officer, on August 19, 2004, conducted a Section 106 cultural resources evaluation of the project features and determined that the project would not impact any known archeological sites.

Recreational activities within the project area, such as fishing and hunting, should increase due to the project, because of marsh establishment and reduced turbidity between the terraces and existing marsh shoreline. The increased acreage of marsh and lower-turbidity, shallow open-water would sustain greater fish and wildlife use of the area, thereby increasing opportunities for related recreational activities.

**D. Economic Resources**

Implementation of the Preferred Alternative would help to maintain and, perhaps, increase the economically important recreational and commercial activities dependent on fish and wildlife resources. The net project-related increase in fish and wildlife habitat should enable marshes in the area to continue to support existing recreational shrimping, crabbing, fishing and bird-watching, and commercial trapping activities on the Rockefeller Wildlife Refuge. Freshwater introduction would also protect project-area marshes, and therefore, help to buffer and protect oil and gas infrastructure, as well as hunting and fishing camps from storm-driven waves.

## SECTION 5.0 DISCUSSION OF ALTERNATIVES

Other alternatives considered included the Preferred Alternative's channel enlargements, structures and terraces mentioned above but with the inclusion of the following: 1) deepening of the Doland-Miller Canal, located north of Unit 14, from 2-feet-deep to 4-feet-deep; 2) enlargement of the Grand Volle Ditch to 20-feet-wide by 4-feet-deep; 3) installing a 2,441 linear-foot conveyance channel, with rock and or terraces lining that channel, in Grand Volle Lake, 4) installing 150, 200-foot-square checkerboard terrace cells; 5) modifying the existing Big Constance Water Control Structure; and, 6) installing two additional control structures (i.e., Numbers 9 and 11) at the Boundary Line Canal Levee south of Unit 14 (Clark et al. 1999). The Preferred Alternative was selected in part because the hydrodynamic modeling results indicated that the additional channel enlargements and structural features mentioned above would not significantly increase freshwater flow southward to the target marshes higher than the Preferred Alternative features (Fenstermaker and Associates 2003).

Channel Enlargement

The hydrodynamic modeling study indicated that the Doland–Miller Canal enlargement feature would not be necessary to achieve project goals; thus, that feature was dropped from the Preferred Alternative (Fenstermaker and Associates 2003). Initially the Grand Volle Ditch was planned to be enlarged to a 20-foot bottom width, 4 feet deep, and a top width of 44-feet (3:1 side slopes). To reduce adverse impacts, this enlargement was reduced to a 4-foot-wide bottom and a 28-foot-wide top. Dredged material from channel enlargements north of Rockefeller Refuge were planned to be placed in the marsh via bucket dredge or trackhoe and stacked to an elevation of approximately 4 feet above marsh level. To reduce wetland impacts, the Service and LDNR will attempt to use a spray dredge (if available and cost-effective) to very thinly spread the dredged material over the existing wetlands to avoid adversely impacting those wetlands. If a spray dredge is not cost-effective or available, the Service will have bucket dredged material thinly spread no higher than 10 inches over the existing wetland after initial subsidence. Wetland vegetation in the project area will be able to quickly grow through the thinly spread dredged material for a net reduction in marsh impacts.

Earthen Terraces

Several terrace designs were evaluated, including straight linear rows orientated east to west, a modified “V” or “duck-wing,” and checkerboard configurations. The “duck wing” or “V-shaped” terrace design was selected consistent with the success of recent terracing projects installed in the Cameron-Creole Watershed (East Cove Unit of Sabine NWR, and Miami Corporation property) by Ducks Unlimited, the Service, LDNR, Miami Corporation and others. The existing Sabine NWR terraces located east of Sabine Lake and east of the Deep Bayou Canal are also of the successful “duck-wing” design. Alternative terrace dimensions considered included; top widths ranging from 4-feet to 15-feet-wide; terrace heights ranging from settled marsh level height (1.1 feet NAVD) to 2.2 feet above marsh level (2.5 feet NAVD). The 10-foot-wide top width was selected because it is less likely to erode, provides a larger marsh platform, and has been implemented successfully. The preferred settled terrace height of 2.5 feet NAVD (1.4 feet above marsh level) was also selected because the design has been used successfully, and it provides a lower wetland elevation for better fish and wildlife access and increased productivity.

Control Structures

Initial plans included modifying both of the large Big and Little Constance Bayou radial arm gate structures to remove the 10-foot-wide radial arm gates and replace them with flapgates and stoplogs. It was determined, based on hydrodynamic salinity and water level modeling, that the Big Constance Bayou structure modification would not be effective in moving significant amounts of freshwater southward into Area A; it was therefore, eliminated as a project feature (Fenstermaker and Associates 2003). The hydrodynamic model results also indicated that two (Structure No.’s 9 and 11) of the originally proposed four Boundary Line Canal control structures would also not be very effective in moving significant amounts of freshwater southward to Area A, so they were eliminated from the Preferred Alternative (Fenstermaker and Associates 2003).

## SECTION 6.0 RATIONALE FOR SELECTING THE PREFERRED ALTERNATIVE

Channel Enlargement Features - The Doland–Miller Canal enlargement feature was not included as a Preferred Alternative feature because the hydrodynamic modeling study indicated that it would not be necessary to achieve the project goals (Fenstermaker and Associates 2003). To reduce adverse impacts, the Grand Volle Ditch enlargement was reduced to a 4-foot-wide bottom and a 28-foot-wide top.

Earthen Terraces - The 10-foot-wide top width was selected because it is less likely to erode, provides a greater marsh platform, and has been implemented successfully. The preferred construction settled terrace height of 2.5 feet NAVD (1.4 feet above marsh level) was also selected because that design has been used successfully, and it provides a lower wetland elevation that provides better fish and wildlife access and increased productivity.

Control Structures - Initial plans included modifying both of the large Big and Little Constance Bayou structures to remove the 10-foot-wide radial arm gates and replace them with flapgates and stoplogs. It was determined, as a result of hydrodynamic, salinity, and water level modeling, that the Big Constance Bayou structure modification and two (Structure No.'s 9 and 11) of the originally proposed four Boundary Line Canal control structures would not be effective in moving significant amounts of freshwater southward into Area A; accordingly, they were eliminated as project features (Fenstermaker and Associates 2003).

## SECTION 7.0 COMPATIBILITY WITH COASTAL WETLANDS PLANNING PROTECTION AND RESTORATION ACT AND COMMUNITY OBJECTIVES

Implementing the proposed action would help to achieve CWPPRA objectives for protection and restoration of Louisiana's coastal wetlands. Movement of water from north to south across LA Highway 82 and associated drainage improvements were identified by the Coast 2050 Plan as a Regional Ecosystem Strategy for the Mermentau Basin (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998). Community and socioeconomic objectives would likely be enhanced by implementing the proposed project, because it would help sustain fishing, shrimping, crabbing, bird-watching, and trapping opportunities important to the region's economy and culture. The general public also supports wetland restoration and conservation of fish and wildlife habitat, and the recreational, esthetic, and other consumptive and nonconsumptive uses sustained by coastal wetlands.

# SECTION 8.0 COMPLIANCE WITH LAWS, REGULATIONS AND POLICIES

This Environmental Assessment was prepared in accordance with the National Environmental Policy Act of 1969. It is consistent with the policy contained in the Service's manual (550 FW 3), and employs a systematic, interdisciplinary approach. The proposed action involves disposal of fill material into waters of the United States; therefore, authorization is required by Section 404 of the Clean Water Act of 1977, as amended, and by a State Water Quality Certification under Section 401 of that Act. A State Water Quality Certification was issued by the LA Department of Environmental Quality on August 17, 2004. The Corps Section 404 Clean Water Act draft permit was received on February 23, 2005. The final Corps permit is expected in March 2005 and will be obtained prior to construction.

Under the MSFCMA, the Service has evaluated project-related impacts to essential fish habitat. The proposed action would have minor adverse impacts to some categories of essential fish habitat, but such impacts would be adequately offset by restoration and protection of estuarine emergent wetlands.

The proposed action is located within the Louisiana Coastal Zone, but involves no construction activities that would result in significant direct, indirect, or cumulative adverse impacts to coastal waters or wetlands. The Service received Consistency Determinations from the LDNR on March 11, 2004, June 3, 2004, and February 16, 2005 . The Service considers the proposed action to be consistent, to the maximum extent practicable, with Louisiana's Coastal Resources Program and the Federal Coastal Zone Management Act. A permit from Cameron Parish was received on March 17, 2004.

The proposed project has been reviewed for compliance with other Federal and state requirements including but not limited to, the Endangered Species Act of 1973, as amended; Archeological and Historic Preservation Act of 1974; National Historic Preservation Act of 1966, as amended; Executive Order 11988 (Floodplain Management); and Executive Order 11990 (Protection of Wetlands). Full compliance with relevant laws and regulations will be achieved upon review of this Environmental Assessment by appropriate agencies and interested parties, and the signing of a Finding of No Significant Impact and Environmental Action Statement.

# SECTION 9.0 PREPARERS

This Environmental Assessment was prepared by Darryl Clark, Senior Field Biologist and Joyce Mazourek, Fish and Wildlife Biologist, of the Service's Louisiana Field Office.

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# Appendix A

# Highway 82 Freshwater Introduction Project Habitat and Vegetation Analysis

**Table A1: Freshwater Introduction South of LA Highway 82 Project Area 1988-1990 Habitat Analysis**

| **Habitat Type** | **Area A (Acres)** | **Area B (Acres)** | **Area C (Acres)** | **Total** | **Percent** |
|---|---|---|---|---|---|
| Water | 2,658 | 726 | 743 | 4,127 | 17% |
| Fresh Marsh | | 34 | 17 | 51 | < 1 |
| Intermediate Marsh | 133 | 2,179 | 1,890 | 4,202 | 17% |
| Brackish Marsh | 8,829 | 31 | | 8,860 | 36% |
| Saline Marsh | 7,634 | | | 7,634 | 31% |
| Upland Shrub/Scrub | 56 | | | 56 | < 1 |
| **Total** | **19,254** | **2,970** | **2,650** | **24,874** | **100** |

**Table A2: Freshwater Introduction South of LA Highway 82 Project Vegetative Species Percent Cover**

| **Species** | **Area A (Saline)** | **Area B** | **Area C** | **Unit 6** | **Average** |
|---|---|---|---|---|---|
| Smooth Cordgrass (*Spartina alterniflora*) | 10% | | | 5% | 5% |
| Saltmarsh Grass (*Distichlis spicata*) | 70% | | | | 18% |
| Leafy Three Square (*Schoenoplexus maritimus*) | 10% | 10% | 30% | 5% | 14% |
| Hog Cane (*Spartina cynosuroides*) | 10% | | | 10% | 5% |
| Marshhay Cordgrass (*Spartina patens*) | | 80% | 35% | 80% | 49% |
| Roseau Cane (*Phragmites australis*) | | 5% | 15% | Trace | 5% |
| Cattail (*Typha* spp.) | | 5% | 10% | Trace | 4% |
| Alligator Weed (*Alternanthera philoxeroides*) | | Trace | | Trace | Trace |
| Bullwhip (*Shoenoplexus clalifornicus*) | | 5% | | | Trace |
| Giant Cutgrass (*Zizaniopsis mileacea)* | | Trace | | | trace |

# Appendix B

## Summary Table of Project Benefits and Impacts

**Table B-1: Freshwater Introduction South of LA Highway 82 Project (ME-16) Summary Table of Benefits and Impacts**

| Feature | Discharge and Type | Total Excavation (Area/ Volume) | Open Water Fill (Area/Volume) | Wetland Excavation (area/ volume) | *Wetland Fill (Area/ Volume) | Spoil/ Levee Fill (area/ vol) | Marsh Restoration/ Protection |
|---|---|---|---|---|---|---|---|
| LA Hwy 82 Channel Enlargement (13,565 ft x 44 ft x 4 ft) | 42,245 cu yds water bottom | 13.7 ac/ 42,245 cy | | | *0 ac 42,245 cy (*28 ac; 100 ft x 12,209 ft) | | |
| Grand Volle Channel North (12,650 ft x 28 ft x 4 ft) | 34,615 cu yds water bottoms & marsh | 8.1 ac/ 34,615 cy | | 2.3 ac/ 9,800 cy (12,650 ft x 28 ft) | *0 ac 34,615 cy (17.4 ac; 60 ft x 12,650 ft) | | |
| Grand Volle Lake Channel (200 ft x 200 ft x 3 ft) | Total 4,500 cy | 0.9 ac 4,500 cy | Total 0.9 ac 4,500 cy | | | | |
| Grand Volle Channel South (3,400 ft x 28 ft x 4 ft) | 11,690 cu yds, water bottoms & marsh | 2.2 acres 11,690 cy | | | *0 ac 11,690 cy (*4.7 acres; (3,400 ft x 60 ft) | | |
| Terraces (26,000 ft x 34 ft x 3.5 ft) | 101,000 cu yds, water bottoms | 21.7 acres 101,000 cy (36.3 ft x 26,000 ft) | 21.7 acres 101,000 cy (36.3 ft x 26,000 ft) (14 acres = marsh restoration) | | | | + 14 acres (24 ft x 26,000 ft) |

| Feature | Discharge and Type | Total Excavation (Area/ Volume) | Open Water Fill (Area/Volume) | Wetland Excavation (area/ volume) | *Wetland Fill (Area/ Volume) | Spoil/ Levee Fill (area/ vol) | Marsh Restoration/ Protection |
|---|---|---|---|---|---|---|---|
| Earthen Plug Removal (120 ft x 150 ft) | 4,922 cu yds., 0.29 acres<br>Existing plug, canal bottom | 0.41 acres<br>4,992 cy<br>(120 x 150 ft) | | | | 0.29 acres<br>(250 ft x 50 ft) | |
| Little Constance Structure Modification<br>(replace 3, 10 x 10 ft radial arm gates with flapgates and stoplogs) | N/A | | | | | | |
| New Dyson Structure (4, 48 inch-diameter flapgated culverts with stoplogs) | 3,897 cu yds, 0.45 acres<br>existing spoil levee, water bottom & marsh<br><br>(outlet channel - 300 ft x 33.7 ft; 2,269 cy, 0.23 ac<br>Temporary fill - 70 ft x 35 ft; 887 cy, 0.056 acres<br>Inlet channel fill - 80 ft x 45 ft; 508 cy, 0.083 acres<br>Rip-rap fill - 39 ft x 54 ft + 30 ft x 52 ft; 233 cy, 0.08 acres) | 0.52 acres<br>3,664 cy<br><br>(Outlet channel - 300 ft X 53 ft; 2,269 cy, 0.37 acres<br>Structure - 64 x 43 ft, 887 cy, 0.063 acres<br>Inlet channel - 80 ft x 45 ft; 508 cy, 0.083 acres ) | 0.08 acres<br>233 cy<br><br>(Rip-rap fill - 39 ft x 54 ft + 30 ft x 52 ft; 233 cy, 0.08 acres ) | 0.37 acres<br>2,269 cy | 0.21 acres<br>2,269 cy<br><br>(Outlet channel fill - 33.7 ft x 275 ft) | 0.06 acres<br>887 cy<br><br>(Temporary fill - 70 ft x 35 ft) | |

| **Feature** | **Discharge and Type** | **Total Excavation (Area/ Volume)** | **Open Water Fill (Area/Volume)** | **Wetland Excavation (area/ volume)** | ***Wetland Fill (Area/ Volume)** | **Spoil/ Levee Fill (area/ volume)** | **Marsh Restoration/ Protection** |
|---|---|---|---|---|---|---|---|
| New Cop-Cop Structure (4, 48 inch-diameter flapgated culverts with stoplogs) | 3,742 cu yds, 0.69 acres existing spoil levee, water bottom & marsh<br><br>(Outlet channel discharge - 140 ft x 150 ft, 2,244 cy, 0.48 acres<br>Temporary fill - 65 ft x 35 ft; 793 cy, 0.05 acres<br>Inlet channel fill - 80 ft x 45 ft; 472 cy, 0.083 acres<br>Rip-rap fill - 39 ft x 54 ft + 30 ft x 52 ft; 233 cy, 0.08 acres ) | 0.52 acres<br>3,509 cy<br><br>(Outlet channel - 275 ft x 58 ft; 2,244 cy, 0.37 acres<br>Structure - 64 x 43 ft, 793 cy, 0.063 acres<br>Inlet channel - 80 ft x 45 ft; 472 cy, 0.083 acres ) | 0.56 acres<br>2,477 cy<br><br>(Outlet channel discharge - 140 ft x 150 ft; 2,244 cy, 0.48 acres<br>Rip-rap fill - 39 ft x 54 ft + 30 ft x 52 ft; 233 cy, 0.08 acres ) | 0.37 acres / 2,244 cy | | 0.05 acres / 793 cy<br><br>(Temporary fill - 65 ft x 35 ft | 0.48 acres / 2,244 cy<br><br>(Outlet channel fill in Cop Cop Bayou - 140 x 150 ft) |
| Structure No. 10 (3, 48 inch-diameter flapgated culverts with stoplogs) | 1,816 cu yds, 0.29 acres existing spoil levee, water, marsh<br><br>(Outlet channel discharge - 200 ft x 28 ft; 779 cy, 0.13 acres<br>Temporary fill - 65 ft x 30 ft; 508 cy, 0.05 acres<br>Inlet channel fill - 45 ft x 35 ft; 296 cy, 0.036 acres<br>Rip-rap fill - 39 ft x43 ft + 30 ft x 41 ft; 233 cy, 0.07 acres ) | 0.33 acres<br>1,583 cy<br><br>(Outlet channel - 200 ft x 54 ft; 779 cy, 0.25 acres<br>Structure - 32 ft x 64 ft; 508 cy, 0.047 acres<br>Inlet channel - 45 ft x 35 ft; 296 cy, 0.036 acres ) | 0.07 acres<br>233 cy<br><br>(Rip-rap fill - 39 ft x 43 ft + 30 ft x 41 ft; 233 cy, 0.07 acres ) | 0.25 acres<br>779 cy | 0.13 acres<br>779 cy<br><br>(Outlet channel fill - 28 ft x 200 ft) | 0.05 acres<br>508 cy<br><br>(Temporary fill - 65 ft x 30 ft; 508 cy, 0.05 acres ) | |

| Feature | Discharge and Type | Total Excavation (Area/ Volume) | Open Water Fill (Area/Volume) | Wetland Excavation (area/ volume) | *Wetland Fill (Area/ Volume) | Spoil/ Levee Fill (area/ vol) | Marsh Restoration/ Protection |
|---|---|---|---|---|---|---|---|
| Structure No. 12 (3, 48 inch-diameter flapgated culverts with stoplogs) | 2,065 cu yds, 0.31 acres existing spoil levee, water, marsh<br><br>(Outlet channel discharge - 200 ft x 32 ft; 948 cy, 0.15 acres<br>Temporary fill - 65 ft x 30 ft; 549 cy, 0.05 acres<br>Inlet channel fill - 45 ft x 35 ft; 335 cy, 0.036 acres<br>Rip-rap fill - 39 ft x 43 ft + 30 ft x 41 ft; 233 cy, 0.07 acres ) | 0.36 acres<br>1,832 cy<br><br>(Outlet channel - 200 ft x 62 ft; 948 cy, 0.28 acres<br>Structure - 32 ft x 64 ft; 549 cy, 0.047 acres<br>Inlet channel - 45 ft x 35 ft; 335 cy, 0.036 acres ) | 0.07 acres /<br>233 cy<br><br>(Rip-rap fill - 39 ft x 43 ft + 30 ft x 41 ft; 233 cy, 0.07 acres ) | 0.28 acres /<br>948 cy | 0.15 acres<br>948 cy<br><br>(Outlet channel fill - 200 ft x 32 ft; 948 cy, 0.15 acres ) | 0.05 acres<br>549 cy<br><br>(Temporary fill - 65 ft x 30 ft; 549 cy, 0.05 acres ) | |
| Boundary Line Canal Enlargement (13,850 ft x 40 ft x 4 ft deep) | 40,000 cu yds, 9.5 acres<br>open water canal and spoil levee | 12.7 acres<br>40,000 cy<br><br>(40 ft x 13,850 ft = 12.7 acres ) | | | 0 acres<br><br>(Dredged material placed on existing embankment/levee) | 9.5 acres<br>40,000 cy<br><br>(30 ft x 13, 850 ft = 9.5 acres ) | |
| **Freshwater Introduction Benefits** | | | | | | | **262 acres** |
| **Marsh Restoration Benefits** | | | | | | | **14.5 acres** |
| **Total Benefits/Impacts** | **250,492 cu yds/ 84.2 acres** | **61.4 acres/ 249,630 cy** | **23.4 acres/ 178,676 cy** | **3.6 acres/ 16,040 cy** | **0.49ac/ 3,996 cy (*50.6 acres/ 92,546 cy)** | **10 ac/ 40,000 cy** | **+ 276.5 acres** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Net Wetland Benefits**<br>**(Benefits – Impacts)** | | | | | | | **272 ac** |

* Note:  Most of the spoil will be thinly spread on marsh to a maximum settled height of 10 inches, or spray-dredged over existing marsh in order to reduce marsh impacts.  We anticipate the marsh to grow quickly through the thinly spread or spray-dredged spoil for a net reduction in marsh impacts (i.e., wetland fill area).

# Appendix C

# Preferred Alternative Project Features

# Figure C-1 Freshwater Introduction South of LA Hwy 82 Project Location Map

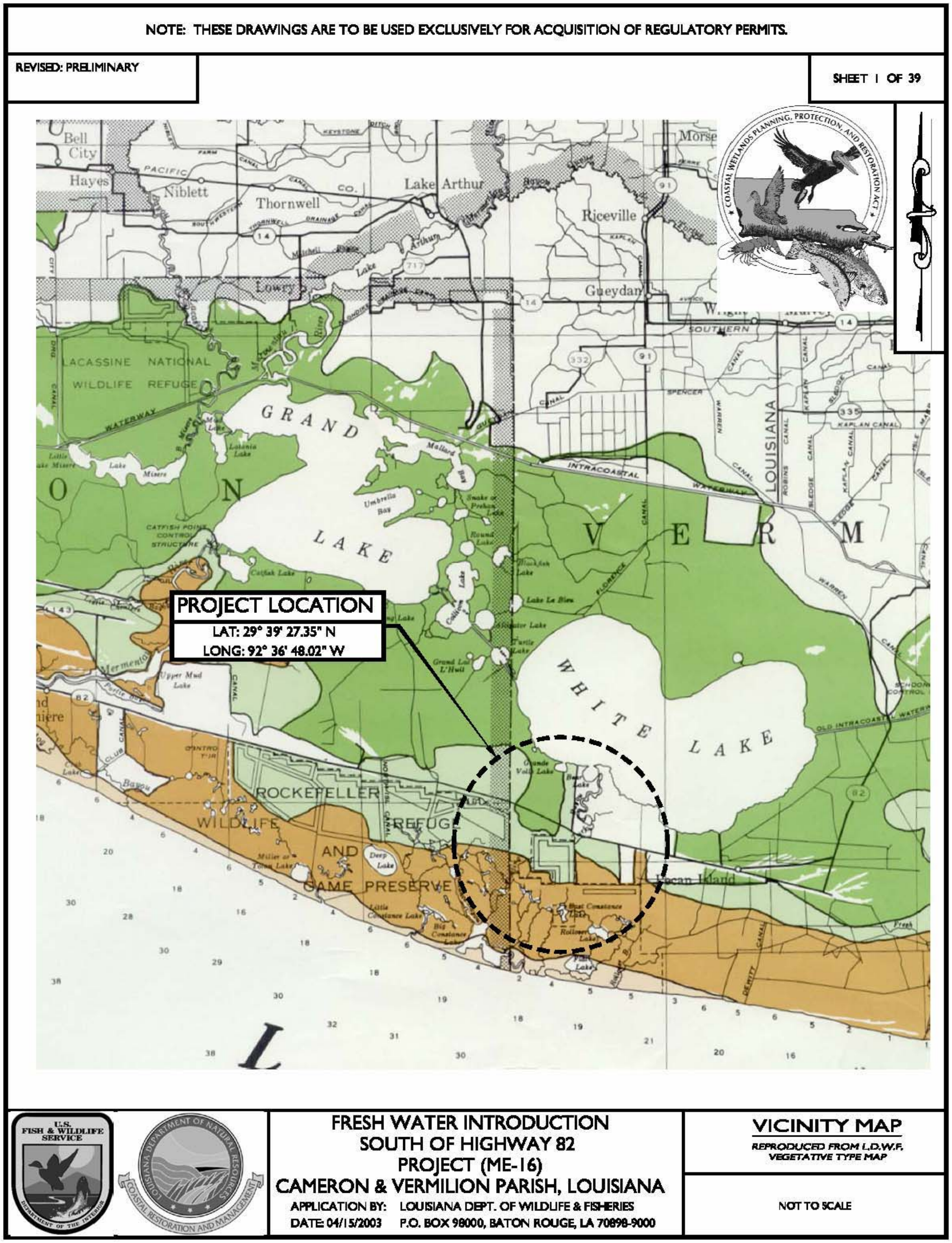


**Figure C-2. Freshwater Introduction South of LA Highway 82 Project Highway 82 Channel Enlargement**

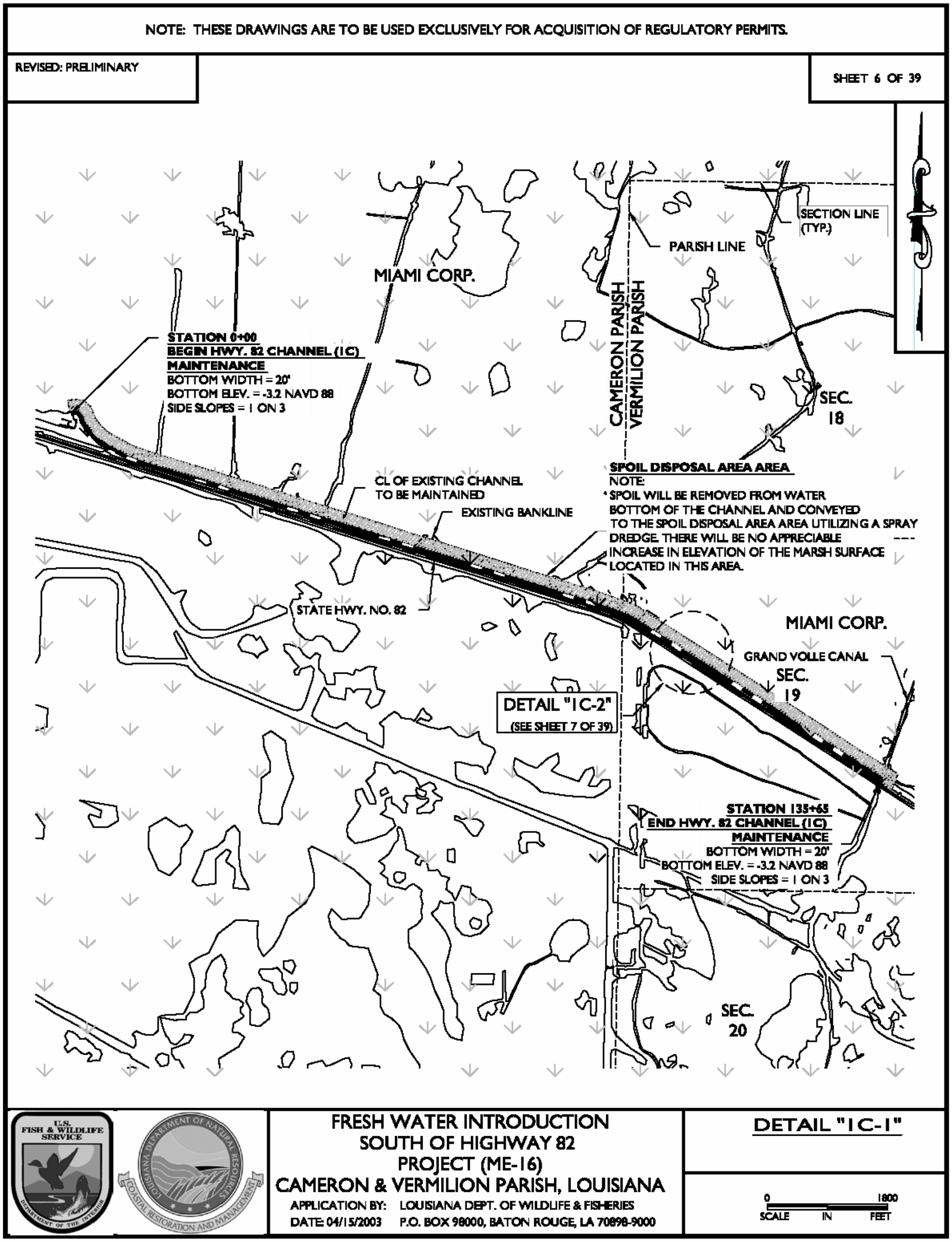


**Figure C-3. Freshwater Introduction South of LA Highway 82 Project Hwy 82 Channel Enlargement Plan and Cross Sectional Views**

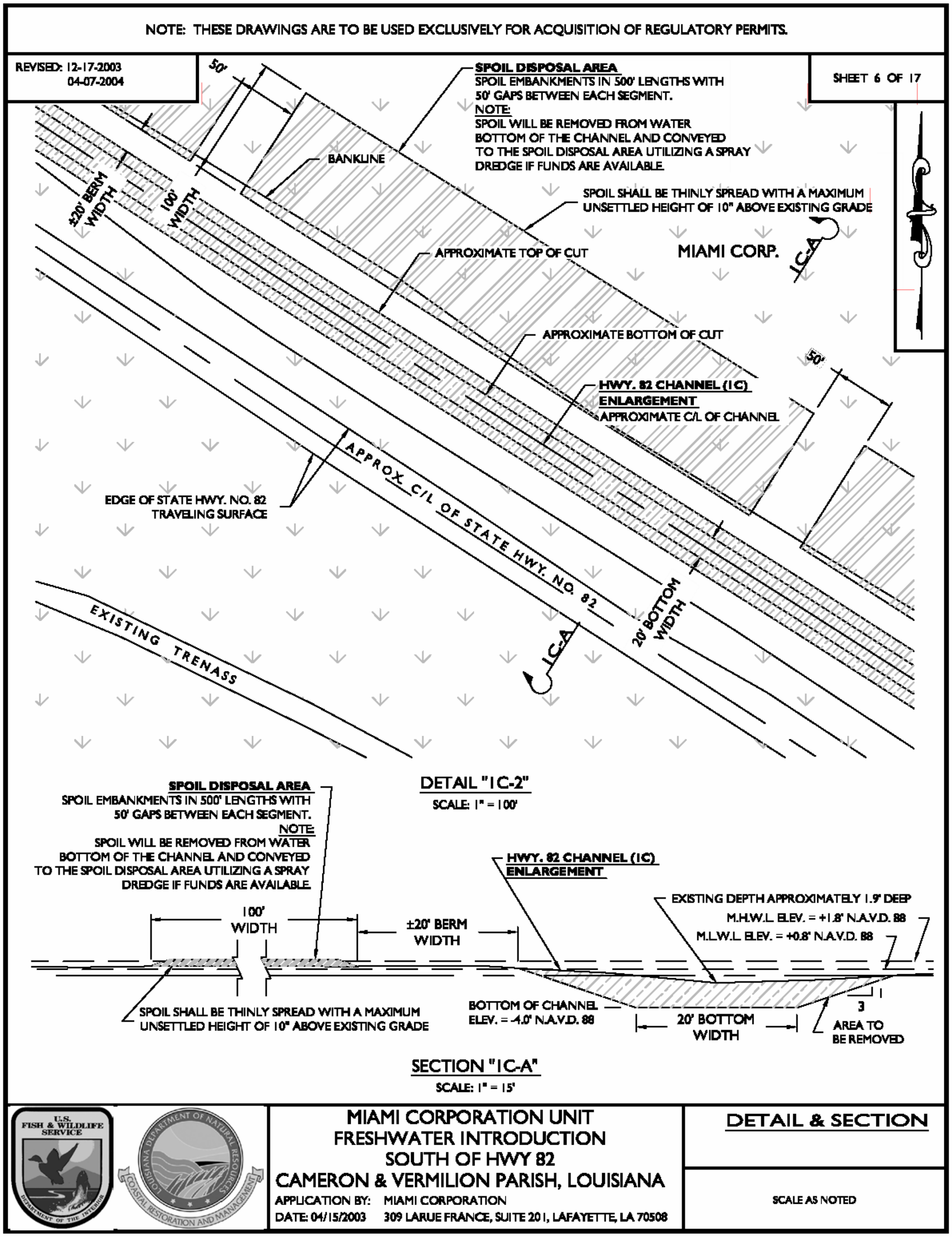


**Figure C-4. Freshwater Introduction South of LA Highway 82 Project Grand Volle Ditch Channel Enlargement**

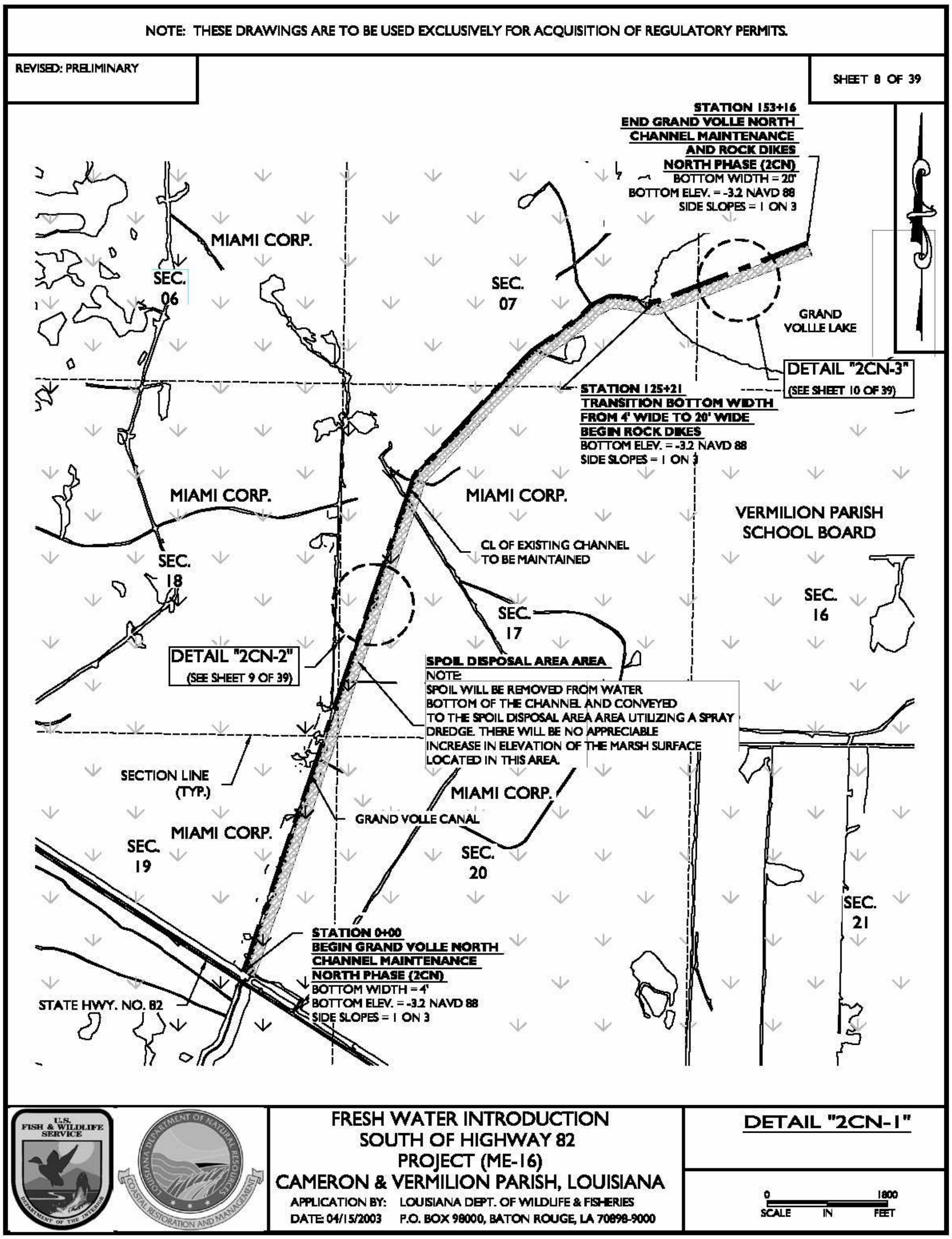


**Figure C-5. Freshwater Introduction South of LA Highway 82 Project Grand Volle Ditch Plan View**

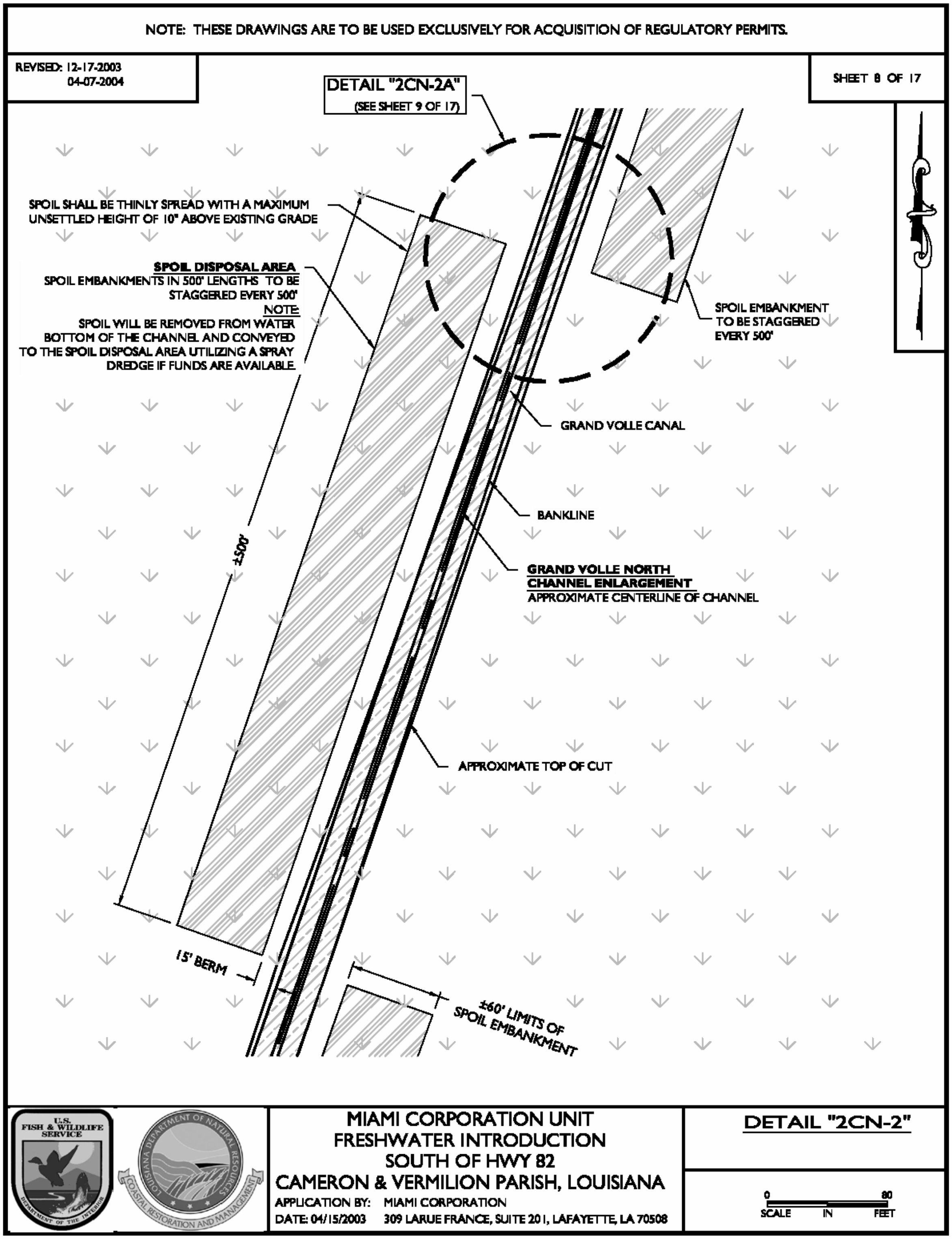


**Figure C-6. Freshwater Introduction South of LA Highway 82 Project South Grand Volle Ditch Enlargement Plan View**

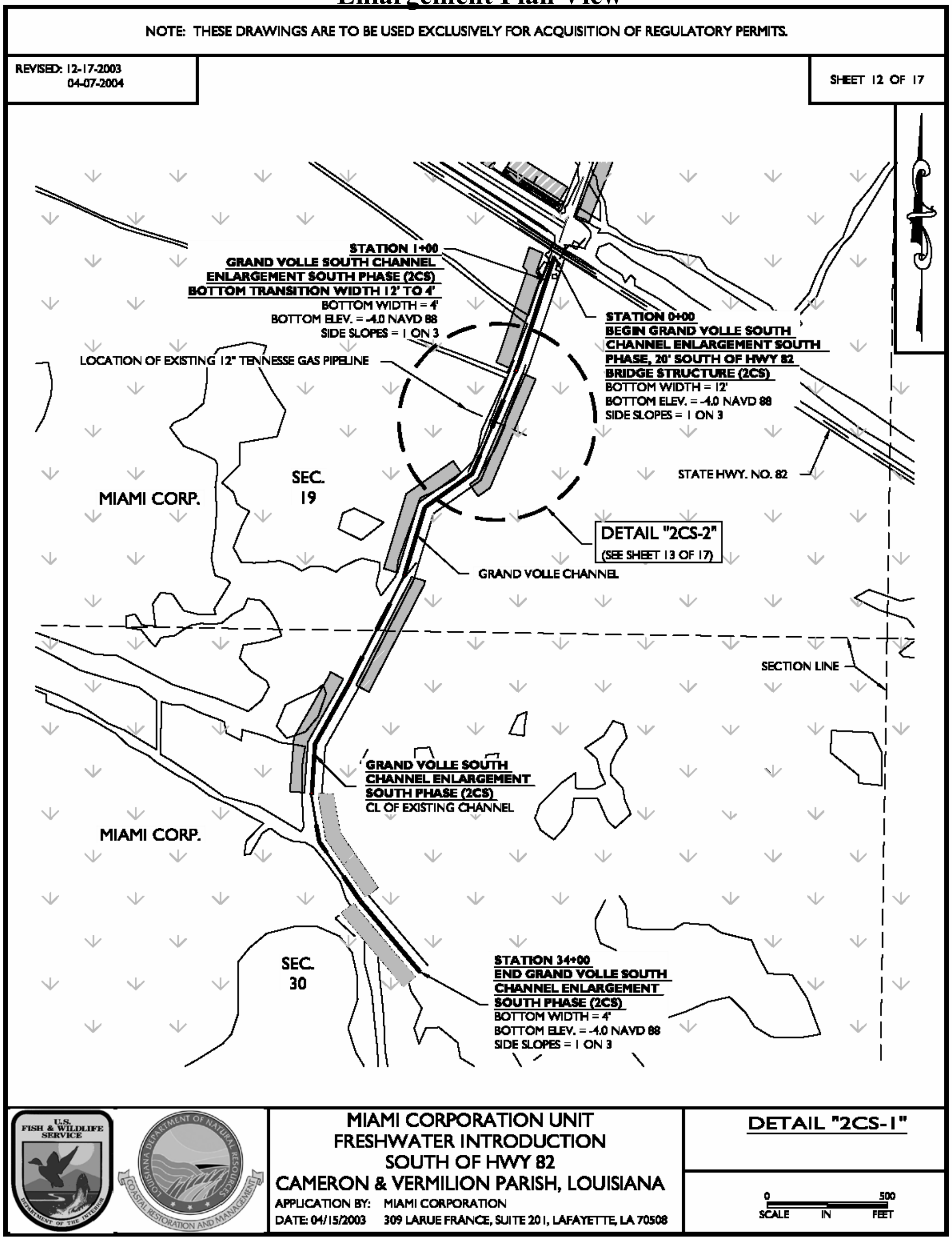


**Figure C-7. Freshwater Introduction South of LA Highway 82 Project South Grand Volle Ditch Enlargement Detailed Plan View**

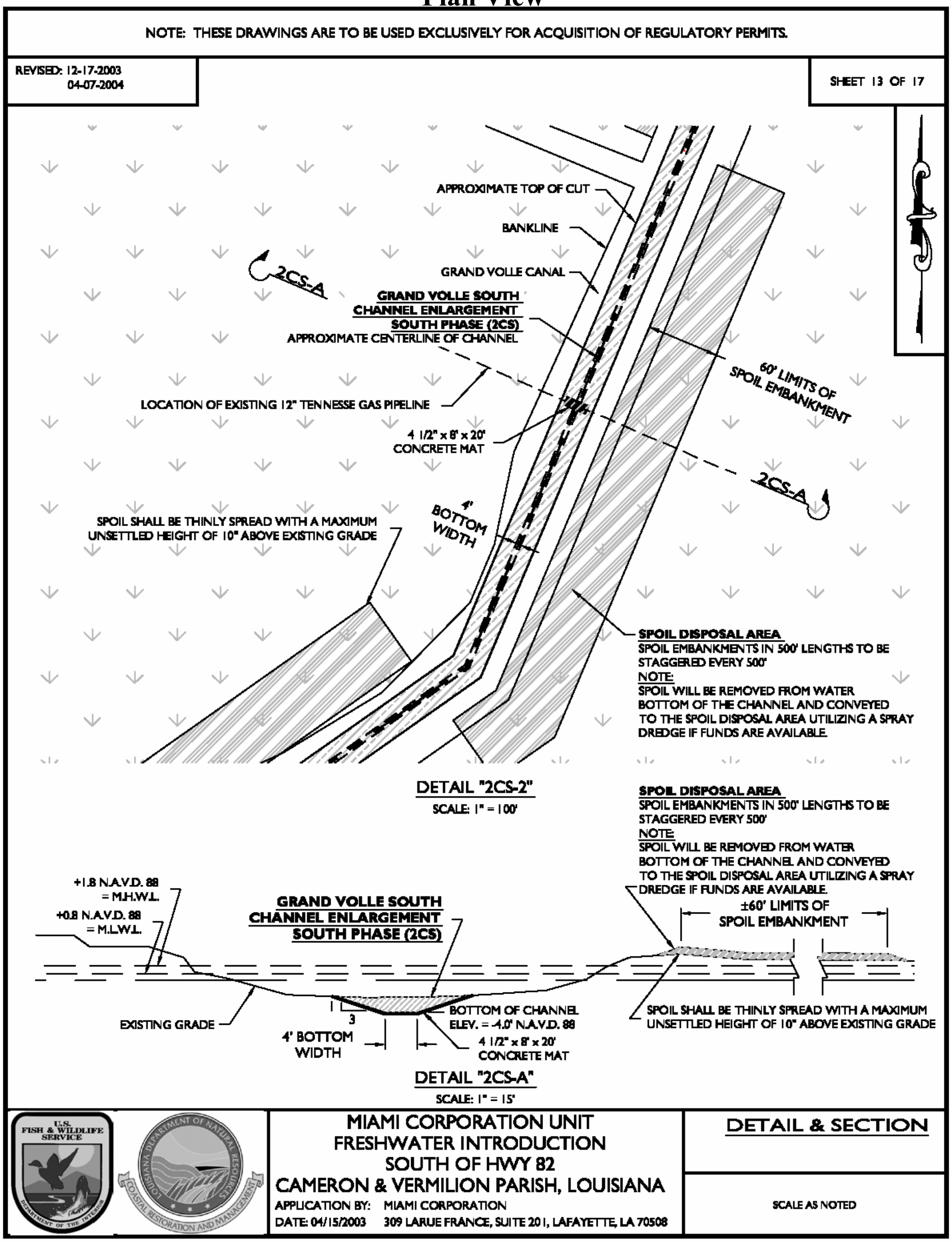


**Figure C-8. Freshwater Introduction South of LA Highway 82 Project Duck-Wing Terrace Plan View**

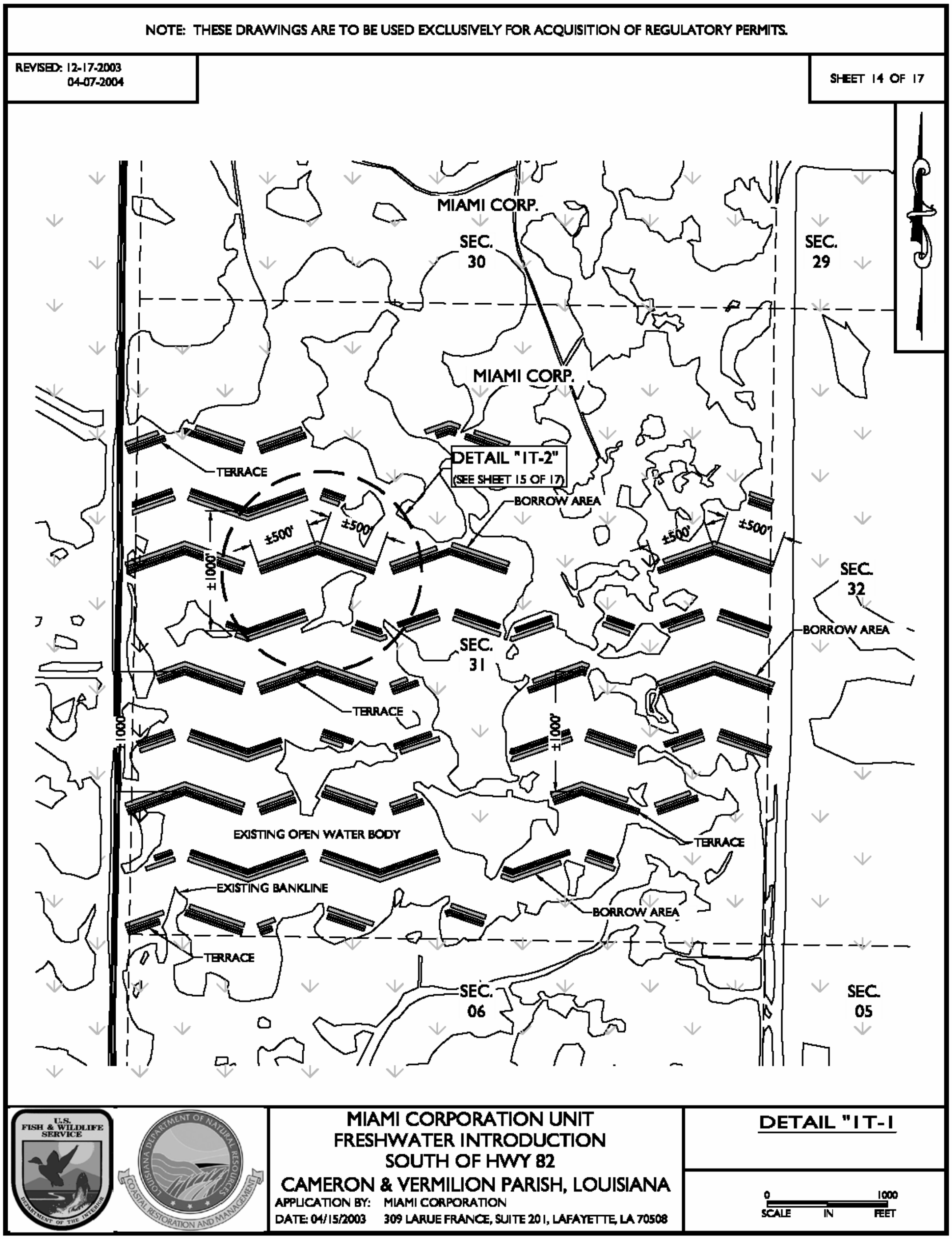


**Figure C-9. Freshwater Introduction South of LA Highway 82 Project Duck-Wing Terrace Plan and Cross Sectional Views**

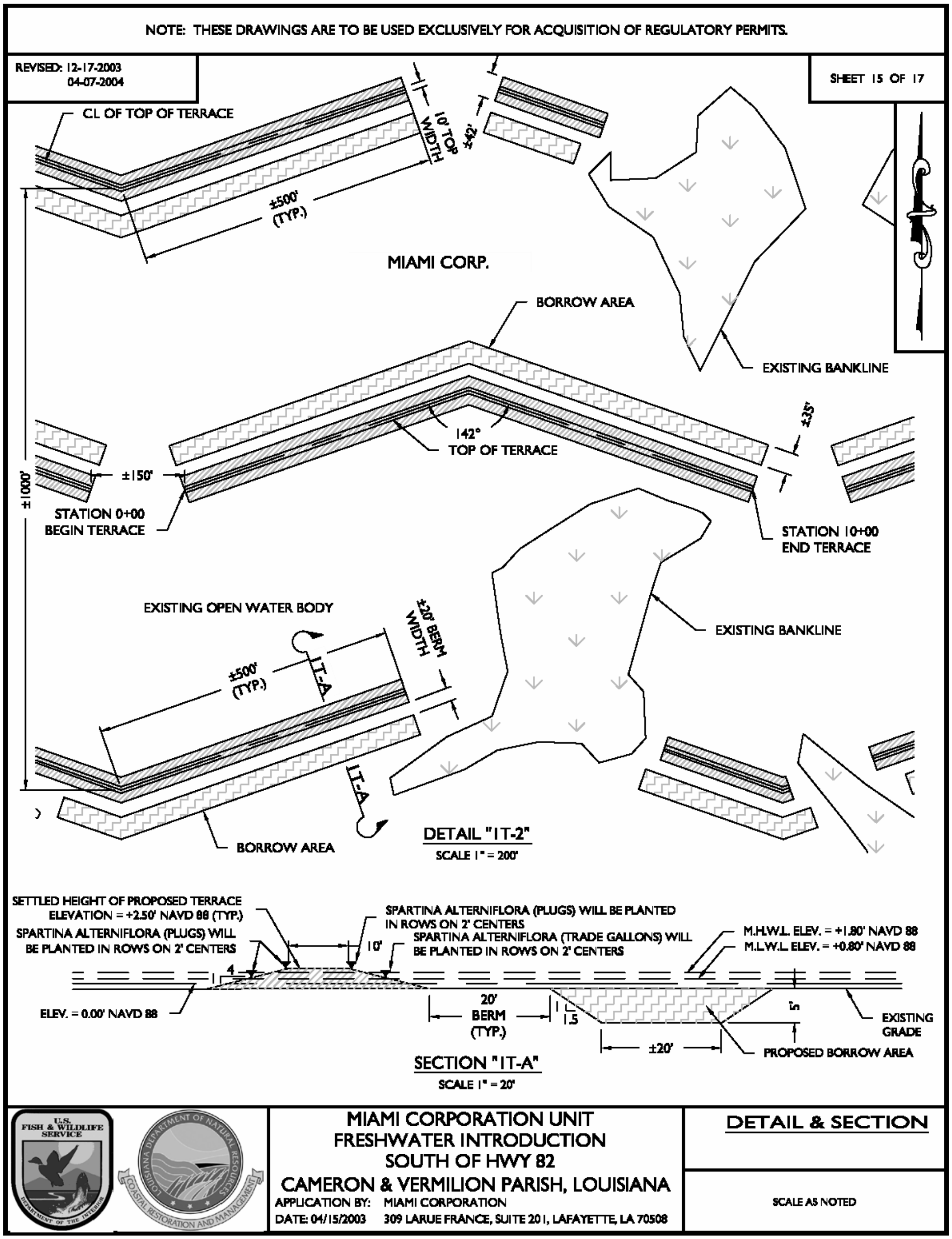


**Figure C-10. Freshwater Introduction South of LA Highway 82 Project Plug Removal Plan View**

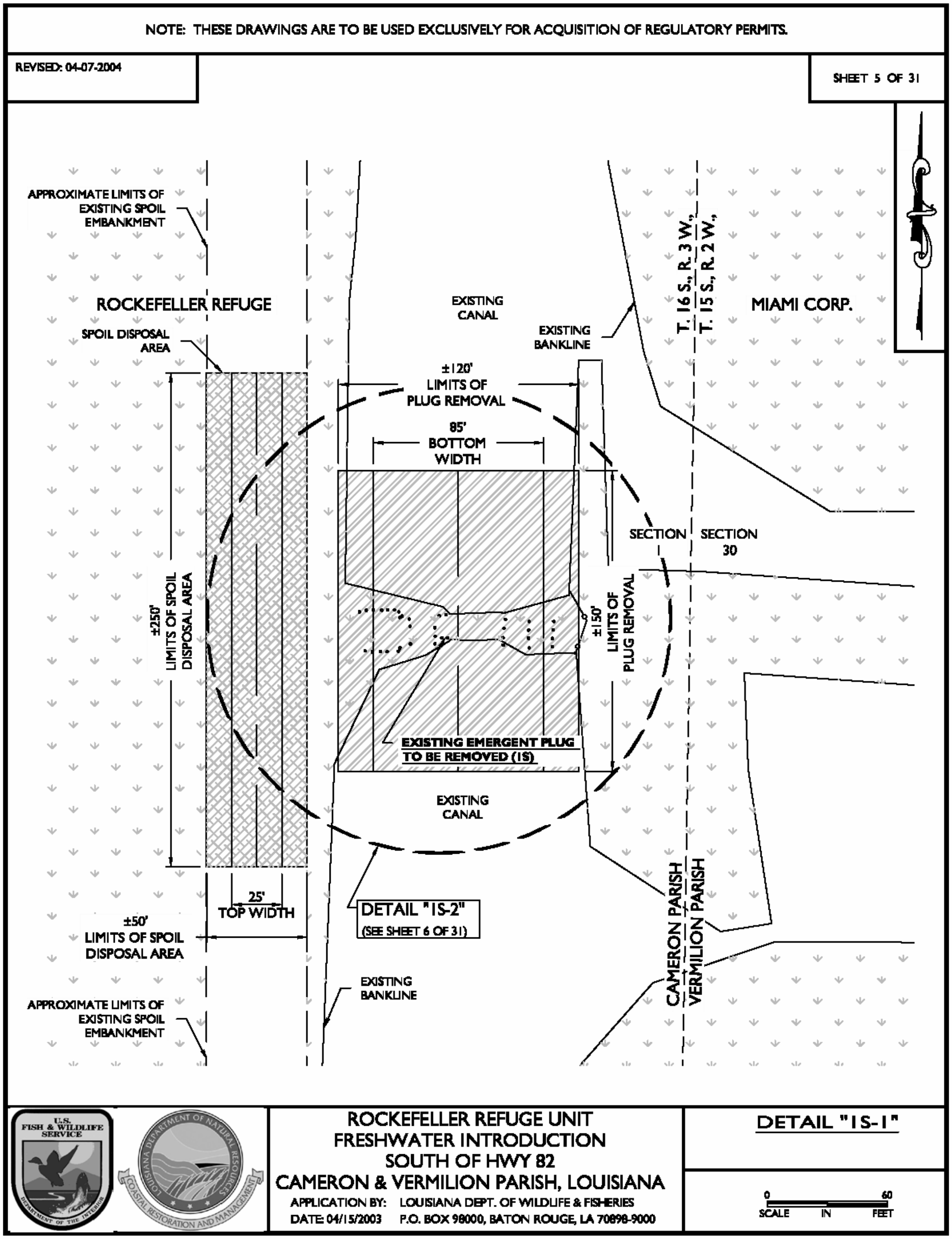


**Figure C-11. Freshwater Introduction South of LA Highway 82 Project Little Constance Structure Plan View**

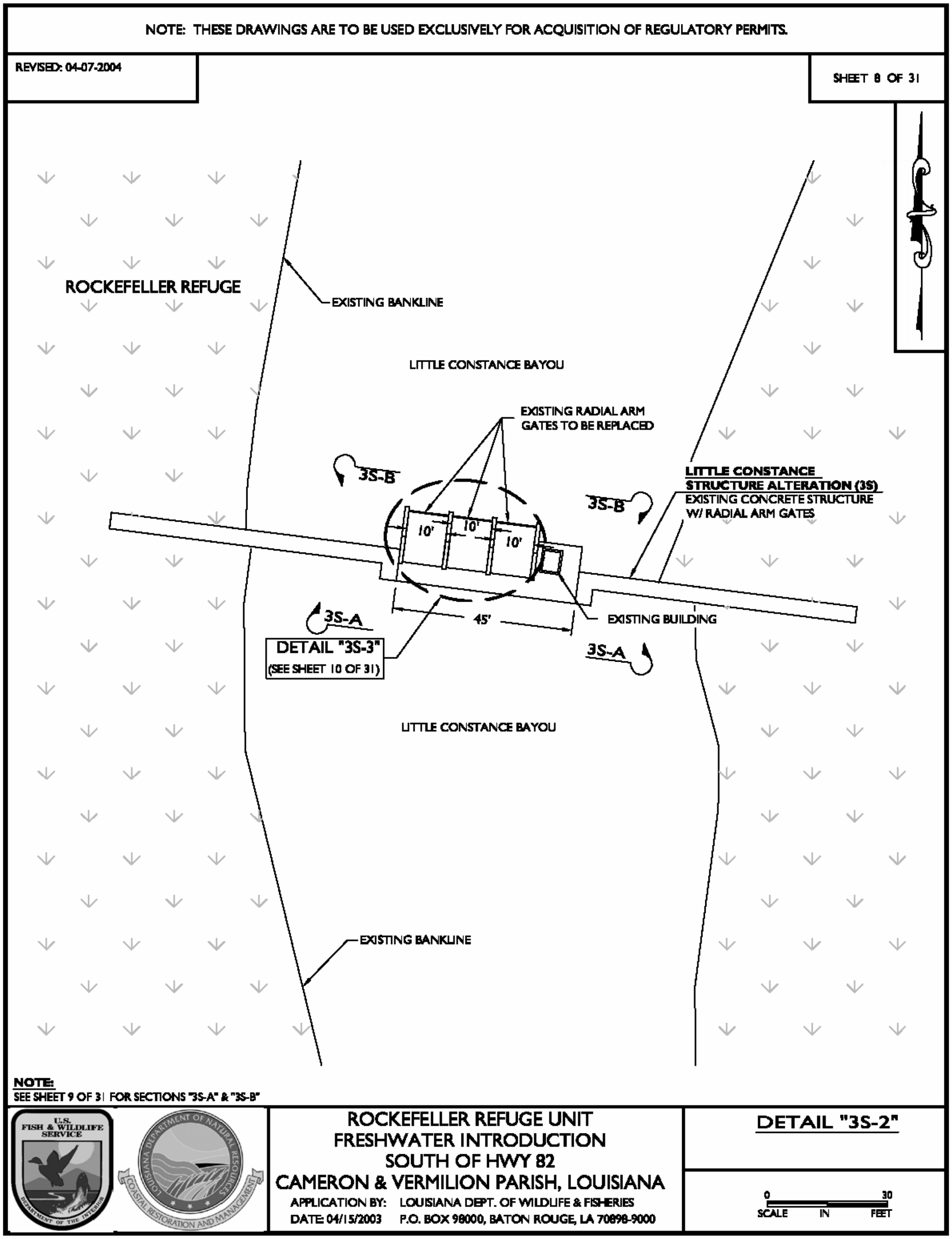


**Figure C-12. Freshwater Introduction South of LA Highway 82 Project Little Constance Structure Frontal View**

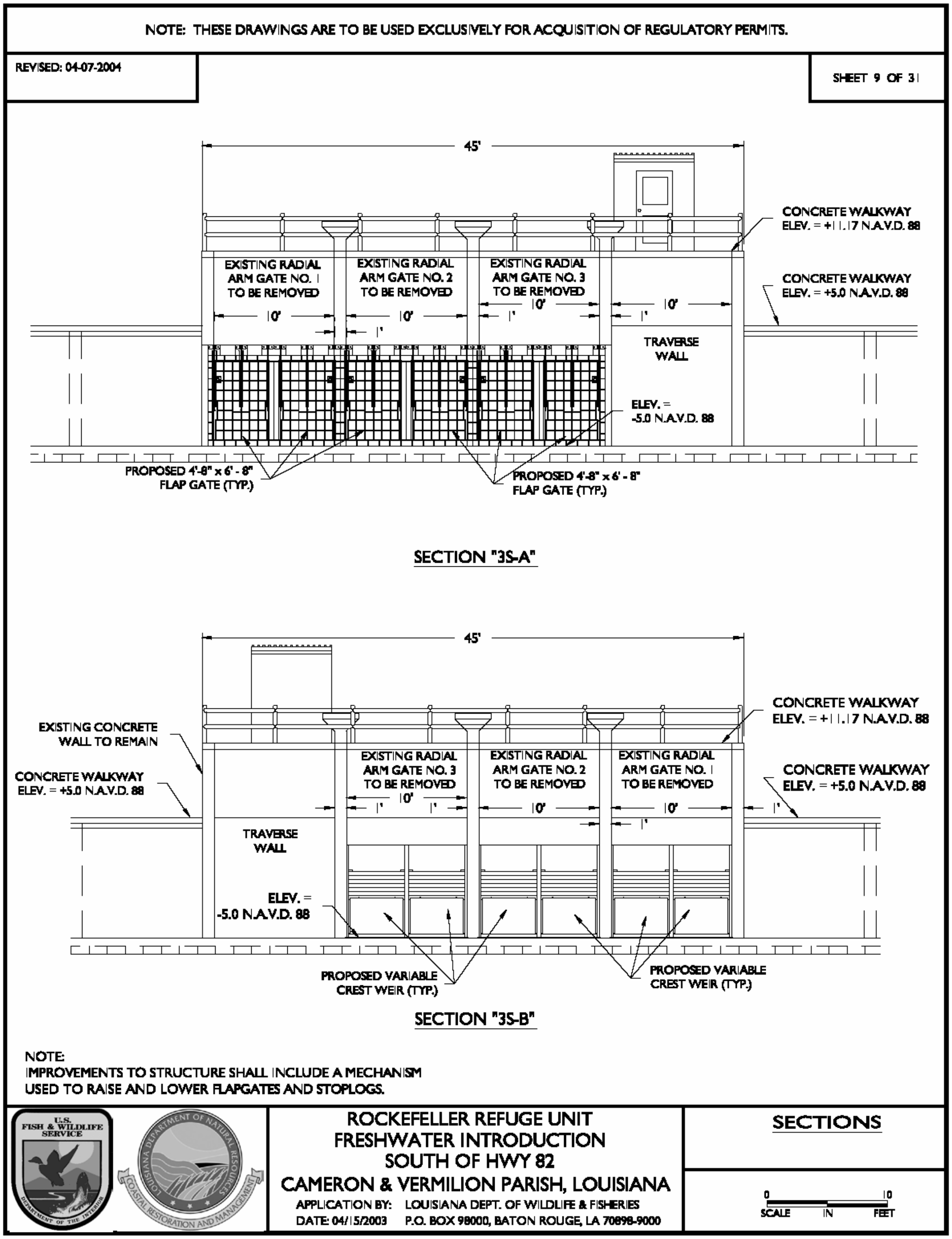


**Figure C-13. Freshwater Introduction South of LA Highway 82 Project 48-inch Diameter Culvert Control Structure Plan View**

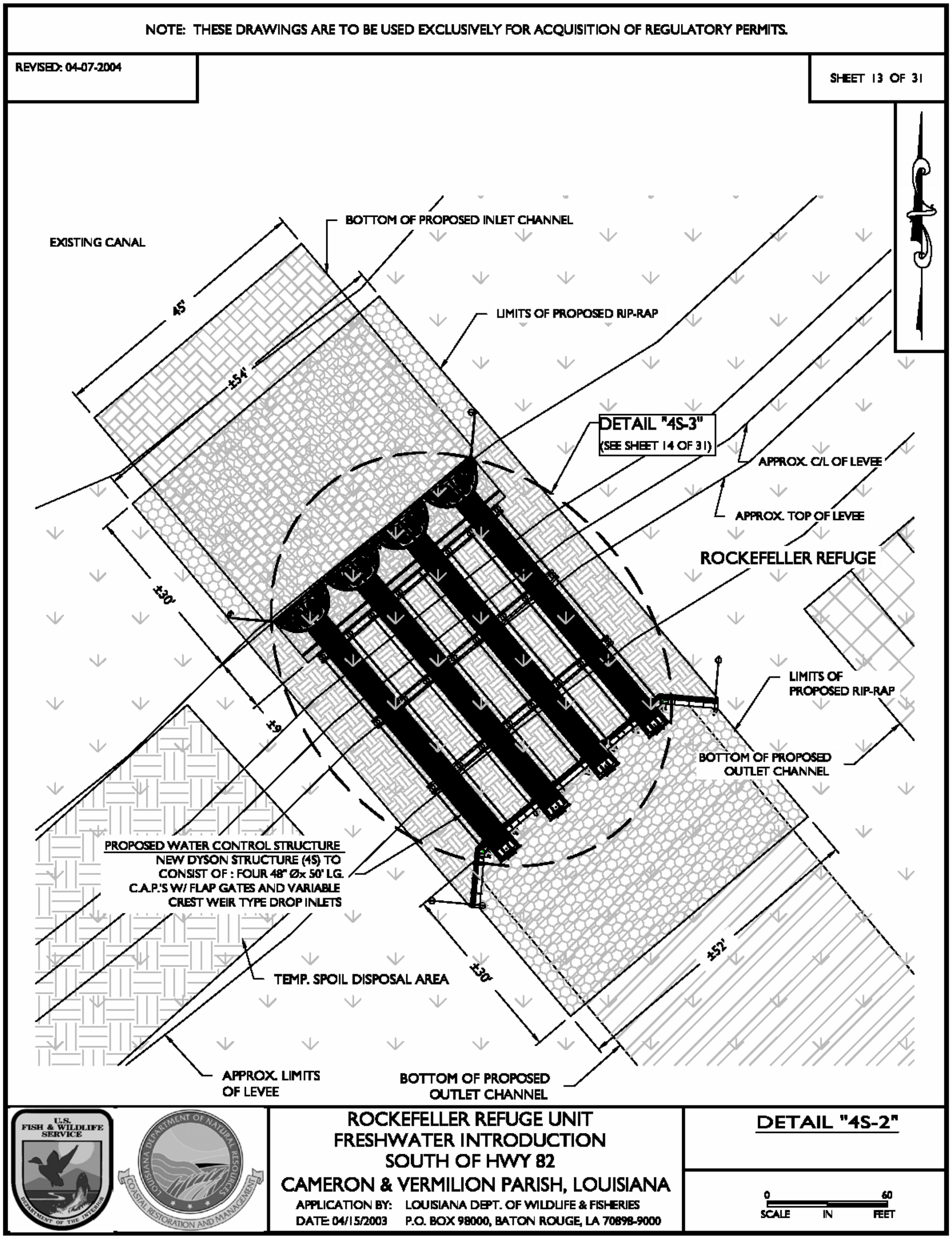


**Figure C-14. Freshwater Introduction South of LA Highway 82 Project 48-Inch Diameter Culvert Detailed Plan View**

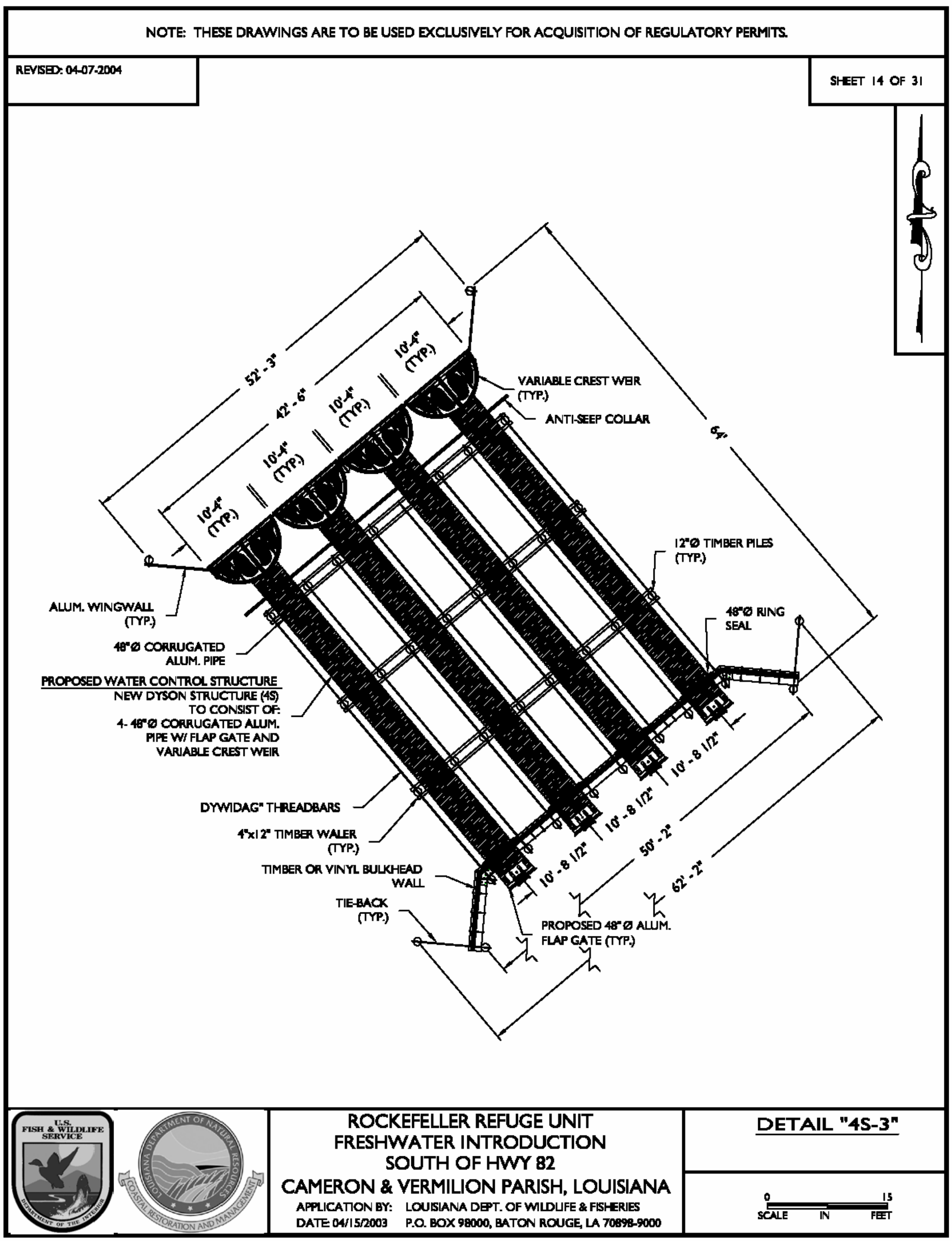


**Figure C-15. Freshwater Introduction South of LA Highway 82 Project Typical 48-Inch Diameter Culverted Structure Longitudinal and Cross Sections**

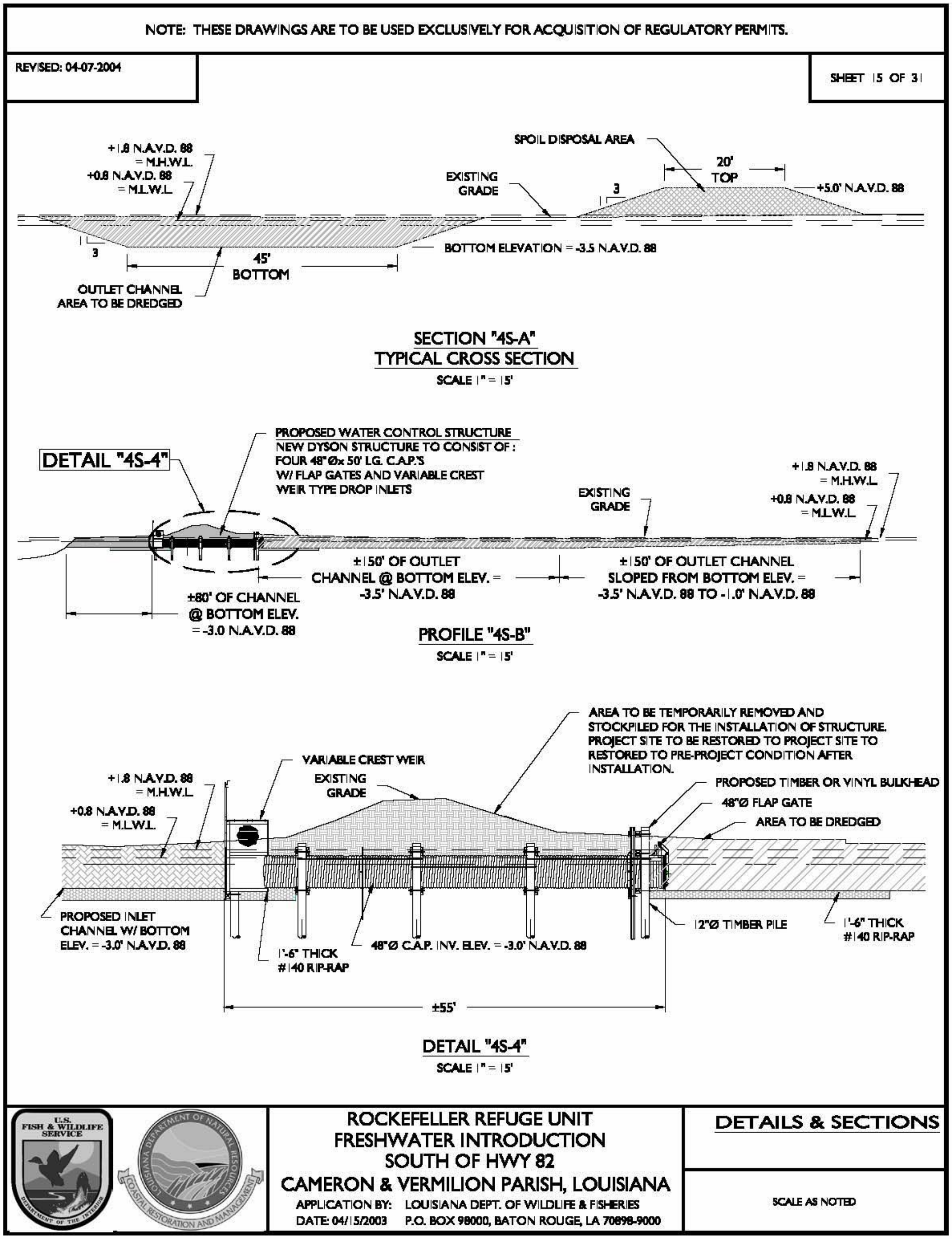
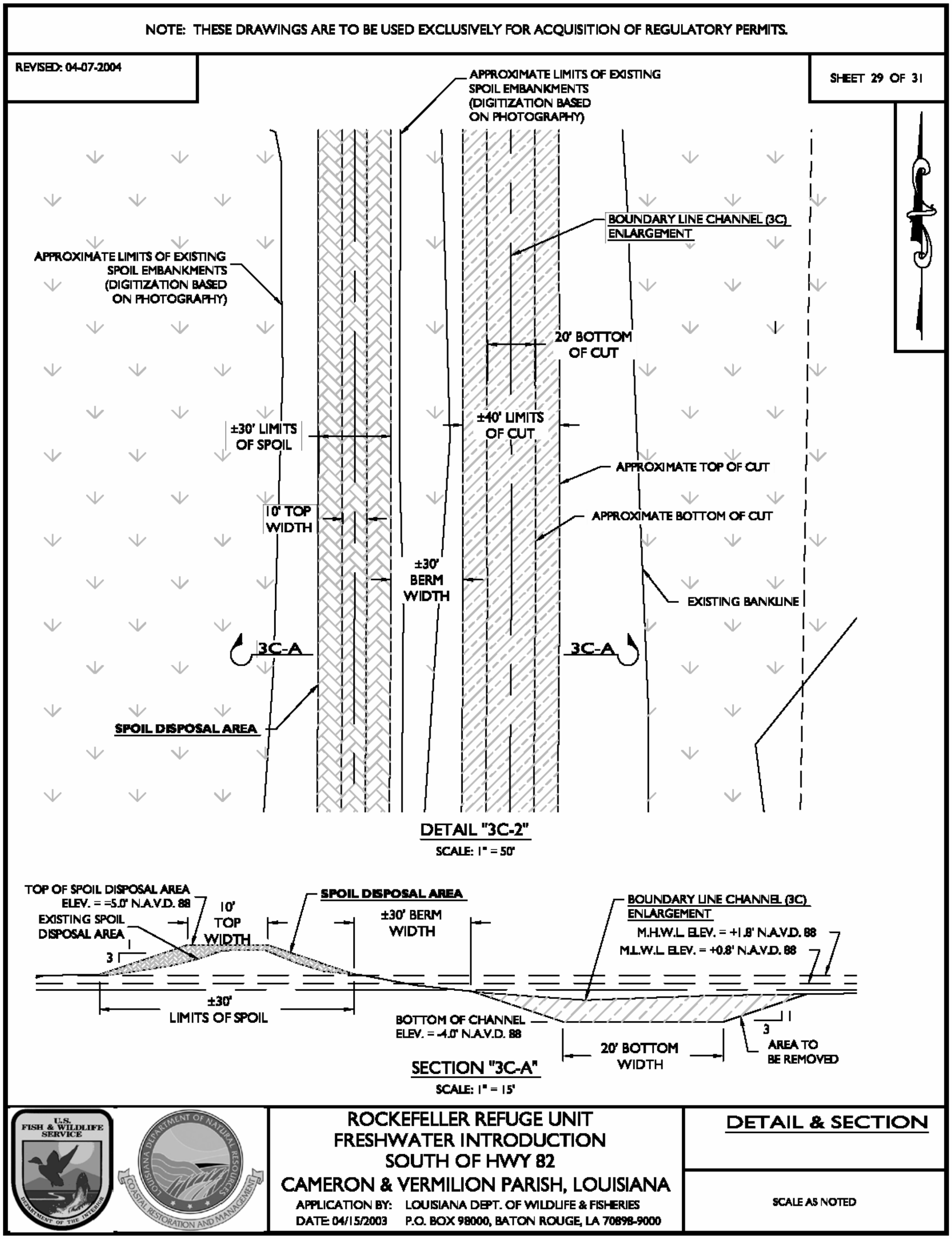


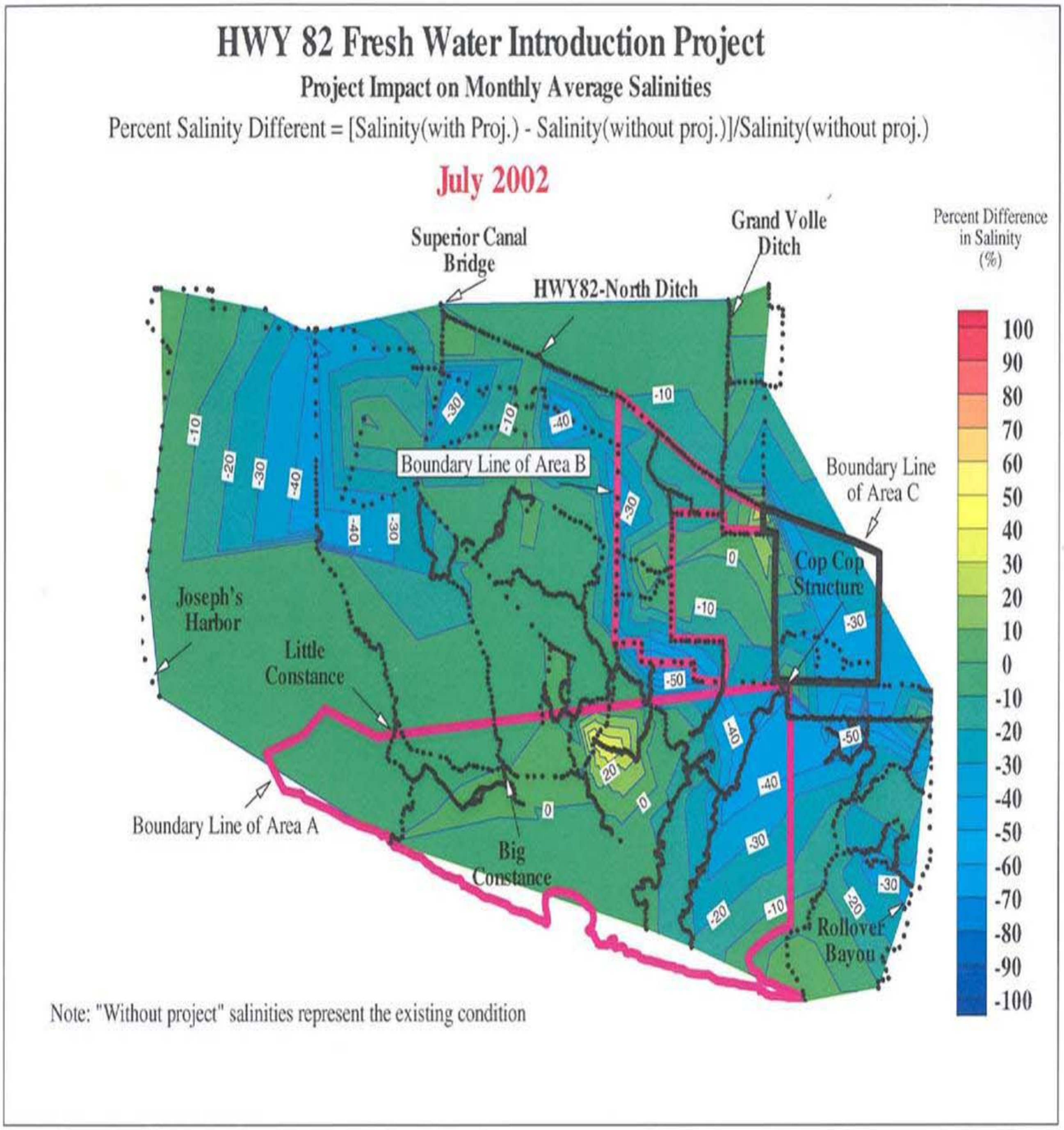
**Figure C-16. Freshwater Introduction South of LA Highway 82 Project Boundary Line Canal Enlargement Plan and Cross Sectional Views**



# Appendix D

## 1-Dimentional Hydrodynamic Modeling Results

**Figure D-1. 1-Dimentional Hydrodynamic Modeling Results Showing Predicted Highway 82 Project (ME-16) Average Percent Salinity Reductions for July 2002**



# Appendix E - Letters of Comment

No letters of comment were received concerning the Draft Environmental Assessment.