



**State of Louisiana  
Department of Natural Resources  
Coastal Restoration Division and  
Coastal Engineering Division**

**2004 Operations, Maintenance,  
and Monitoring Report**

for

**Sabine Refuge Protection**

State Project Number CS-18  
Priority Project List 2

May 2004  
Cameron Parish

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For  
Sabine Refuge Protection (CS-18)

Table of Contents

I. Introduction.....	1
II. Maintenance Activity.....	3
a. Project Feature Inspection Procedures .....	3
b. Inspection Results .....	3
c. Maintenance Recommendations .....	4
i. Immediate/Emergency .....	4
ii. Programmatic/Routine.....	4
III. Operation Activity .....	4
a. Operation Plan.....	4
b. Actual operations .....	4
IV. Monitoring Activity .....	5
a. Monitoring Goals .....	5
b. Monitoring Elements .....	5
c. Preliminary Monitoring Results and Discussion .....	6
V. Conclusions.....	11
a. Project Effectiveness.....	11
b. Recommended Improvements .....	11
c. Lessons Learned.....	11

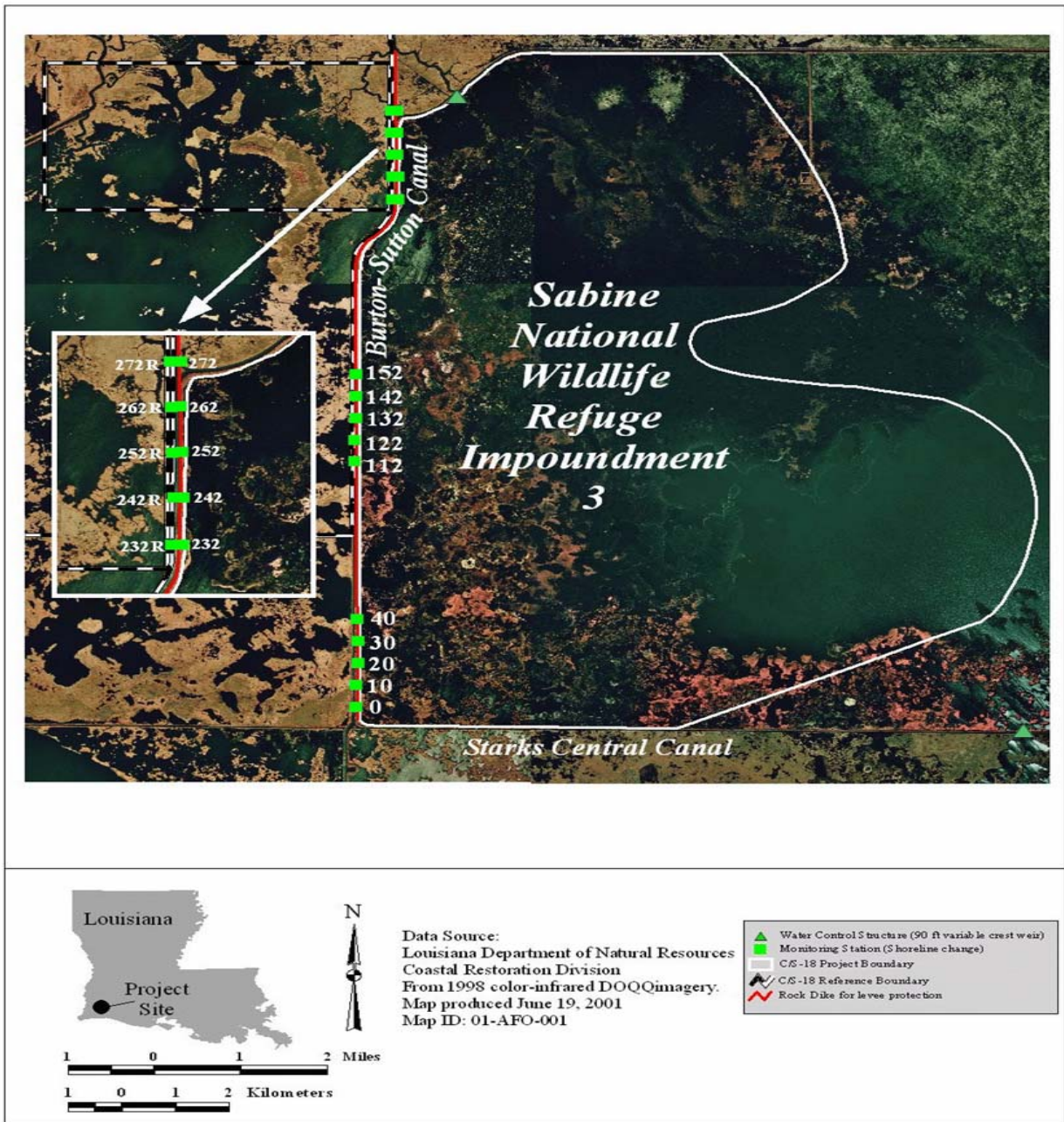


## I. Introduction

The project is located approximately 20 mi (32 km) west-southwest of Hackberry, Louisiana (figure 1) on the east levee of the Burton-Sutton Canal (BSC) adjacent to the Sabine National Wildlife Refuge Impoundment 3, a 27,000 ac (10,927 ha) freshwater impoundment that provides habitat for freshwater game fish, alligator, furbearers, and migratory and resident waterfowl. The impoundment supports freshwater vegetation including *Zizaniopsis aquatica* (giant cutgrass) and *Nelumbo lutea* (American lotus). The existing west levee along Impoundment 3, which was constructed in 1951, has already deteriorated due to boat wake erosion and subsequent sloughing of levee material into the BSC. Continued erosion will result in multiple breaches of the levee, allowing higher salinity waters from the Calcasieu Ship Channel and Sabine Lake to enter the impoundment via the BSC. Since much of the freshwater marsh within the impoundment is highly organic and floating, saltwater intrusion and increased tidal exchange would likely convert as much as 13,000 ac (5,261 ha) of the impoundment to shallow open water. The loss of floating and submersed vegetation would result in greater wind-induced wave erosion of the remaining marsh within the impoundment.

To prevent further bank erosion, 5.5 mi (8.9 km) of free-standing rock breakwater was constructed on the canal side of the east levee of the BSC (figure 1) and the levee was restored where it had been degraded using dredge material from the canal in January, 1995.





**Figure 1.** Sabine Refuge Protection (CS-18) project boundary, reference boundary, rock dike along the Burton-Sutton Canal, and shoreline change monitoring station locations.

## **II. Maintenance Activity**

### **a. Project Feature Inspection Procedures**

The purpose of the annual inspection of the Sabine Refuge Protection Project (CS-18) is to evaluate the constructed project features to identify any deficiencies and prepare a report detailing the condition of project features and recommended corrective actions needed. Should it be determined that corrective actions are needed, LDNR shall provide, in the report, a detailed cost estimate for engineering, design, supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs.

An inspection of the Sabine Refuge Protection Project (CS-18) was held on June 14, 2004 under partly cloudy skies and warm temperatures. In attendance was Stan Aucoin, Dewey Billodeau, Chuck Degatur and Pat Landry from LDNR. Representatives from USFWS were invited but chose not to attend. The inspection began on the south end of the foreshore dike on the Burton Sutton Canal.

The field inspection included a complete visual inspection of the entire project site. Staff gauge readings and existing temporary benchmarks were used to determine approximate elevations of water, rock weirs, earthen embankments, steel bulkhead structures and other project features. Hand held GPS units were used to mark low areas of rock dikes and earthen embankments which may require corrective actions or monitoring on future site visits.

### **b. Inspection Results**

#### **Foreshore Rock Dike (Burton Sutton & Starks Central Canals)**

The dikes are in excellent post construction condition. No need for any maintenance in the foreseeable future.

#### **Reinforcement of wingwalls at 3 water control structures**

Excellent condition. No maintenance required at this time.

#### **Alligator crossings**

Only one crossing, possibly two were found. Airboats were using the crossing on the Beach Canal. Since the others were indistinguishable from the surrounding levee, it is assumed that the alligators are no longer using them.



**II. Maintenance Activity (continued)**

**c. Maintenance Recommendations**

**i. Immediate/ Emergency Repairs**

None

**ii. Programmatic/ Routine Repairs**

None

**III. Operation Activity**

**a. Operation Plan**

**b. Actual Operations**

There are no active operations associated with this project.



## **IV. Monitoring Activity**

### **a. Monitoring Goals**

The objective of the Sabine Refuge Protection Project is to protect the existing freshwater vegetation within Impoundment 3 of Sabine NWR adjacent to the Burton-Sutton Canal and to prevent the encroachment of the Burton-Sutton Canal into the impoundment.

The following goals will contribute to the evaluation of the above objective:

1. Restore and protect the west levee of Impoundment 3 using dredge material and a free-standing rock breakwater.
2. Protect existing freshwater vegetation in Impoundment 3 from saltwater intrusion via the Burton-Sutton Canal.

### **b. Monitoring Elements**

#### **Aerial Photography:**

Near-vertical color-infrared aerial photography (1:24,000 scale) was used to measure vegetated and non-vegetated areas for the project and reference areas. The photography was obtained on November 1, 1993 prior to construction and on January 7, 1997, 2 years following project construction. The original photography was checked for flight accuracy, color correctness, and clarity and was subsequently archived. Aerial photography was scanned, mosaicked, and georectified by USGS/NWRC personnel according to standard operating procedures.

#### **Shoreline Change:**

To document shoreline movement, shoreline markers were placed on the vegetated marsh edge along the east bank of the BSC (and in a reference area along the west bank of the BSC, opposite the northernmost mile of the rock dike) adjacent to the northernmost, central, and southernmost miles of the rock dike, at 1,000 ft (305 m) intervals. Shoreline position relative to the shoreline markers was documented by direct measurement in 1995 (pre-construction), and post-construction in 2000. Shoreline position will be monitored in 2005, 2010, and 2014. Aerial photography and GPS measurements were also be used to document shoreline movement.





#### **IV. Monitoring Activity (continued)**

##### **c. Preliminary Monitoring Results and Discussion**

###### **Aerial photography:**

Land to water ratios in the project area were 51.8% land to 48.2% water pre-construction in 1993 and 45.9% land to 54.1% water in 1997 postconstruction. In the reference area in 1993, ratios were 38.5% land to 61.5% water and in 1997, ratios were 37.9% land to 62.1% water. It was determined that the 1997 post construction aerial photography was flown when water levels in Impoundment 3 were much higher than during pre-construction photography (1993). Because the reference area is not impounded, water levels were lower than in the impoundment, and land to water ratios did not reflect those in the project area. The land loss in Impoundment 3 (figures 2 and 3) is not as high as it appears. Field observations suggest that little or no land loss has occurred.

###### **Shoreline change:**

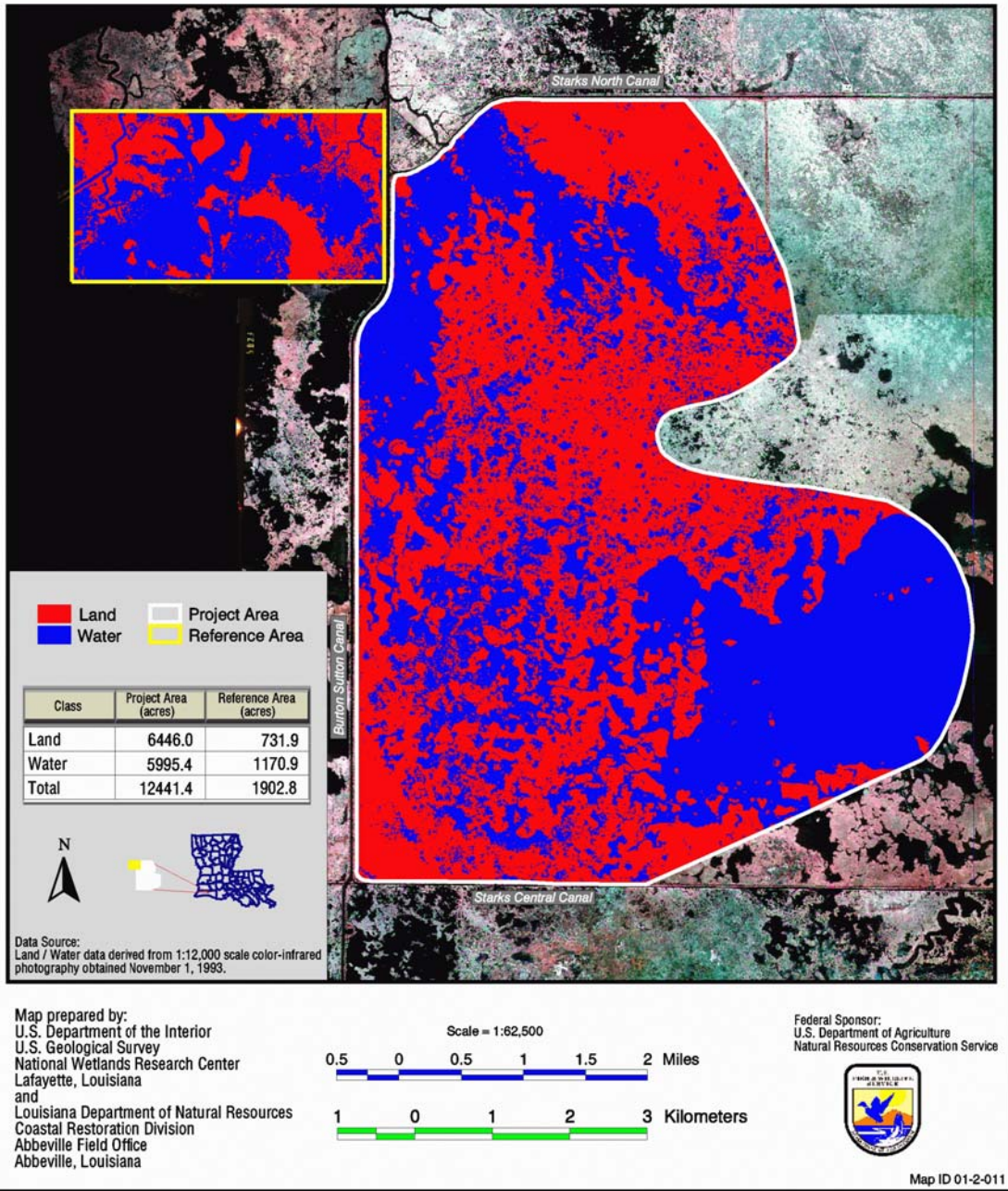
Shoreline survey results, presented in figures 4a and 4b, show shoreline position change during the study period differing by less than 8.5 ft (2.6 m) at any one station for both the project and reference areas. Shoreline advance was detected at all project stations except stations 30 and 112 and for all reference stations except 252R during the period between 1995 and 2000 (figures 5a and 5b). Mean shoreline advance rates were calculated to be 1.3 + 1.1 ft/yr (0.4 + 0.3 m/yr) and 0.9 + 1.9 ft/yr (0.3 + 0.6 m/yr) for the project and reference areas, respectively. The results of the two-sample t-test indicated that there was no significant difference in shoreline change rate detected between the project and reference areas ( $P = 0.90$ ).

Scheduled shoreline change surveys (for years 2005, 2010, and 2014), and comprehensive monitoring reports for years 2006, 2011, and 2015 will be completed and will provide further monitoring documentation for this shoreline protection project. Future inspections of the project area by CED engineers will be conducted at regular intervals to document the condition of the rock breakwater and any required maintenance.



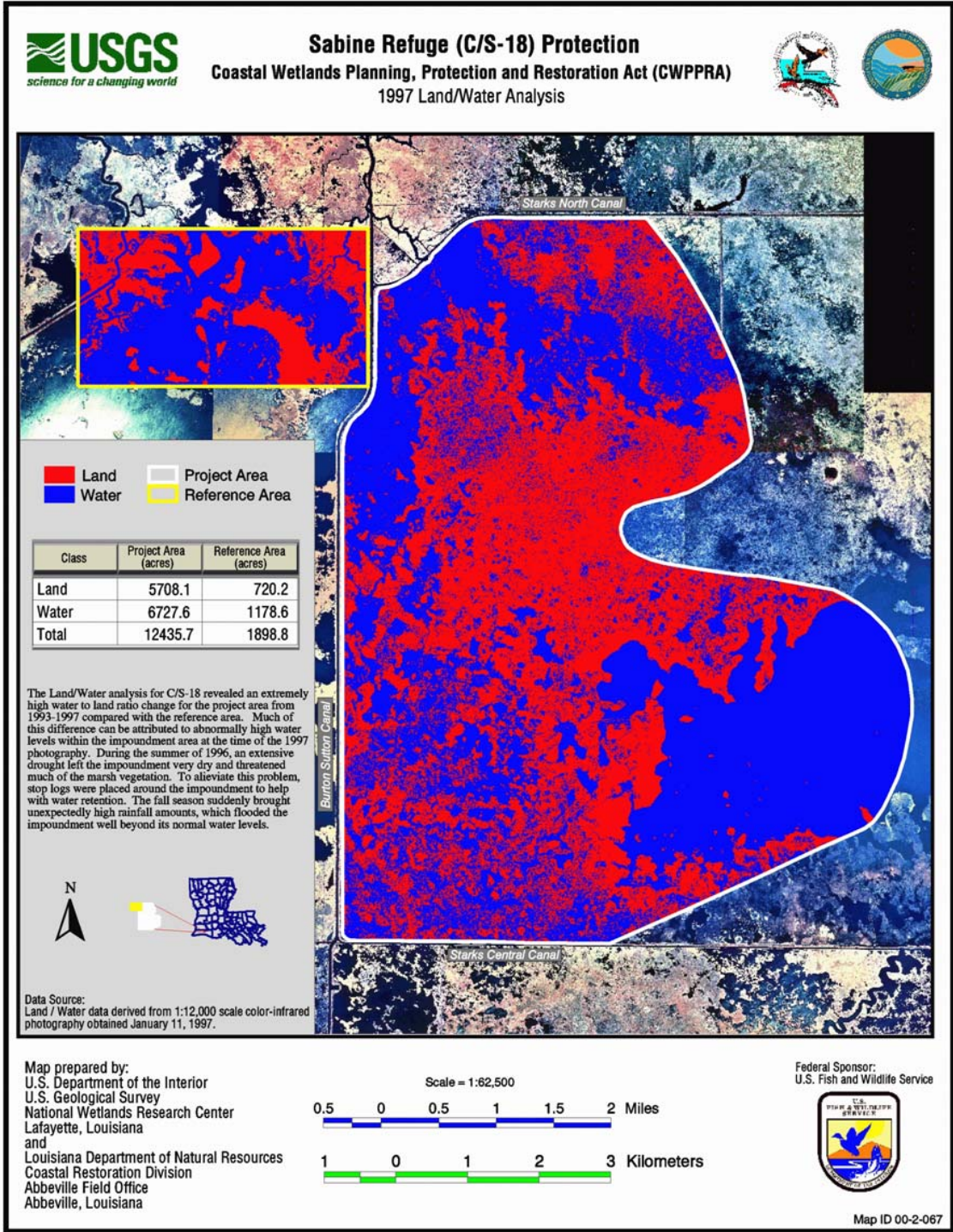


**Sabine Refuge (C/S-18) Protection**  
 Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA)  
 1993 Land/Water Analysis



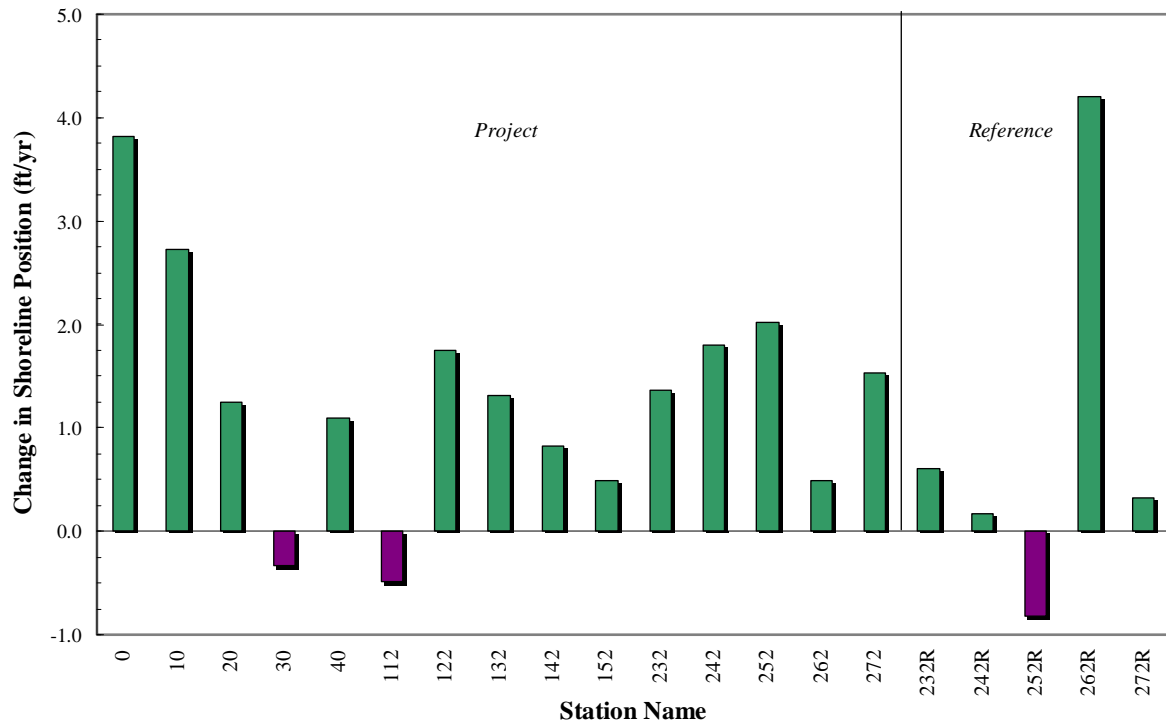
**Figure 2.** Sabine Refuge Protection (CS-18) GIS analysis of project and reference area pre-construction aerial photography (1993).





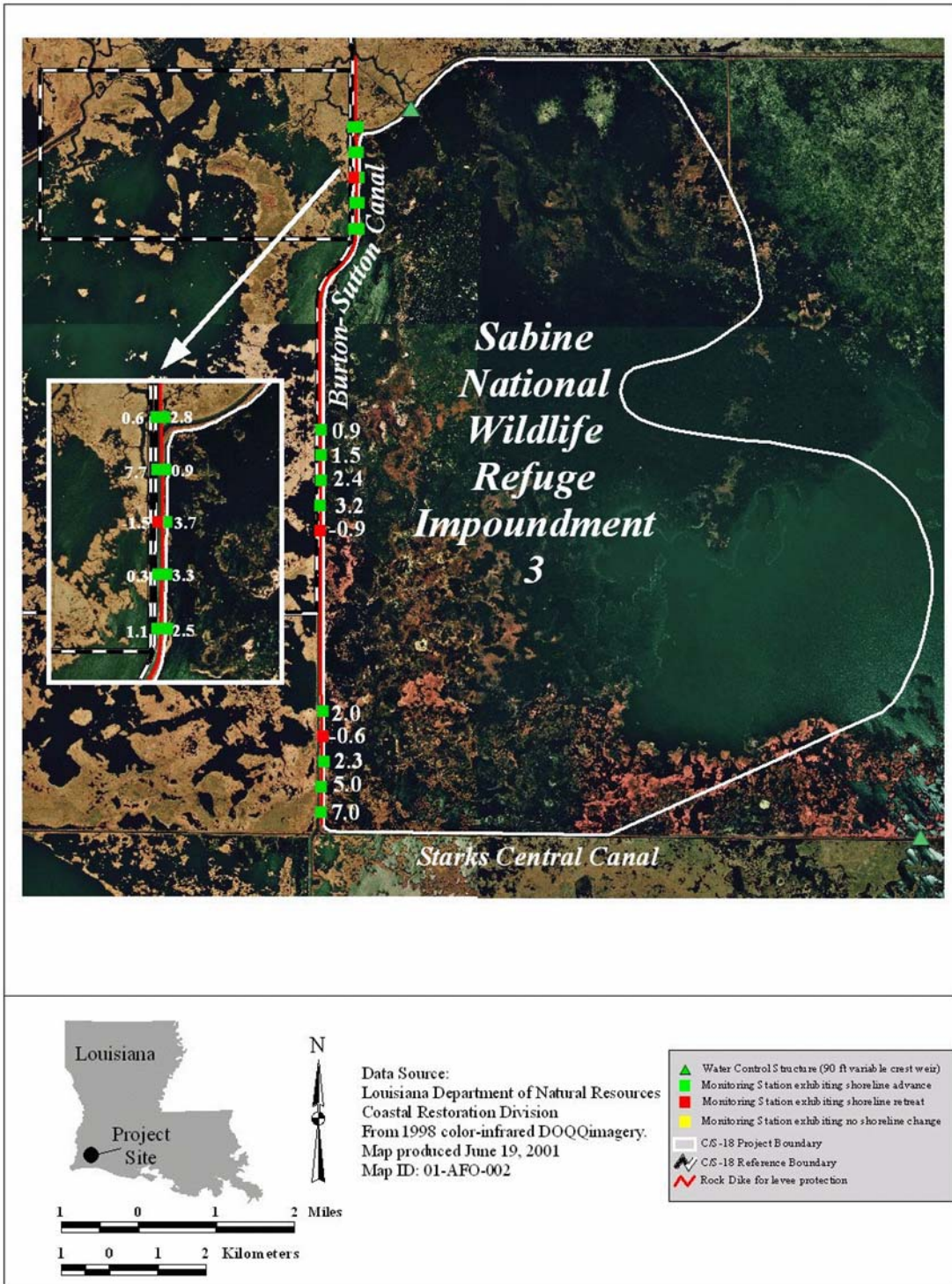
**Figure 3.** Sabine Refuge Protection (CS-18) GIS analysis of project and reference area post-construction aerial photography (1997).





**Figure 4.** Sabine Refuge Protection (CS-18) shoreline change for the project and reference area from 1995 to 2000. Rates are calculated in ft/yr.





**Figure 5.** Sabine Refuge Protection (CS-18) shoreline change (ft) at project and reference area monitoring station locations between October 1995 and August 2000.



## V. Conclusions

### a. Project Effectiveness

The Sabine Refuge Protection project has been successful in stabilizing bank erosion of the west levee on Burton Sutton Canal, thus preventing land loss in Impoundment 3 on Sabine Refuge. Visual observation indicates vertical accretion of the wetland area at many locations between the foreshore rock dike and the shoreline.

### b. Recommended Improvements

There are no recommendations for this project.

### c. Lessons Learned

This project demonstrates the effectiveness of shoreline protection projects in coastal environments.

Based on multiple O & M inspections, the foreshore rock dike has proven to be very effective in reducing shoreline erosion along the GIWW, while experiencing no deterioration and requiring no maintenance. The foreshore Rock Dike was constructed on the (-) 2 contour with no crown, 2:1 side slopes and 400 lb. stone gradation.

Aerial photography should be flown under similar water level and tidal conditions for accuracy.

