State of Louisiana
Coastal Protection and Restoration Authority

2013 Operations, Maintenance, and Monitoring Report

for

BARATARIA BASIN LANDBRIDGE SHORELINE PROTECTION PROJECT (PHASES 1&2, 3, and 4)

State Project Number BA-27
Phases 1 & 2, Priority Project List 7
Phase 3, Priority Project List 9
Phase 4, Priority Project List 11

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Prepared by:

Melissa Hymel
CPRA Operations Division
New Orleans Regional Office

Adam Ledet
CPRA Operations Division
Thibodaux Regional Office

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2013 Operations, Maintenance, and Monitoring Report
For
Barataria Landbridge Shoreline Protection Project (BA-27) – Phases 1 & 2, 3, and 4

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Preface

This report includes monitoring data collected through December 2012, and Annual Maintenance Inspections through March 2013.

The 2013 Operations, Maintenance, & Monitoring (OM&M) Report is the third in a series that includes monitoring data and analyses presented previously in the 2005 and 2010 OM&M reports (Babin and Hymel 2005, Babin and Hymel 2010), plus additional project-specific and CRMS data collected since 2007. These reports can be downloaded at the following website: http://sonris.com/direct.asp?path=/sundown/cart_prod/cart_bms_avail_documents_f

I. Introduction

The Barataria Landbridge Shoreline Protection Project is located approximately 14 miles south of the town of Lafitte in Jefferson and Lafourche Parishes, along the shoreline/bankline of Bayous Perot and Rigolettes, Little Lake, and Harvey Cutoff Canal (Figure 1). This project is co-sponsored by the Natural Resources Conservation Service (NRCS) and the Coastal Protection and Restoration Authority (CPRA) of Louisiana, and was authorized by Section 303(a) of Title III Public law 101-646, the Coastal Wetlands Planning Protection and Restoration Act (CWPPRA) enacted on November 29, 1990, as amended. Phases 1 & 2 (BA-27a, b), Phase 3 (BA-27c) and Phase 4 (BA-27d) of the Barataria Landbridge Shoreline Protection Project were approved on the 7th, 9th and 11th Priority Project List, respectively.

The Barataria Basin Landbridge Project is located within the Barataria Basin, which is bounded to the north and east by the Mississippi River, to the west by Bayou Lafourche, and to the south by the Gulf of Mexico. The upper portion of the Barataria Basin is a largely freshwater-dominated system of natural levee ridges, bald cypress – water tupelo swamps, and fresh marsh habitats. The lower portion of the basin is dominated by marine/tidal processes, with barrier islands, saline marsh, brackish marshes, tidal channels, and large bays and lakes. Historically, a small meandering Bayou Perot, and the longer, narrower Bayou Dupont-Bayou Barataria-Bayou Villars channels provided limited hydrologic connection between the upper and lower basin (USDA/NRCS 2000). The hydrologic connections between the upper and lower basin are much greater today due to the Barataria Waterway, Bayou Segnette Waterway, Harvey Cutoff Canal, causing substantial erosion and interior marsh loss along and between the now-enlarged Bayou Perot and Bayou Rigolettes (LDNR 2001). Major factors contributing to excessive marsh loss in this area include the elimination of overbank flooding of the Mississippi River; closure of Bayou Lafourche at the Mississippi River; dredging of the Gulf Intracoastal Waterway, Barataria Bay Waterway, Harvey Cutoff Canal, and oilfield access canals; physical erosion due to wind, boat-wake, and tidal energy; subsidence; and sea level rise (USDA/NRCS 2000).

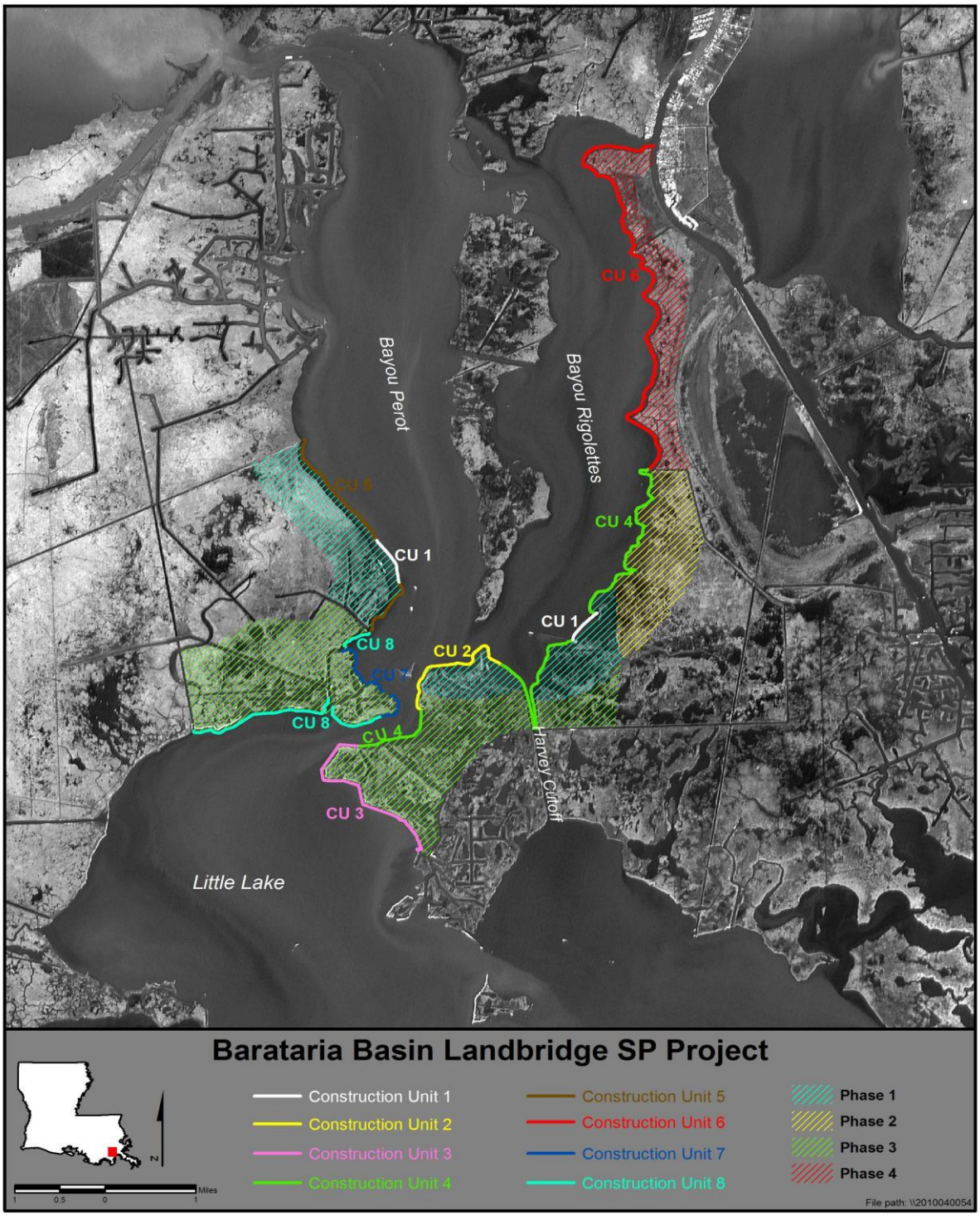

Figure 1. Overall map of the Barataria Basin Landbridge Shoreline Protection Project (BA-27) showing all Phases and Construction Units.

This project consists of four separate phases and will provide approximately 119,290 ft (36,360 m) of shoreline protection to the project area. Because of the large size of this project, construction has been broken down into smaller Construction Units (CU) (Table 1). Phases 1 and 2 of the Barataria Landbridge Project include all of CU 1 & 2, a portion of CU 4 and all of CU 5. Phase 3 encompasses a portion of CU 4 and all of CU 3, CU 7, and CU 8. Phase 4 includes all of CU 6. To date, CU's 1, 2, 3, 4, 5 and 6 have been completed. CU 7 and 8 are in final engineering and design and should be going to the construction phase in 2014. **The 2013 Operations, Maintenance and Monitoring Report will cover the completed portion of the project only (CU's 1, 2, 3, 4, 5 and 6).**

Table 1. Summary of Construction Units for the Barataria Basin Landbridge Shoreline Protection Project (BA-27), Phases 1, 2, 3, and 4.

Construction Unit	Phase	Construction Completed	Approximate Length Constructed (ft)
1 (test project)	1/2	May 2001	3,200
2	1/2	Oct 2002	6,403
3	3	May 2004	10,865
4	1/2,3	Jul 2009	32,406
5	1/2	Jul 2008	12,626
6	4	Apr 2006	30,541
7	3	Not constructed	6,225
8	3	Not constructed	17,024
		TOTAL:	119,290

Construction Unit 1 was a demonstration project consisting of various test sections along the west bank of Bayou Perot and the southeast bank of Bayou Rigolettes (Figure 2). The purpose of the test project was to demonstrate the effectiveness of four different methods of shoreline protection at two separate locations in areas of high wave energies. Approximately 1,600 linear feet (488 m) of shoreline protection was constructed at both locations. The structural components included a rock dike placed on freshly excavated spoil material, composite rock dike with light aggregate core encapsulated in geotextile fabric, rock dike using a furrow method to place and encapsulate lightweight aggregate core, and pre-stressed concrete pile and panel wall (LDNR 2002a and b). Constructed features of CU 1 include the following:

- Section A and A1 consisted of 200 linear feet of rock dike above geotextile fabric and 200 linear feet of rock dike placed on freshly excavated spoil material. This construction technique tested the underlying organic substrate. The rock dike in both techniques was constructed to an elevation of +3.0 ft NAVD, with a 3-ft wide crown and 4:1 side slopes.

Figure 2. Project infrastructure map for the Barataria Basin Landbridge Shoreline Protection Project (BA-27) – Phase 1, Construction Unit 1.

- Section B consisted of 400 linear feet of composite rock dike utilizing a core of lightweight aggregate encapsulated in geotextile fabric. This technique required the contractor to contain the lightweight material prior to placement in the water and install a 2-ft layer of rock over the lightweight core. The rock dike was constructed to an elevation of +3.0 ft NAVD, with a 3-ft wide crown and 4:1 side slopes.
- Section C consisted of 400 linear feet of composite rock dike using a furrow method to place and encapsulate the lightweight aggregate core. This method used small parallel sections of rock and two layers of geotextile fabric. The lightweight material was placed on the geotextile between the rock sections. The geotextile was then folded over the lightweight material and the aggregate core was capped with 2 ft of rock. The two parallel sections of rock were constructed to an elevation of +1.0 ft NAVD, with 1.5-ft crown, and 2:1 side slopes. The rock cap above the aggregated core was constructed to an elevation of +3.0 ft NAVD, with a 3-ft wide crown and 4:1 side slopes.
- Section D consisted of 400 linear feet of pre-stressed concrete pile and panel wall. The piles were 16" x 16" x 80' long and the panels were 20' x 6' x 6" thick. The design incorporated 80-ft piles, spaced 20 feet apart. The wall sections were 6 feet high extending one foot below the mud line at -3.0 ft NAVD to an elevation of +3.0 ft NAVD. The toe of the panel wall is protected by a rock scour pad at the base of the wall.

Construction Unit 2, which is part of Phases 1 & 2, was completed in October 2002 and consists of approximately 6,403 linear feet (1,952 m) of shoreline protection located at the southern end of Bayou Rigolettes and Bayou Perot west of the Harvey Cutoff Canal (Figure 3). Construction of this unit was completed in two reaches. Reach 1 (east side) consisted of the construction of approximately 3,691 linear feet (1,125 m) of rock dike east of an existing location canal and the mouth of the Harvey Cutoff Canal. The rock dike constructed for Reach 2 (west side) began on the west bank of the existing location canal and proceeded west approximately 2,712 linear feet (827 m) along the southern shoreline of Bayou Rigolettes and Bayou Perot towards Little Lake. The rock dike for both reaches was constructed to an elevation of +3.5 ft NAVD with a 2.0 ft wide crest and 2:1 side slopes (LDNR 2002a and b).

Construction Unit 3 of Phase 3 was completed in May 2004 and consists of approximately 10,865 linear feet (3,312 m) of rock dike along the northeast shoreline of Little Lake and the south bank of Bayous Rigolettes and Perot (Figure 4). The rock dike structure was constructed to an elevation of +3.5 ft NAVD with a 4-ft wide crest and 3:1 side slopes. Two 60-ft wide fish dips were constructed to allow for marine organism access. The spoil material resulting from access dredging was deposited into seven small open water ponds located landward of the rock dike. The total area of marsh created from beneficial use of dredge material was approximately 30 acres (LDNR 2002a and b).

Construction Unit 4, which covered portions of Phases 1, 2, and 3, was completed in July 2009. This included the construction of approximately 31,352 linear feet (9,500 m) of concrete pile and

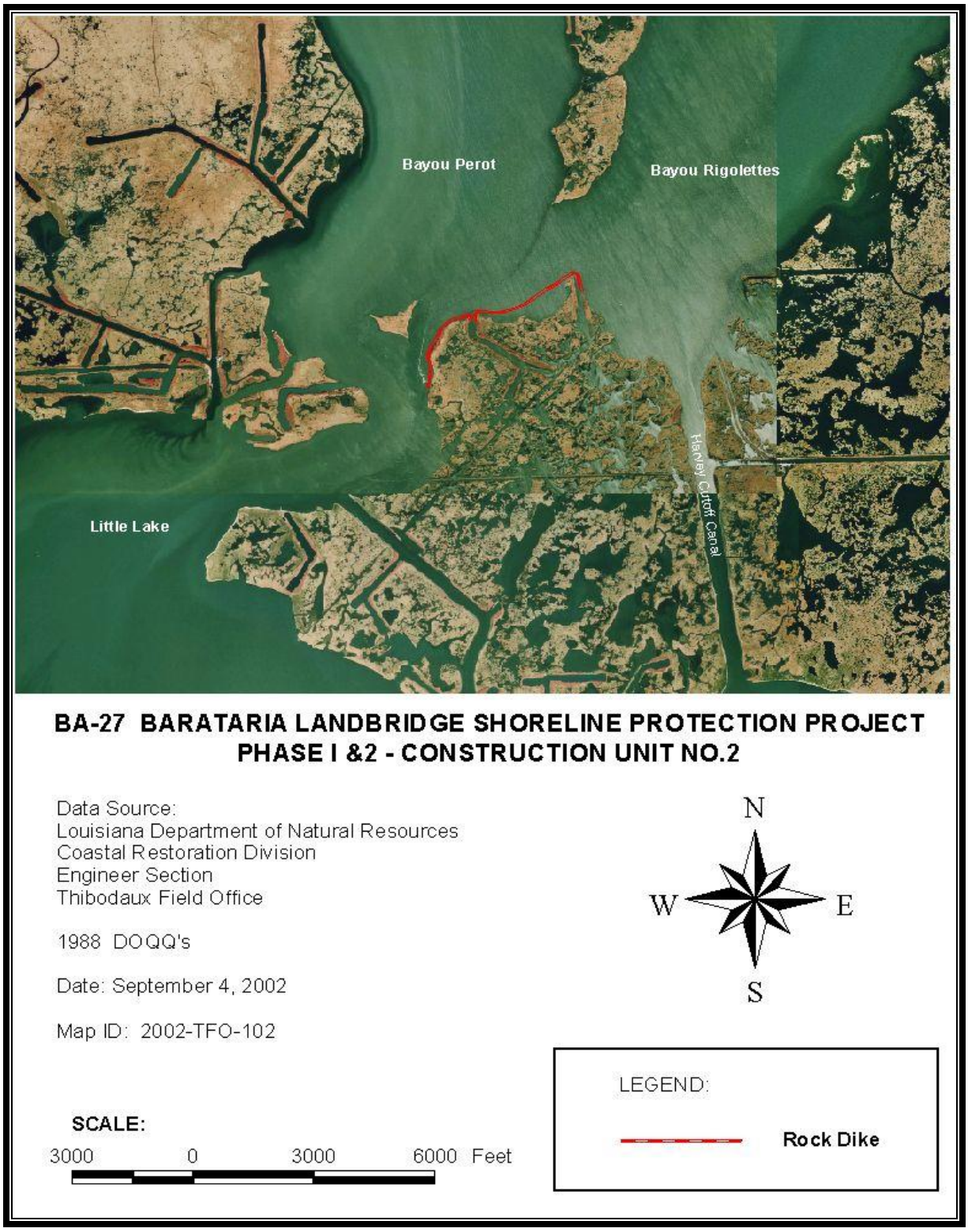

Figure 3. Project infrastructure map for the Barataria Basin Landbridge Shoreline Protection Project (BA-27a, b) – Phase 1 & 2, Construction Unit 2.

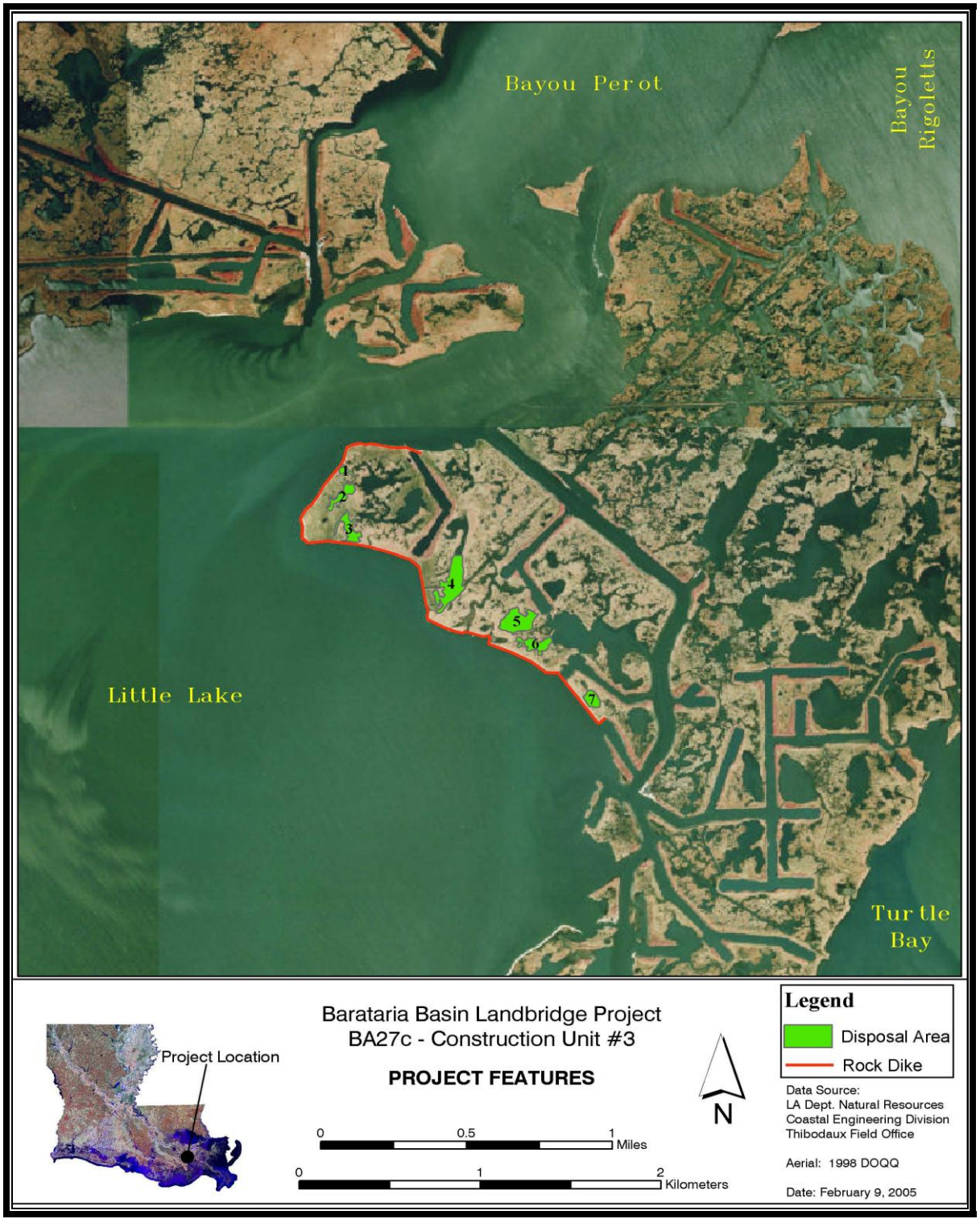

Figure 4. Project infrastructure map for the Barataria Basin Landbridge Shoreline Protection Project (BA-27c) – Phase 3, Construction Unit 3.

wall panels, and 1,238 linear ft (377 m) of rock revetment and rock tie-ins along the southeast shoreline of Bayou Rigolettes, both sides of the mouth of the Harvey Cutoff Canal and a segment between CU's 2 and 3 along the east bank of Bayou Perot (Figure 5).

Construction Unit 5, which covered a portion of Phase 1 along the west shoreline of Bayou Perot, was completed in October 2008 and included approximately 12,332 linear feet (3,759 m) of concrete pile and wall panels and 294 feet (90 m) of rock tie-ins (Figure 6).

Construction Unit 6, which comprised all of Phase 4, was completed in April 2006 and consisted of 30,541 linear feet (9,309 m) of rock revetment along the northeastern reach of Bayou Rigolettes (Figure 7).

Construction Units 7 and 8 are in the final phases of engineering and design, and construction should begin in early 2014. The proposed features of CU 7 include approximately 6,225 linear feet (1,897 m) of rock revetment along the southwestern bank of Bayou Perot near Little Lake. CU 8 consists of the construction of approximately 17,024 linear feet (5,189 m) of rock revetment and rock dike along the west bank of Bayou Perot and the north shore of Little Lake.

Another CWPPRA project, the Dedicated Dredging on the Barataria Basin Landbridge (BA-36) project, was constructed in 2010 within some areas of the BA-27 project boundary (Figure 8). The purpose of this project, which was co-sponsored by the U.S. Fish and Wildlife Service and the CPRA, was to create new emergent marsh and nourish existing marsh using hydraulically dredged sediments from Bayous Perot and Rigolettes. In two contained marsh creation areas, the BA-36 project created approximately 1,246 acres of intertidal marsh. In two adjacent uncontained areas, borrow material was used to nourish approximately 1,578 acres of additional marsh.

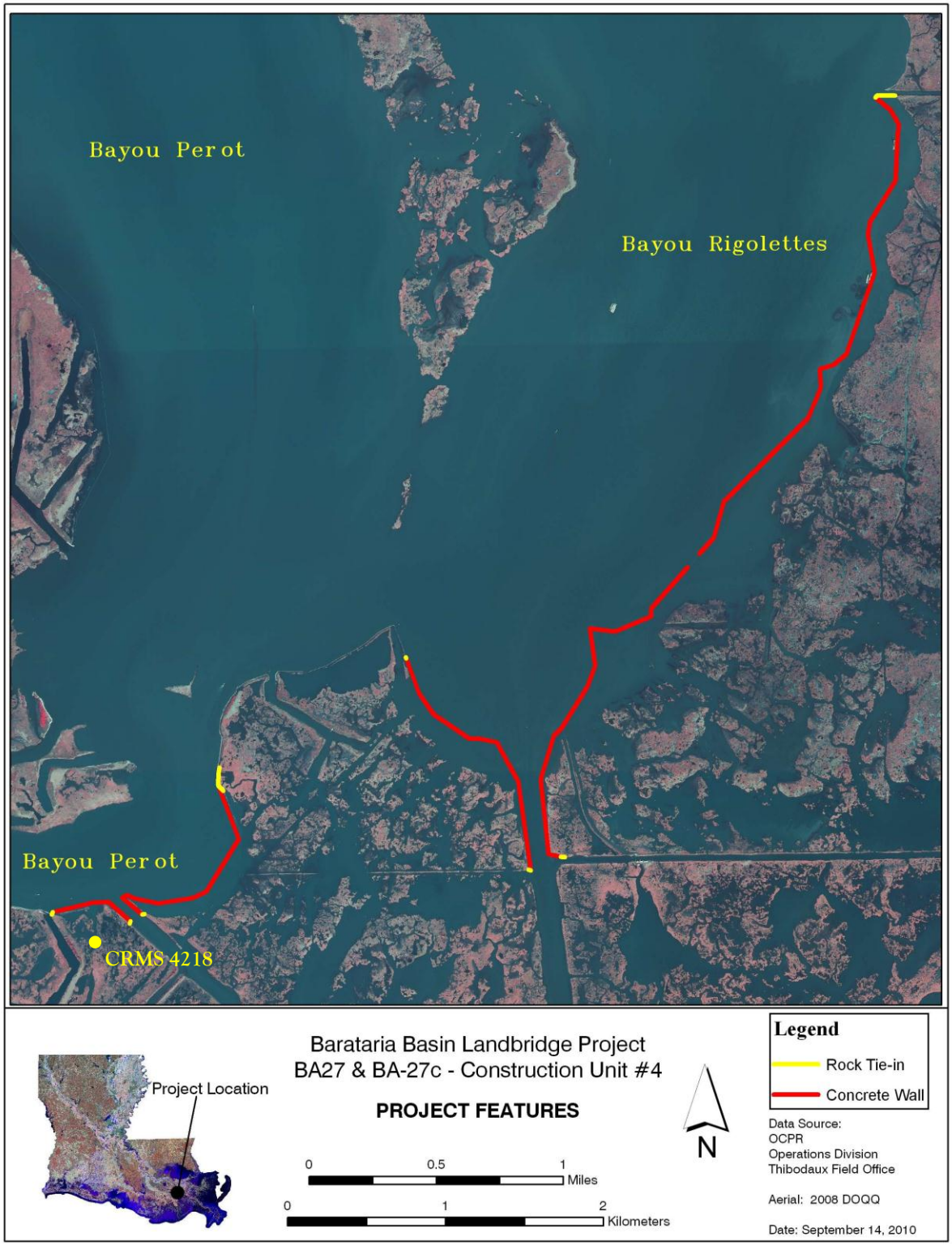

Figure 5. Project infrastructure map for the Barataria Basin Landbridge Shoreline Protection Project (BA-27 & BA-27c) – Phases 1, 2, and 3, Construction Unit 4.

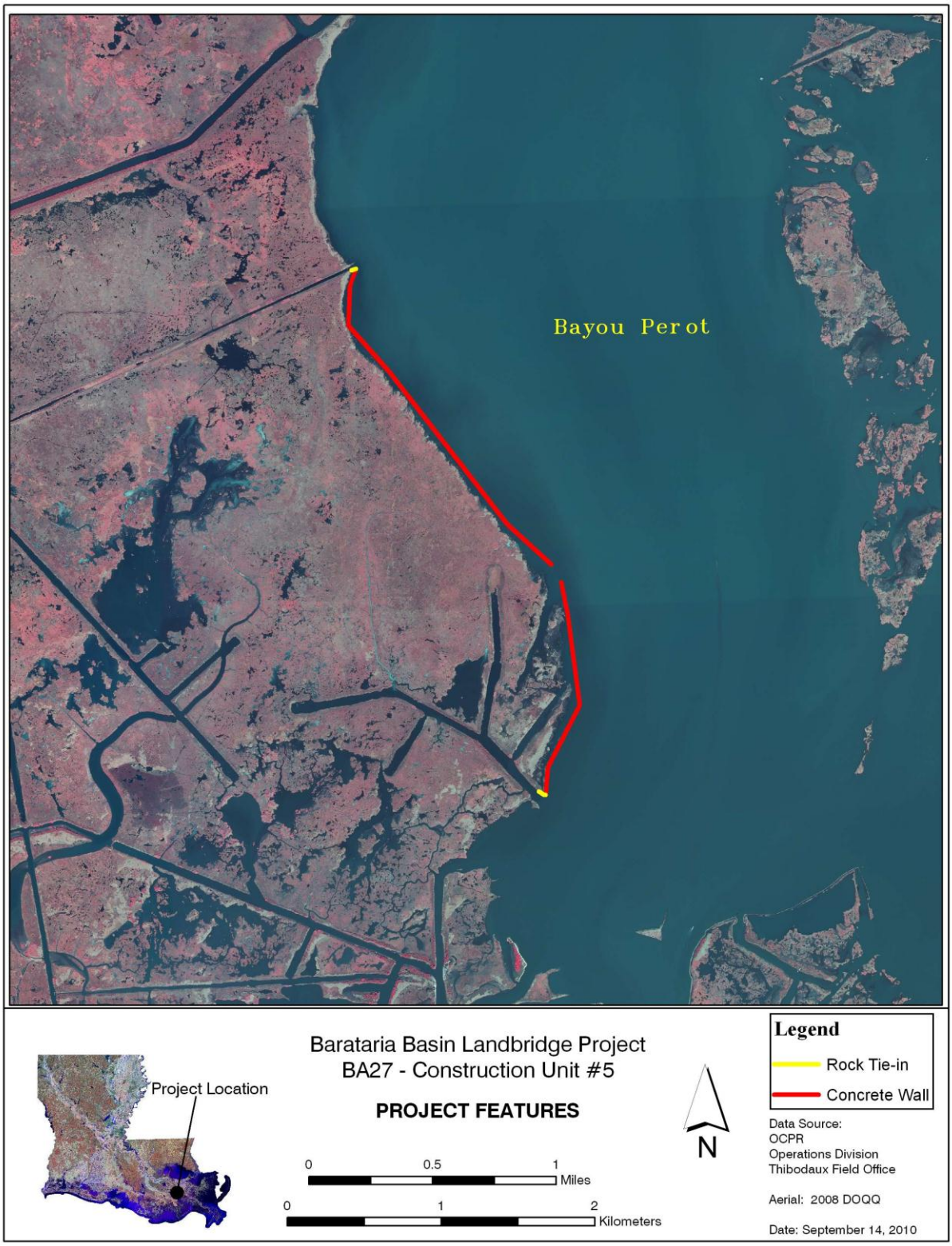

Figure 6. Project infrastructure map for the Barataria Basin Landbridge Shoreline Protection Project (BA-27) – Phase 1, Construction Unit 5.

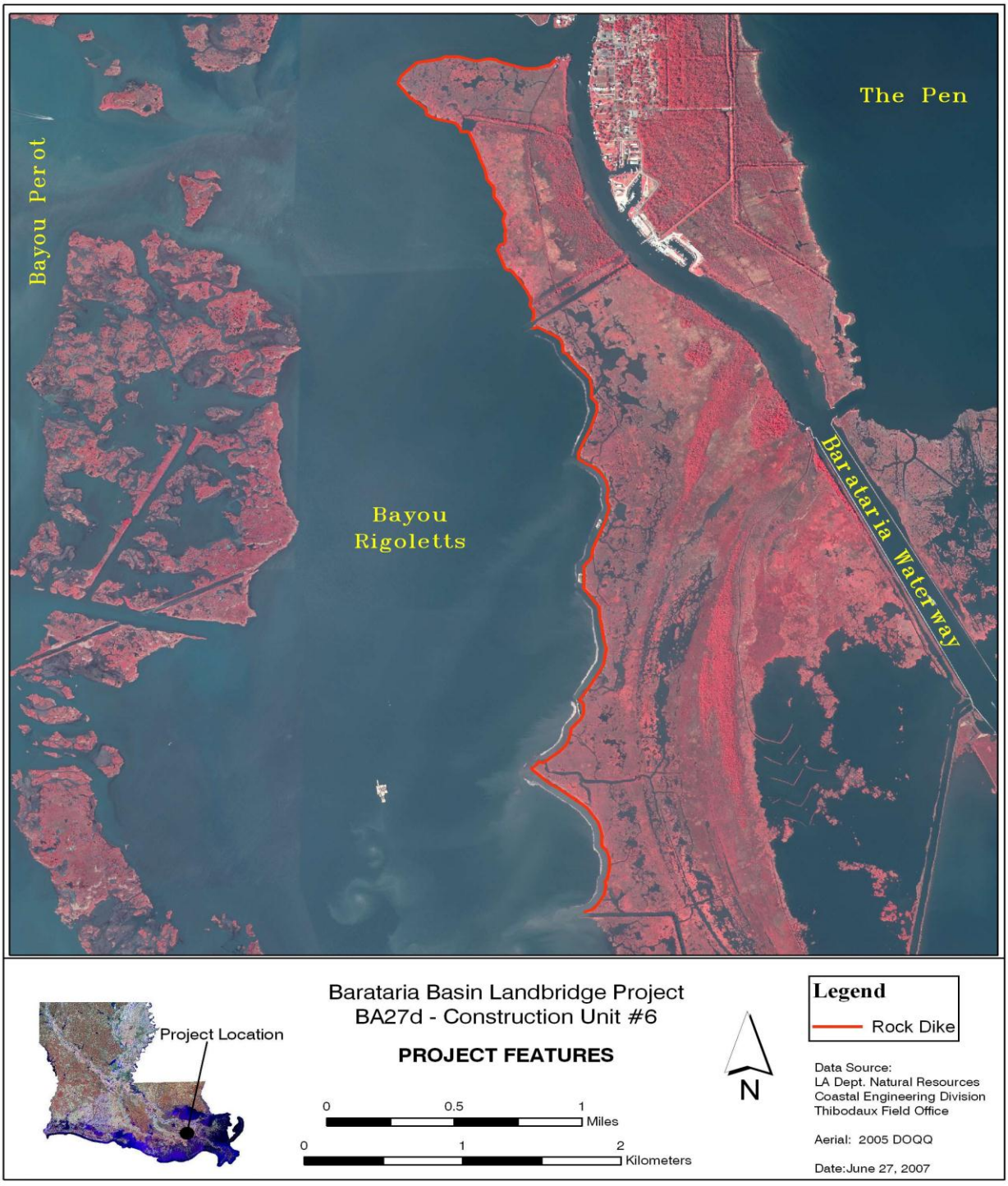

Figure 7. Project infrastructure map for the Barataria Basin Landbridge Shoreline Protection Project (BA-27d) – Phase 4, Construction Unit 6.

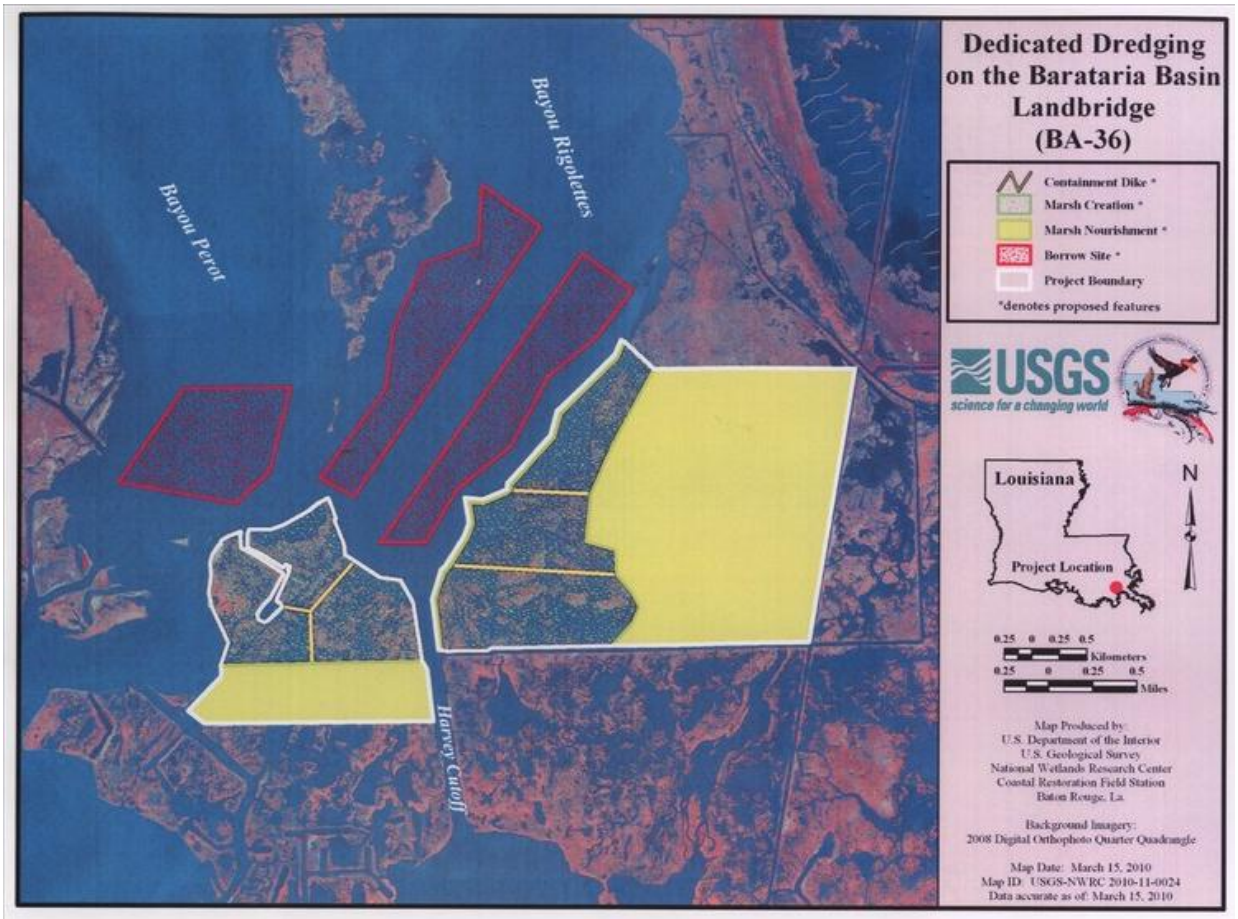

Figure 8. Location and features of the Dedicated Dredging on the Barataria Landbridge (BA-36) project.

II. Maintenance Activity

a. Inspection Purpose and Procedures

The purpose of the annual inspection of the Barataria Landbridge Shoreline Protection Project (BA-27), (BA-27c) and (BA-27d) is to evaluate the constructed project features, identify any deficiencies, prepare a report detailing the condition of such features and to recommend corrective actions needed, if any (LDNR 2002a & b, LDNR 2005, CPRA 2012). Should it be determined that corrective actions are needed, CPRA shall provide in report form, a detailed cost estimate for engineering, design, supervision, inspection, construction contingencies, and an assessment of the urgency of such repairs. The inspection report also contains a summary of maintenance projects undertaken since the constructed features were completed and an estimated project budget for the upcoming three (3) years for operation and maintenance and rehabilitation. The three (3) year projected operation and maintenance budgets for CU 1, CU 2, CU 3, CU 4, CU 5, and CU 6 are based on the outcome of this inspection and are compiled in Appendix A. Since CU 1 is a demonstration project, no maintenance funds were allocated. Prior to construction of CU 4 and CU 5, all of the project features constructed under CU 1 were removed with exception of the concrete pile wall panels. These concrete pile wall panels have been incorporated into the features of CU 4 and CU 5 and will be maintained under their respective construction units. Any future reference to CU 4 and CU 5 shall include the concrete panel walls constructed under CU 1 as well.

A field inspection of the Barataria Landbridge Shoreline Protection Project (BA-27), (BA-27c), and (BA-27d) was held on March 12, 2013, which included a visual inspection of Construction Units 1, 2, 3, 4, 5 and 6. In attendance were Brian Babin and Adam Ledet from CPRA, and Quin Kinler and Brandon Samson with NRCS. The attendees met at the Lucky 7 boat launch in Des Allemands, Louisiana and traveled to the project site by boat. The inspection of CU 5 began along the west bank of Bayou Perot and progressed south along the west bank to the north bank of Little Lake, encompassing CU 5 and CU 1. The inspection then proceeded to the east bank of Little Lake and progressed north along the east bank of Bayou Rigolettes at the Barataria Waterway near Lafitte, encompassing CU 1, 2, 3, 4, and 6. Staff gauge readings, where available, were used to estimate water elevations, elevations of rock dikes, rock tie-ins and other constructed features.

b. Summary of Past Operation and Maintenance Projects

Since the completion of Construction Units 2, 3, 4, 5 and 6, no maintenance, rehabilitation or corrective actions have been required.

c. Inspection Results

BA-27 -Construction Unit 1

Prior to construction of CU 4 and CU 5, all of the project features constructed under CU 1 were removed with exception of the concrete pile wall panels. These concrete pile wall panels have been incorporated into the features of CU 4 and CU 5 and are inspected and described along with those construction units.

BA-27 -Construction Unit 2

CU 2 appeared to be in good overall condition. The inspection of CU 2 began at the west end near Sta. 0+42 and proceeded to the east end of the reach near Sta. 36+83. As previously reported, a low area of the rock dike approximately 200 feet wide exists from Sta. 31+50 to Sta. 29+50. In comparison to the photos taken last year, there appeared to be no further settlement of the rock dike in this section. Directly behind this low area is a containment dike and newly created marsh constructed under the Dedicated Dredging on the Barataria Basin Landbridge (BA-36) project. Satellite images of this containment dike shows this area is not degrading or eroding due to the low area of the rock dike. Also previously reported was a slight dip in the rock dike above the Exxon/Humble pipeline right-of-way located near Sta. 12+33. Again, comparison with images taken in previous years shows no indication of further settlement of the rock dike or deterioration of the containment dike directly behind it. Due to the lack of marsh degradation and high construction cost associated with repairing small sections of dike, we are not recommending any corrective actions at this time, but these areas will continue to be monitored should their conditions change. (Appendix B, Photos #1-7)

BA-27c -Construction Unit 3

CU 3 was in good overall condition. The inspection of CU 3 began on the east bank of Little Lake at Sta. 108+65 and progressed along the northeast bank of Little Lake to the mouth of Bayou Perot at Sta. 0+00. A visual inspection of this unit revealed the rock dike in good overall condition with minor settlement near the BP pipeline crossing at Sta. 67+00. Despite the settlement, the structure appeared to provide adequate shoreline protection and does not require maintenance at this time. The embankment tie-ins were in overall good condition with no visible erosion or wash-outs on both ends. (Appendix B, Photos #8-14)

BA-27 & BA-27c -Construction Unit 4

CU 4 was completed in 2009 and appeared to be in good condition. The inspection of CU 4 began with the concrete pile and wall structure of Reach 3 located between CU 2 and CU 3. From there the inspection continued along the south bank of Bayou Rigolettes and west bank of Harvey Cutoff at Reach 2. The inspection of CU 4 concluded as we traveled north from the east bank of Harvey Cutoff and the east bank of Bayou Rigolettes along

Reach 1. All of the transitions from rock riprap to concrete wall were in good condition. The rock riprap embankment tie-ins were also in good condition. A warning sign and its support marking the concrete pile on the west side of the oilfield canal in Reach 3 were missing. It is recommended this sign and its support should be replaced. Also, a timber piling was resting on the concrete wall on the east bank of Harvey Cutoff in Reach 1. This timber piling did not appear to be damaging the concrete wall, but it is recommended that it should be removed. There are no other recommendations for maintenance at this time. (Appendix B, Photos #1 & #15-32)

BA-27 -Construction Unit 5

CU 5 was also constructed in early 2009 and appeared to be in good condition with no displacement or cracked panels. The inspection began at the northernmost point of CU 5 on the west bank of Bayou Perot near the Enbridge Pipeline Canal and progressed southward along the shoreline to the southernmost point of CU 5 at an existing location canal. The rock tie-ins were also in very good condition with no obvious washouts or erosion. There are no recommendations for maintenance of CU 5 at this time. (Appendix B, Photos #33-37)

BA-27d – Construction Unit 6

The rock dike appeared to be in good overall condition with no visual displacement or settlement of rock material. The inspection of CU 6 began at Sta. 0+00 near an existing oilfield access canal and proceeded along the east bank of Bayou Rigolettes to Sta. 307+78 near the Barataria Waterway. All signs and supports at the fish dip locations were also in good condition. We are not recommending any corrective actions at this time. (Appendix B, Photos # 38-48)

III. Operation Activity

a. Operation Plan

There are no water control structures associated with this project, therefore a Structure Operation Plan is not required.

b. Actual Operations

There are no water control structures associated with this project; therefore, there are no required structure operations.

IV. Monitoring Activity

The following monitoring strategies were developed for Phases 1, 2, and 3 of the BA-27 project before the implementation of the Coastwide Reference Monitoring System (CRMS). CWPPRA projects authorized for construction after April 16, 2003 are monitored only with CRMS stations, other existing data collection, and any additional data-collection specifically added to the project and funded separately from the normal monitoring budget. Therefore, Phase 4 (CU 6) of the BA-27 project will not be monitored using the monitoring strategies outlined below.

a. Monitoring Goals

The objective of the BA-27 project is to provide approximately 120,000 ft (36,576 m) of shoreline protection to the area referred to as the 'Barataria Basin Landbridge'.

The following measurable goal will contribute to the evaluation of the above objective:

1. Decrease the mean rate of shoreline/bankline erosion in subsections of the project area along Bayous Perot and Rigolettes, Little Lake, and Harvey Cutoff.

b. Monitoring Elements

Two 5,000-ft (1,524-m) sections of shoreline were designated as reference areas. Reference Area 1 is located along the western side of Bayou Perot just north of CU 5, and Reference Area 2 is located along the northwestern shore of Little Lake just west of the proposed CU 8 (Figure 9).

Aerial Photography:

To document long-term shoreline movement, color infrared aerial photography (1:6,000) of the BA-27 and BA-27c projects (Phases 1, 2, and 3) and two reference areas was obtained in 2002 and 2008. Photography of BA-27d (Phase 4) was also obtained in 2002 and 2008, although this was not specified in the monitoring plan. In 2012, photography of the project and reference areas was acquired through the Coastwide Reference Monitoring System (CRMS) using digital imagery (Z/I Imaging digital mapping camera) with 1-meter resolution and was determined to be comparable to previous project-specific photography. The 2002, 2008, and 2012 photography of the project and reference areas was georectified and analyzed with GIS for land/water ratios using standard procedures described in Steyer et al. (1995, revised 2000). A final land/water analysis will be conducted using CRMS photography in year 2017.

Shoreline Delineation:

To evaluate marsh edge movement, controlled sub-meter DGPS was used to map the position of the vegetated marsh edge of the project and reference area shorelines using techniques described in Steyer et al. (1995, revised 2000). Shoreline delineation surveys are conducted after construction of each unit to determine 'as-built' conditions, and again

in post-construction years 3 (Round 2) and 6 (Round 3). Shoreline delineation of the entire Phase 1, 2, and 3 project areas (~76,000-ft of shoreline) is cost prohibitive; therefore, monitoring of some construction units was limited to approximately 20% of the total shoreline length. In these cases, the total length of the construction unit was subdivided into 500-ft sections, and the number of sections randomly chosen for monitoring was based on twenty percent of the total length of the construction unit rounded up to the nearest 500-ft. If it was possible to travel the length of the shoreline via airboat, the CU length was mapped using a DGPS mounted at the end of a pole and set to continuously log points at 1-second intervals. In these cases, it was possible to map a larger section of the shoreline than the required 20%. In areas where the rock dike was on or near the shoreline, DGPS points were collected while walking the shoreline.

Three rounds of shoreline delineation surveys have been conducted on 20% of the total shoreline length behind CU's 2 and 3 and on the entire shoreline length of the reference areas (Table 2). As-built and Round 2 surveys were also conducted on the areas of the CU 4 shoreline that were not affected by the BA-36 project, and approximately 10,000 ft of the CU 5 shoreline.

Table 2. Shoreline delineation timeline for construction units and reference areas of the Barataria Basin Landbridge Shoreline Protection Project (BA-27), Phases 1, 2, 3, and 4.

Construction Unit	Phase	Construction Completed (projected*)	As Built	Round 2 (projected*)	Round 3 (projected*)
1	1	5/1/2001	no monitoring	no monitoring	no monitoring
2	1	10/11/2002	3/19/2003	2/2008	5/25/2011
3	3	5/27/2004	7/20/2004	2/2008	5/25/2011
4	1,2,3	2009	11/17/2009	10/23/2012	2015*
5	1	7/2008	11/17/2009	10/23/2012	2015*
6	4	4/2006	no monitoring	no monitoring	no monitoring
7	3	2015*	2015*	2018*	2021*
8	3	2015*	2015*	2018*	2021*
Reference	N/A	N/A	5/13/2005	11/17/2009	10/23/2012

CRMS Supplemental

Additional data were collected at CRMS-*Wetlands* stations, which can be used as supporting or contextual information for this project. Data types collected at CRMS sites include hydrologic, emergent vegetation, physical soil characteristics, discrete porewater salinity, marsh surface elevation change, vertical accretion, and land:water analysis of the 1-km^2 area encompassing the station (Folse et al. 2012). One CRMS site, CRMS4218, is located inside the BA-27c project area in the area of Phase 3, CU 4 (Figure 5). Data has been collected at this CRMS site since early 2008.

c. Preliminary Monitoring Results and Discussion

i. Aerial Photography

Land-water analyses of the BA-27 project and reference areas were conducted on aerial photography collected in 2002, 2008, and 2012 (Figures 9-11). Because the project phases were broken up geographically into several different locations with varying soil consistencies, acreages were determined for subareas within each Phase to determine differences in land loss rates. Land gain or loss is expressed as a percentage of the total acreage of each subarea because of the difference in size of each subarea analyzed (Table 3). At the beginning of the project life, it was predicted that the shoreline structures of the BA-27 project (Phases 1, 2 & 3) would prevent direct shoreline loss, but that 300 acres of interior marsh loss would still occur over the 20 year project life (USDA/NRCS 2000). It was also estimated that 1,570 acres of shoreline loss would be prevented over 20 years. There are several difficulties, however, with evaluating actual project effects on land loss. The first challenge is that construction of the project has occurred in several construction units beginning in 2002 and estimated to be finished in late 2014. Secondly, some of the project area was filled with dredged sediment through the Dedicated Dredging on the Barataria Landbridge (BA-36) project in 2010. As a result of the BA-36 project, several subareas of the BA-27 project experienced large gains in land acreage between 2008 and 2012 (Figure 12). Finally, construction of the Northwest Little Lake Marsh Creation (BA-54) project increased land acreage in the western portion of Reference Area 2 through marsh creation and nourishment. This project, which was funded through the Coastal Impact Assistance Program (CIAP), was completed in April 2011; therefore, land gains are reflected in the 2012 analysis.

From 2002 to 2008, there was a 4% loss (250 acres) of the total project area acreage and a 9% loss (92 acres) of the combined reference area acreage. The project area loss of 250 acres was approaching the predicted 20-year loss of 300 acres, but at that time several construction units had yet to be built. All BA-27 subareas and reference areas exhibited a decrease in % land from 2002 to 2008 except for BA-27, Phase 4 (CU 6) which showed almost no change (+3 acres) (Table 3). Phase 4 was not included in the 2012 analysis due to lack of monitoring funds, however it appears that land acreage in this area was relatively stable.

From 2008 to 2012, there was a +17% gain (909 acres) of the total project acreage (Phases 1, 2, and 3). All BA-27 subareas and Reference Area 2 exhibited a gain in land acreage, including those not impacted by the BA-36 project (Table 3, Figure 12). Reference Area 1 was the only area to show land loss (4%) between 2008 and 2012. A 3% land gain in Reference Area 2 was attributable to construction of the BA-54 project. Percentage of land in the two subareas on the west bank of Bayou Perot and not impacted by BA-36 increased by 1 to 2%. This includes the subarea associated with CU's 7 and 8, which has yet to be constructed. The four subareas impacted by BA-36 showed an increase in percentage of land of 26-62% from 2008-2012. A total of 884 acres was gained within these subareas from 2008-2012, which would be mostly attributable to the BA-36 project; however, it should be noted that this is not the total acreage gain from the

BA-36 project because some of the BA-36 project area lies outside of the BA-27 boundary.

In the areas on the west bank of Bayou Perot not impacted by BA-36 (Phase 1&2, Area 1; Phase 3, Area 1; Ref Area 1 & 2), it is evident that 2002-2008 was a period of greater land loss than 2008-2012, regardless of project construction. From 2002-2008, the area was impacted by Hurricanes Katrina (2005), Rita (2005), Gustav (2008), and Ike (2008), while the only major storm in the latter time period was Hurricane Isaac (2012). The greater storm activity from 2002-2008 may have contributed to higher loss rates during that period through wind-generated wave activity. The highest land loss rate in the project area from 2002-2008 was in the area associated with CU5 (Phase 1&2, Area 1) with a loss of 81 acres or 9.3% of the total acreage (-1.6%/yr). CU 5 was not constructed until 2008, so this loss occurred prior to construction. After CU 5 construction, this area showed a 2% gain in land from 2008-2012 (+0.5%/yr); however, the area directly to the south of CU 5 (Phase 3, Area 1) also showed a gain in land (+1%) from 2008-2012 even though the shoreline protection structures (CU 7&8) are yet to be constructed. Reference Area 1, which is directly north of CU 5, experienced an even higher loss from 2002-2008 at 14.1% of the total acreage (-2.4%/yr), which dropped to 4% (-1.0%/yr) from 2008-2012.

In summary, confounding factors such as storm effects, staggered construction, and land gains from the BA-36 and BA-54 projects make it difficult to evaluate specific project effects on land loss. Overall, the BA-27 project area (Phases 1, 2, and 3) showed a net land gain of +12% of the total area from 2002-2012 (+656 ac), which is mostly attributable to the BA-36 project. The areas not affected by the BA-36 project (associated with CU's 5, 7, & 8) showed a combined net loss of -88 acres or -4% from 2002-2012. Land loss in these areas occurred only in the first period of analysis (2002-2008), with land acreage remaining stable from 2008-2012. The reduction in land loss from 2008-2012 was most likely due to lower storm activity, since this was observed even in areas that have not yet gone to construction (CU 7 & 8) as well as in the reference areas.

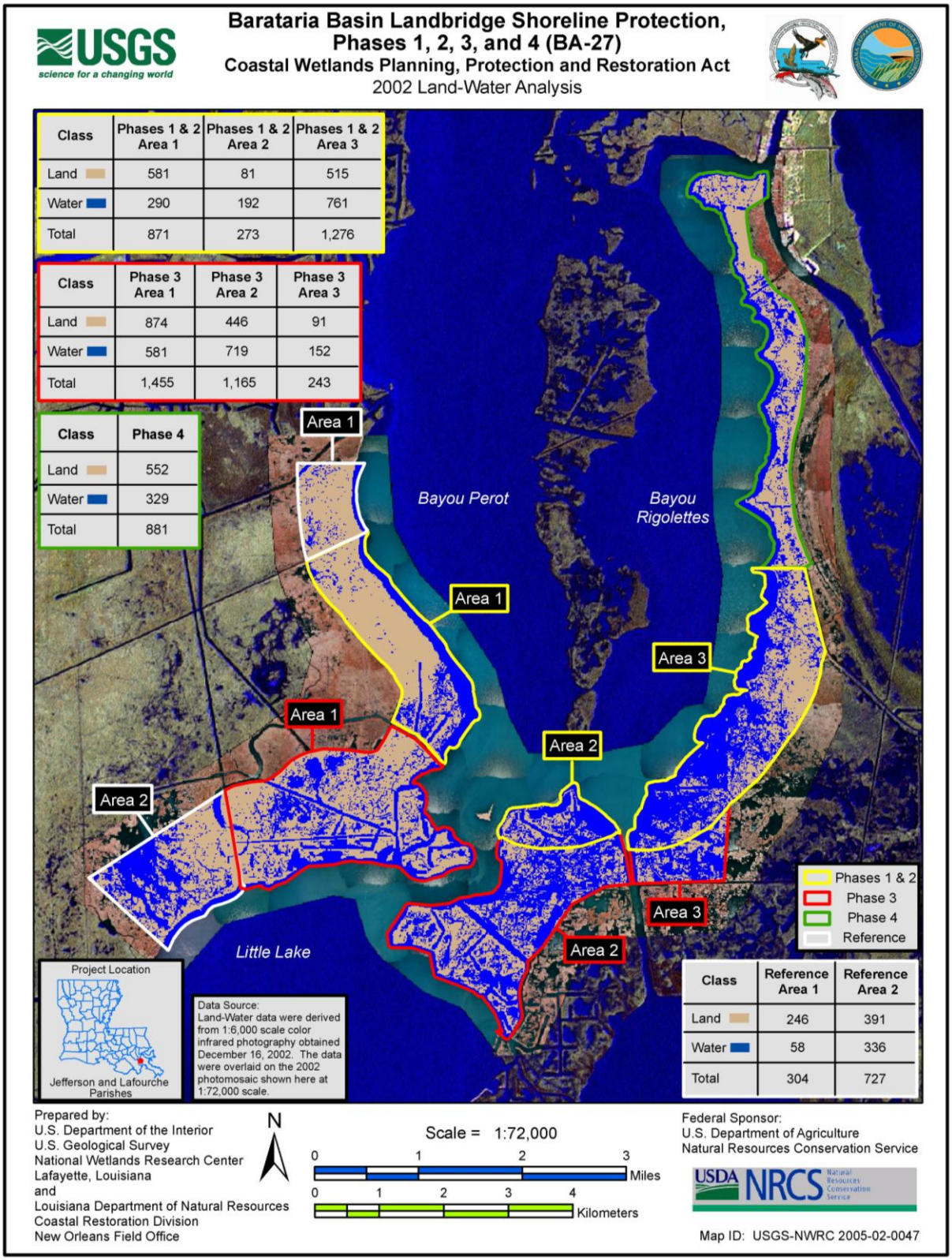

Figure 9. The 2002 land-water analysis of the Barataria Basin Landbridge Shoreline Protection Project (BA-27), Phases 1, 2, 3, and 4.

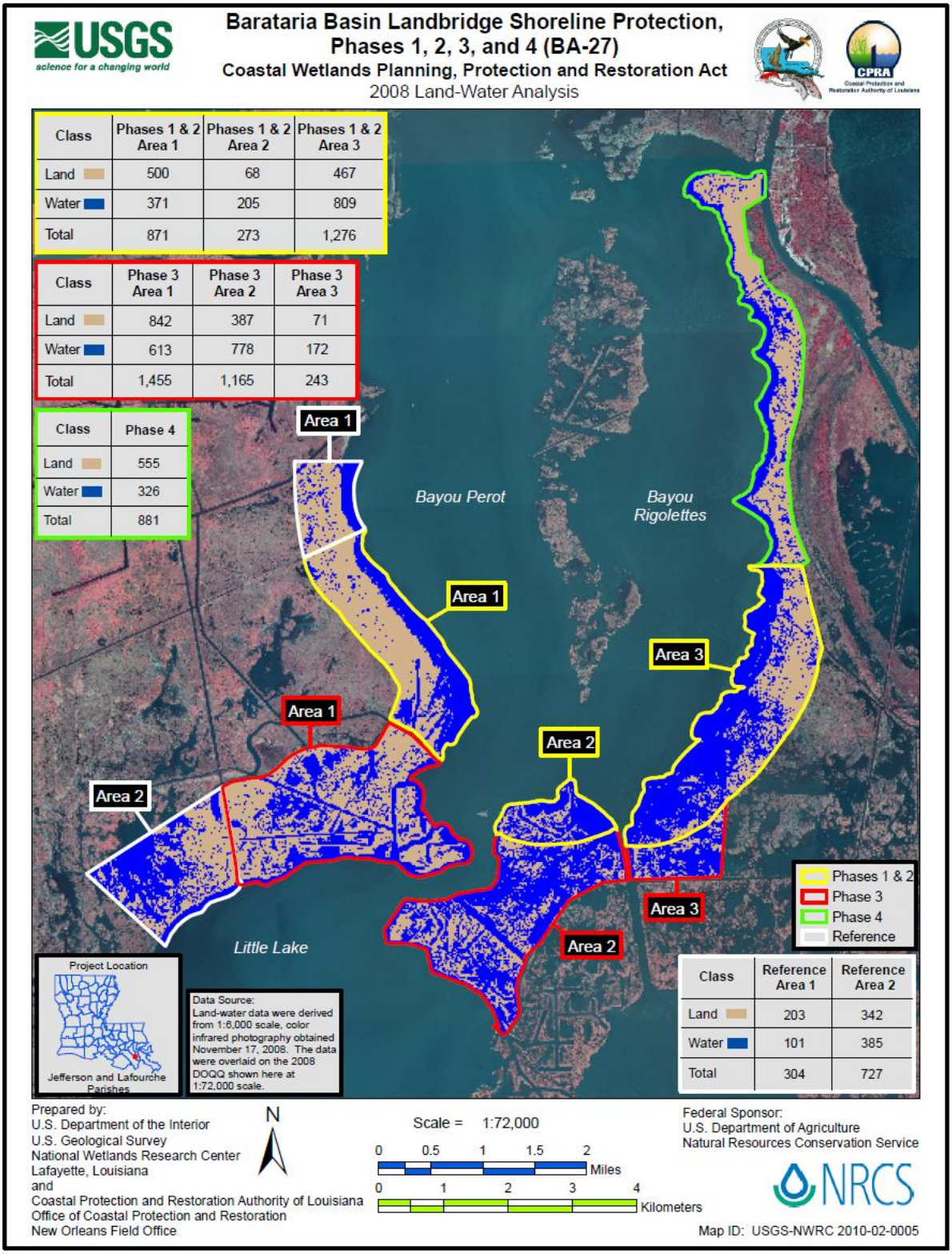

Figure 10. The 2008 land-water analysis of the Barataria Basin Landbridge Shoreline Protection Project (BA-27), Phases 1, 2, 3, and 4.

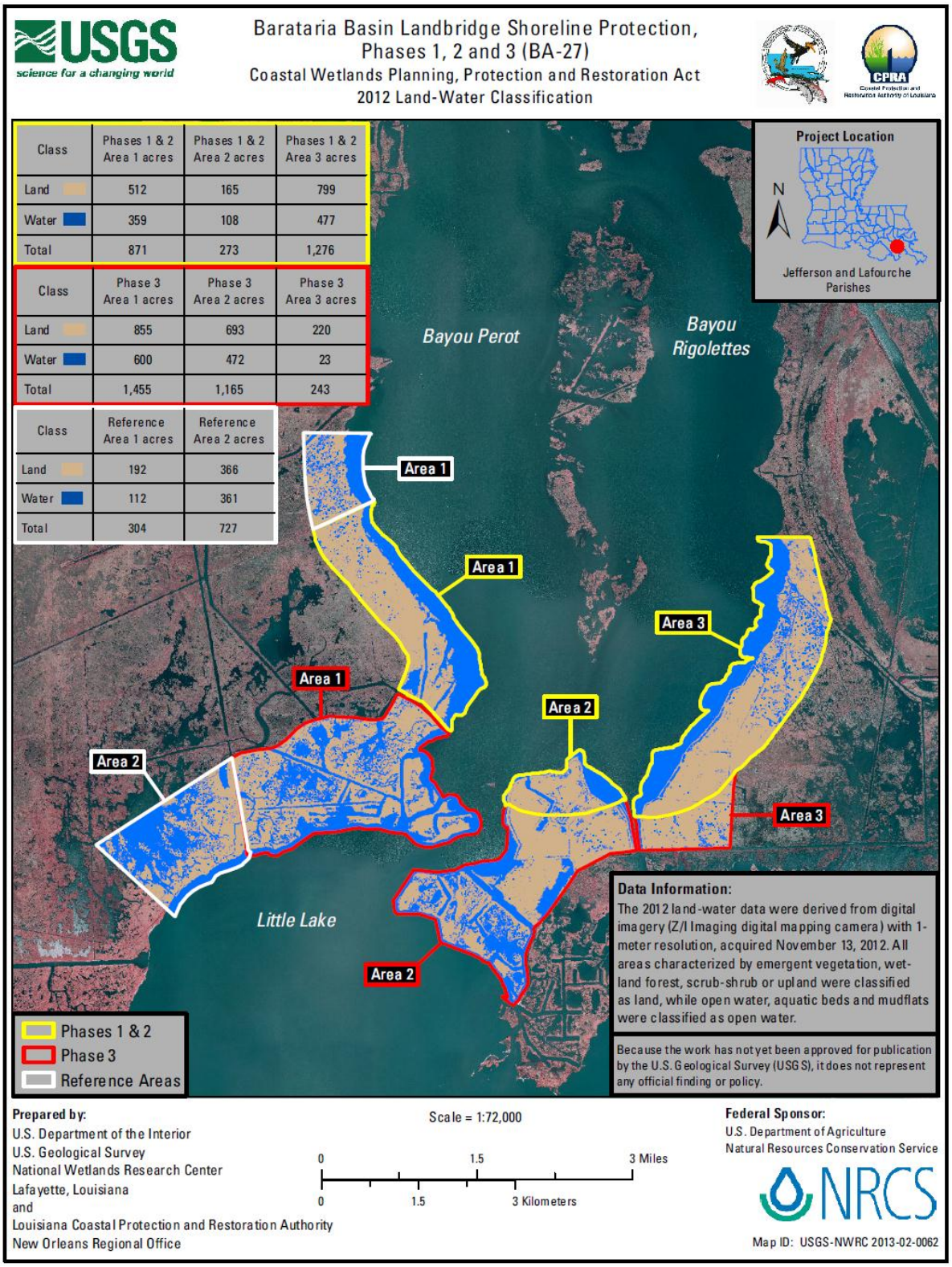

Figure 11. The 2012 land-water analysis of the Barataria Basin Landbridge Shoreline Protection Project (BA-27), Phases 1, 2 and 3.

Table 3. Changes in percent land acreage within subareas of the Barataria Landbridge Shoreline Protection (BA-27) project and reference areas based on the 2002, 2008, and 2012 land/water analyses.

Location	CU# / Year Completed	2002 % Land	2008 % Land	2012 % Land	2002-2012 Net Land Acres Lost/Gained	2002-2012 % Total Acreage Lost/Gained
Phases 1 and 2, Area 1	CU5/2008	67%	57%	59%	-69	-8%
*Phases 1 and 2, Area 2	CU2/2002 CU4/2009	30%	25%	60%	+84	+31%
*Phases 1 and 2, Area 3	CU4/2009	40%	37%	63%	+284	+22%
Total Phases 1 and 2		**49%**	**43%**	**61%**	**+299**	**+12%**
Phase 3, Area 1	CU7,8/not constructed	60%	58%	59%	-19	-1%
*Phase 3, Area 2	CU3/2004 CU4/2009	38%	33%	59%	+247	+21%
*Phase 3, Area 3	CU4/2009	37%	29%	91%	+129	+53%
Total Phase 3		**49%**	**45%**	**62%**	**+357**	**+12%**
Phase 4	CU6/2006	63%	63%	n/a	n/a	n/a
Reference Area 1		81%	67%	63%	-54	-18%
**Reference Area 2		54%	47%	50%	-25	-3%

*Area impacted by the BA-36 Dedicated Dredging on the Barataria Landbridge project in 2010.
**Area impacted by the BA-54 Northwest Little Lake Marsh Creation project in 2011.

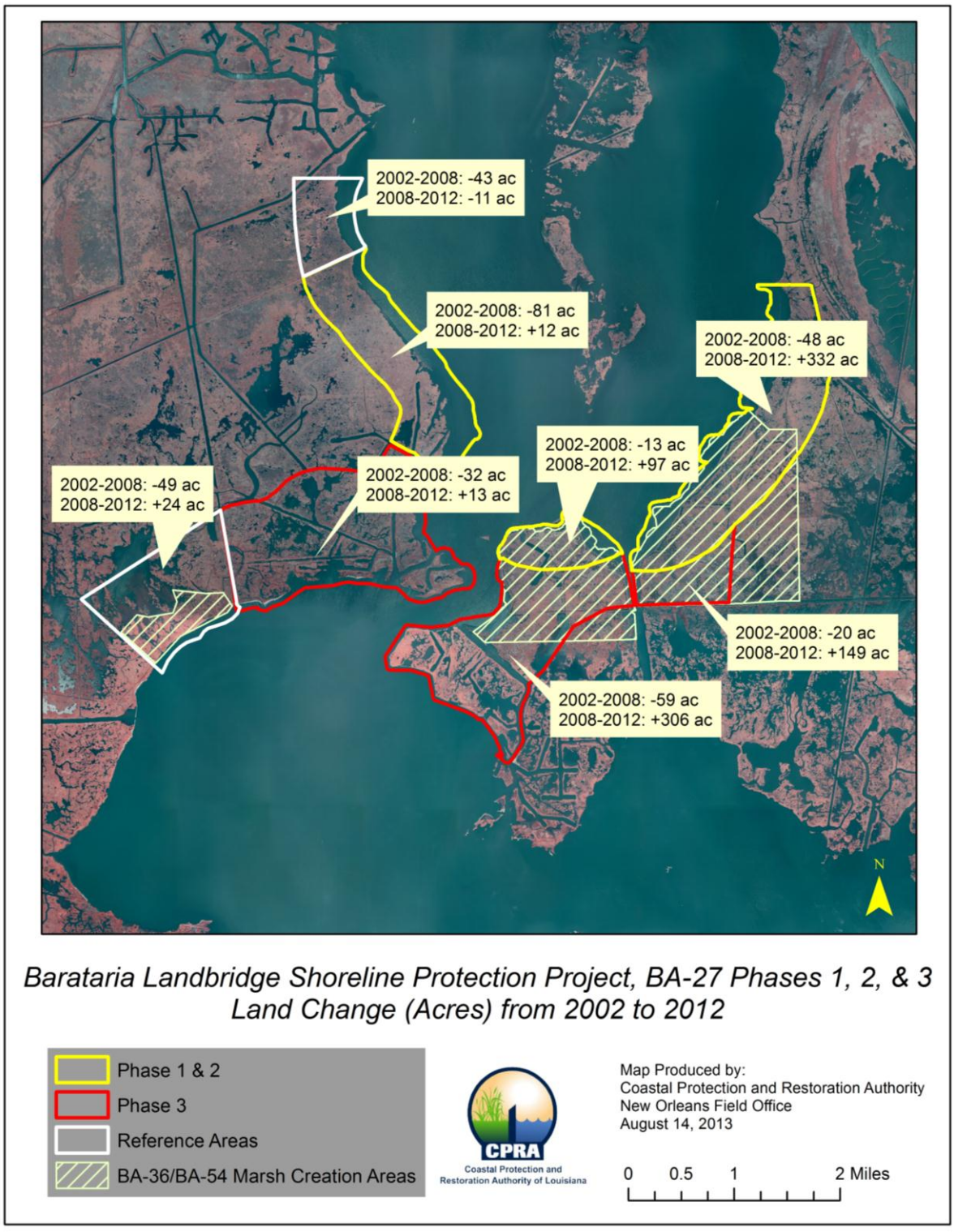

Figure 12. Acreage changes within subareas of the Barataria Landbridge Shoreline Protection Project, Phases 1, 2, and 3 (BA-27a&b, BA-27c) from 2002-2008 and 2008-2012. The BA-36 and BA-54 projects were constructed in 2010 and 2011, respectively.

ii. Shoreline Change

Analyses of shoreline change rates were conducted for CU's 2, 3, 4, and 5, and for Reference Areas 1 and 2. Shoreline delineation surveys were conducted at approximately 3 year intervals to track shoreline position over time. To calculate the change rate (ft/yr) between two survey years, geo-rectified DGPS shoreline segments from each year were first converted to shapefiles. A polygon was then created from the two shoreline polylines to provide a total area (ft^2) of loss/gain between the two polylines. Next, the shoreline change rate was calculated by taking the area inside the polygon and dividing it by the average shoreline length between the two surveys.

Shoreline Change Rate (ft) = Area Change (ft^2) ÷ Average Shoreline Length (ft)

Finally, the shoreline change rate was divided by the number of years between the two survey events to determine shoreline change rate per year (ft/yr).

Shoreline Change Rate/Year (ft/yr) = Shoreline Change Rate (ft) ÷ # of Years between Surveys

Shoreline length can vary considerably between sample years due to the irregular contours of the marsh shoreline. For that reason, the average of the shoreline change rates between time period 'A to B' and time period 'B to C' may not equal the overall shoreline change rate from 'A to C' due to the differences in average shoreline length.

A positive shoreline change rate was observed in all construction units surveyed, whereas significant shoreline loss occurred in each of the reference areas (Table 4). The positive change rates observed in the construction units were relatively small and ranged from 0.5 to 5.1 ft/yr. Historical rates of erosion in the project area and vicinity are highly variable with estimates ranging from 5 ft/yr to 114 ft/yr (USDA/NRCS 2000). Shoreline erosion rates of 114, 103, and 70 ft/yr for the period of 1985-1990 were reported for stations at the southwest bank of Bayou Perot and for the east and southeast bank of Bayou Rigolettes, respectively (Swenson and Kinler 1997). Rates of 76, 101, and 97 ft/yr were reported for those same locations for the period of 1990-1995.

Three surveys were conducted on segments of shoreline associated with CU 2 and CU 3 to provide two time periods of analysis. The shoreline behind CU2 was impacted by the Dedicated Dredging on the Barataria Landbridge (BA-36) project in 2010 (Figure 8) during the second period of analysis. CU 2 (Areas A through D) showed a shoreline loss rate of -2.4 ft/yr from 2003-2008 (Period 1) and a shoreline gain of +12.6 ft/yr (Area A only) from 2008-2011 (Figure 13). Areas B through D, which showed the highest loss rates in Period 1, were not re-sampled in 2011 because the entire open water area between the original shoreline and the rock dike were filled in with dredged material during BA-36 construction. The CU 3 analysis showed a small positive change rate in both periods, with an overall shoreline gain rate of +0.8 ft/yr (Figure 14). Some shoreline gain in CU3 appears to be due to marsh growth into the narrow channel between the shoreline and the rock dike. In the vicinity of CU 2, Swenson and Kinler (1997) reported loss rates of 70

ft/yr from 1985 to 1990 and 97 ft/yr from 1990 to 1995, so it is evident that the BA-27/BA-36 projects have significantly reduced shoreline loss in this area.

Two shoreline surveys were conducted on the shoreline associated with CU 4 and CU 5 in late 2009 and 2012. Unlike CU 2 and 3, CU 4 and 5 consisted of a concrete wall offset from the shoreline. Because of this, larger segments of shoreline could be surveyed via airboat rather than on foot. A large section of CU 4 was not surveyed due to the BA-36 project, which was under construction in 2009. At the time of the 2009 survey, fresh dredge material covered the original marsh edge, and the 'new' shoreline was mostly unvegetated. Over 6,000 ft of CU 4 shoreline were surveyed to the north and about 3,000 ft were surveyed to the west of the BA-36 project area. Because of the distance between these segments, they were analyzed separately and are designated CU 4 North and CU 4 South (Figures 15 and 16). Both CU 4 areas showed a positive shoreline change rate with a greater shoreline gain in CU 4 South (+3.8 ft/yr) than CU 4 North (+0.5 ft/yr).

Over 10,000 ft of CU 5 shoreline were also surveyed in 2009 and 2012 (Figure 17). Along approximately 1,200 ft of CU 5, vegetated marsh had completely filled in between the original shoreline and the concrete wall by the time of the 2012 survey. It is possible that sheared marsh became stacked behind the wall during Hurricane Isaac two months earlier. As a result of this feature, CU5 exhibited the highest overall shoreline gain rate of +5.1 ft/yr. CU's 4 and 5 have successfully halted shoreline loss in areas with historically high loss rates. In the vicinity of CU 4 North, Swenson and Kinler (1997) reported shoreline loss rates of 103 ft/yr and 101 ft/yr for the periods of 1985-1990 and 1990-1995. In the vicinity of CU 5, they reported shoreline loss rates of 114 ft/yr and 76 ft/yr for the periods of 1985-1990 and 1990-1995.

The entire length of Reference Areas 1 and 2 were surveyed in 2005, 2009, and 2012. The shoreline loss rate in both reference areas was greater during Period 1 (May 2005 to 2009) than Period 2 (2009-2012) (Table 4). Reference Area 1 showed the greatest shoreline loss of -68.5 ft/yr during Period 1 and -32 ft/yr during Period 2, with an overall shoreline loss rate of -51.2 ft/yr from 2005 to 2012 (Figure 18). Historical loss rates for this area would be similar to those reported above for CU 5, approximately 76-114 ft/yr. Reference Area 2, which is along the north shore of Little Lake, experienced a lower shoreline loss rate of -7.7 ft/yr in Period 1 and -1.7 ft/yr in Period 2 (Figure 19). Soil in this location is more firm and contains the site of a shell midden as evidenced by *Rangia* shells, which are exposed along much of the edge. The area was impacted by more tropical storm activity during Period 1 (Hurricanes Katrina, Rita, Gustav, and Ike) as opposed to Period 2 (Hurricane Isaac), which may have contributed to the higher loss rate during Period 1. Major storm events would generally be expected to directly accelerate shoreline erosion rates though wind-generated wave activity. It does appear that the shoreline structures associated with the BA-27 project successfully stabilized the shoreline, as evidenced by the lower than historical shoreline loss rates, while the reference areas continue to lose shoreline at rates almost within the historical range.

Table 4. Summary of shoreline change (ft/yr) analyses for Construction Units 2-5 and two Reference Areas associated with the BA-27 project.

Shoreline Location	Period 1	Shoreline Change (ft/yr)	Period 2	Shoreline Change (ft/yr)	Overall	Shoreline Change (ft/yr)
CU 2	2003-2008	**-2.4** ***(Areas A-D)***	2008-2011	**+12.6** ***(Area A only)***	2003-2011	**+4.1** ***(Area A only)***
CU 3	2004-2008	**+0.2**	2008-2011	**+1.6**	2004-2011	**+0.8**
CU 4 ***(North)***	2009-2012	**+0.5**	2012-2015	n/a	2009-2012	**+0.5**
CU 4 ***(South)***	2009-2012	**+3.8**	2012-2015	n/a	2009-2012	**+3.8**
CU 5	2009-2012	**+5.1**	2012-2015	n/a	2009-2012	**+5.1**
Reference Area 1 ***(North)***	2005-2009	**-68.5**	2009-2012	**-32.0**	2005-2012	**-51.2**
Reference Area 2 ***(South)***	2005-2009	**-7.7**	2009-2012	**-1.7**	2005-2012	**-5.4**

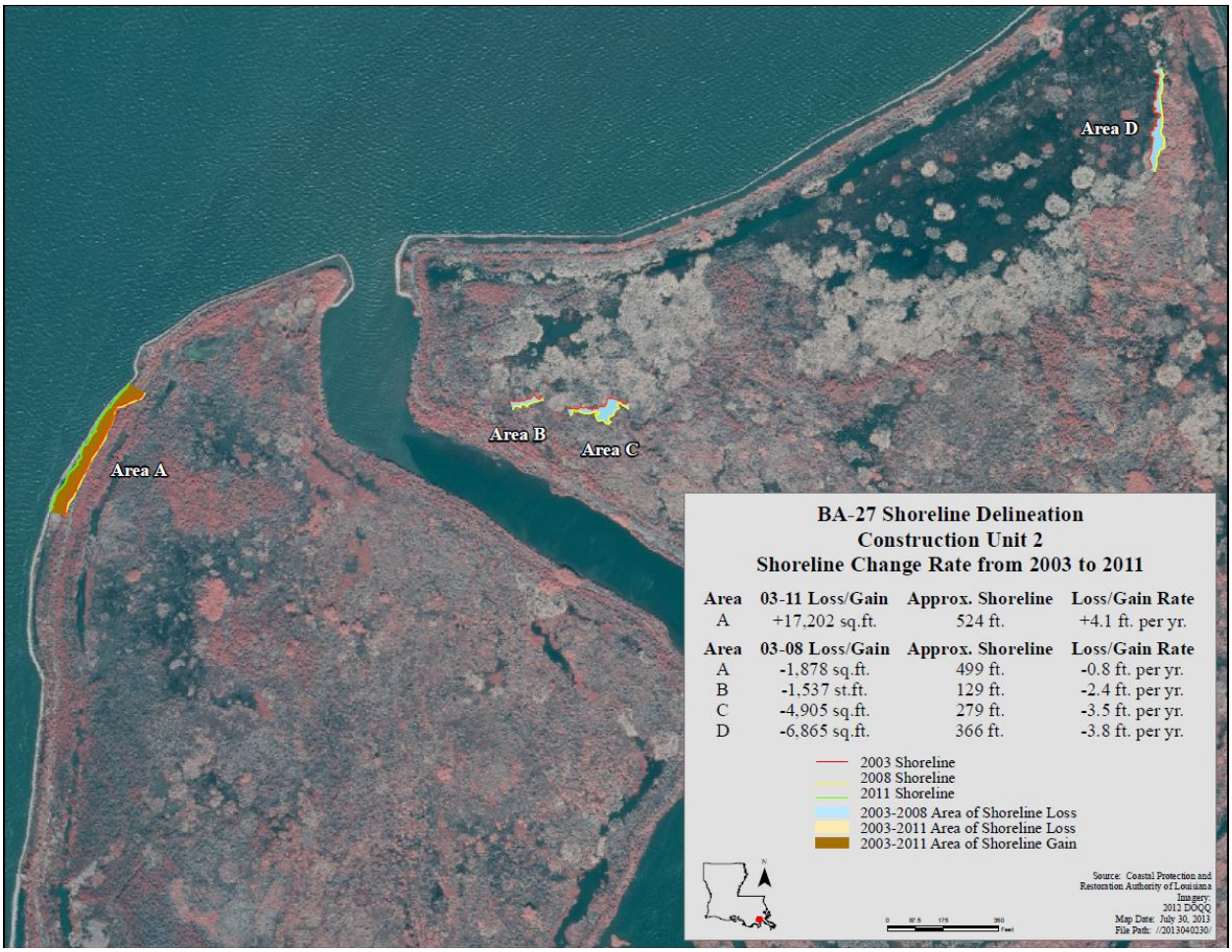

Figure 13. Post-construction shoreline change analysis for Construction Unit 2 of the Barataria Basin Landbridge Shoreline Protection Project (BA-27, Phases 1 and 2) from 2003 to 2011.

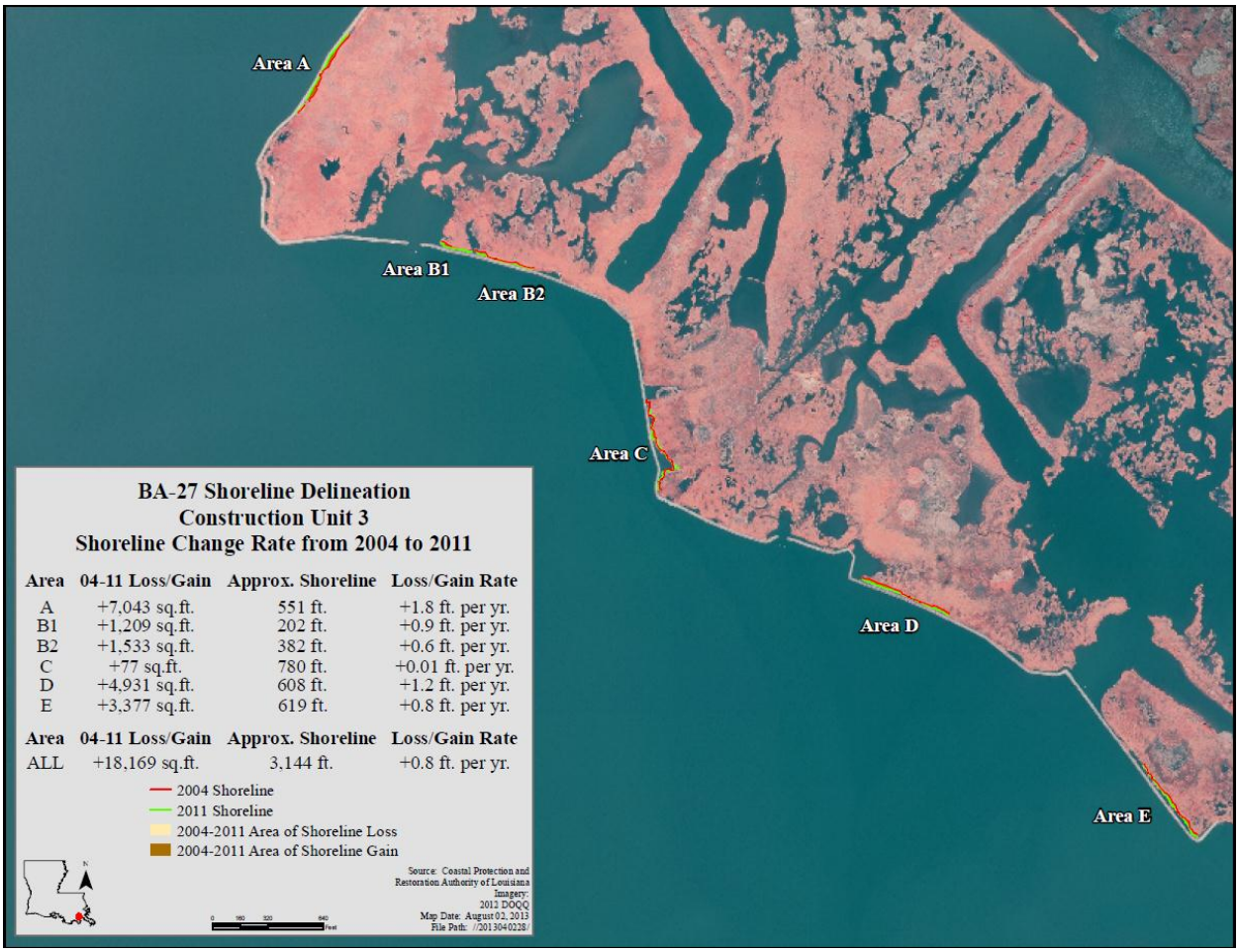

Figure 14. Post-construction shoreline change analysis for Construction Unit 3 of the Barataria Basin Landbridge Shoreline Protection Project (BA-27c, Phase 3) from 2004 to 2011.

Figure 15. Post-construction shoreline change analysis for the northern section of Construction Unit 4 of the Barataria Basin Landbridge Shoreline Protection Project (BA-27, Phases 1 & 2) from 2009 to 2012.

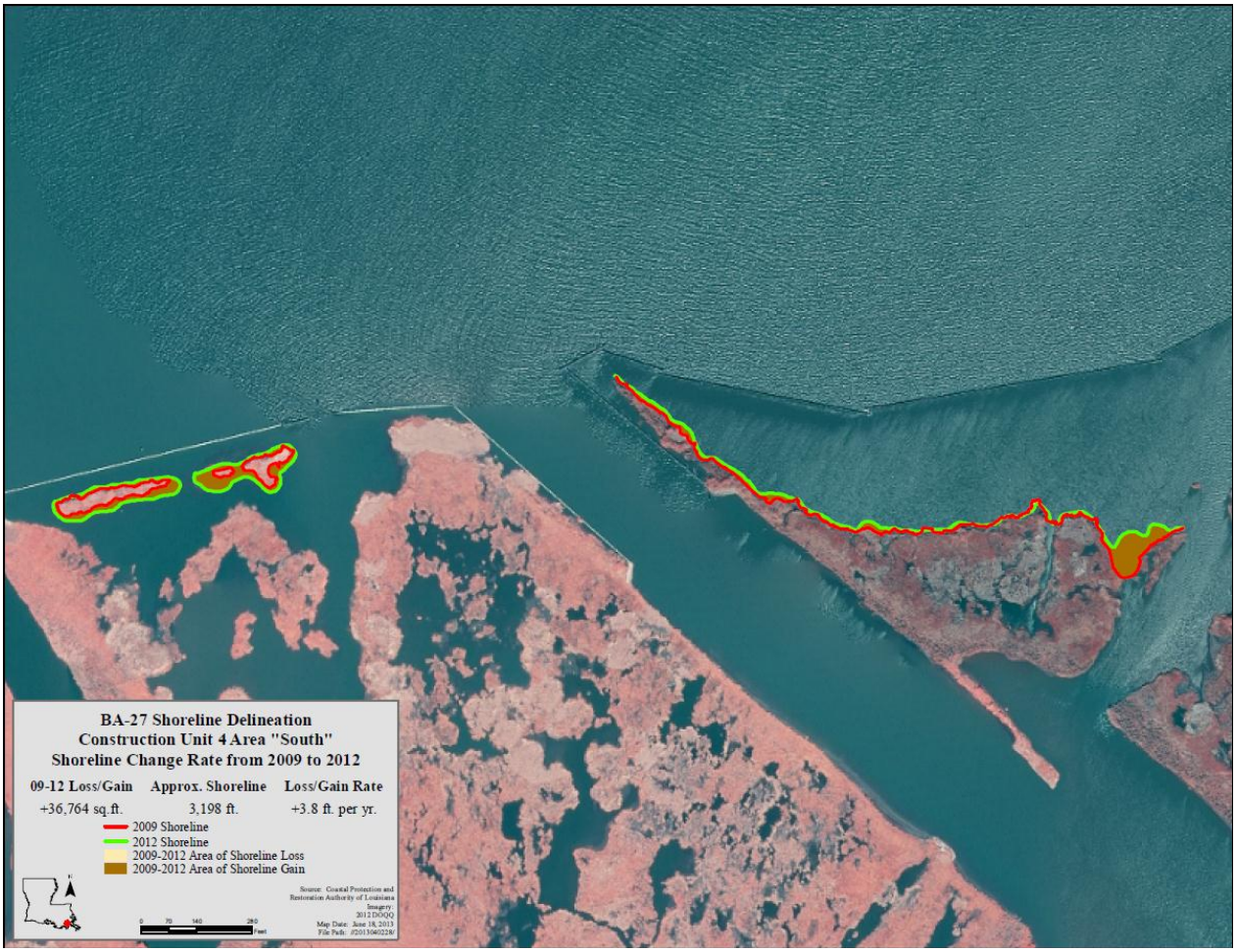

Figure 16. Post-construction shoreline change analysis for the southern section of Construction Unit 4 of the Barataria Basin Landbridge Shoreline Protection Project (BA-27c, Phase 3) from 2009 to 2012.

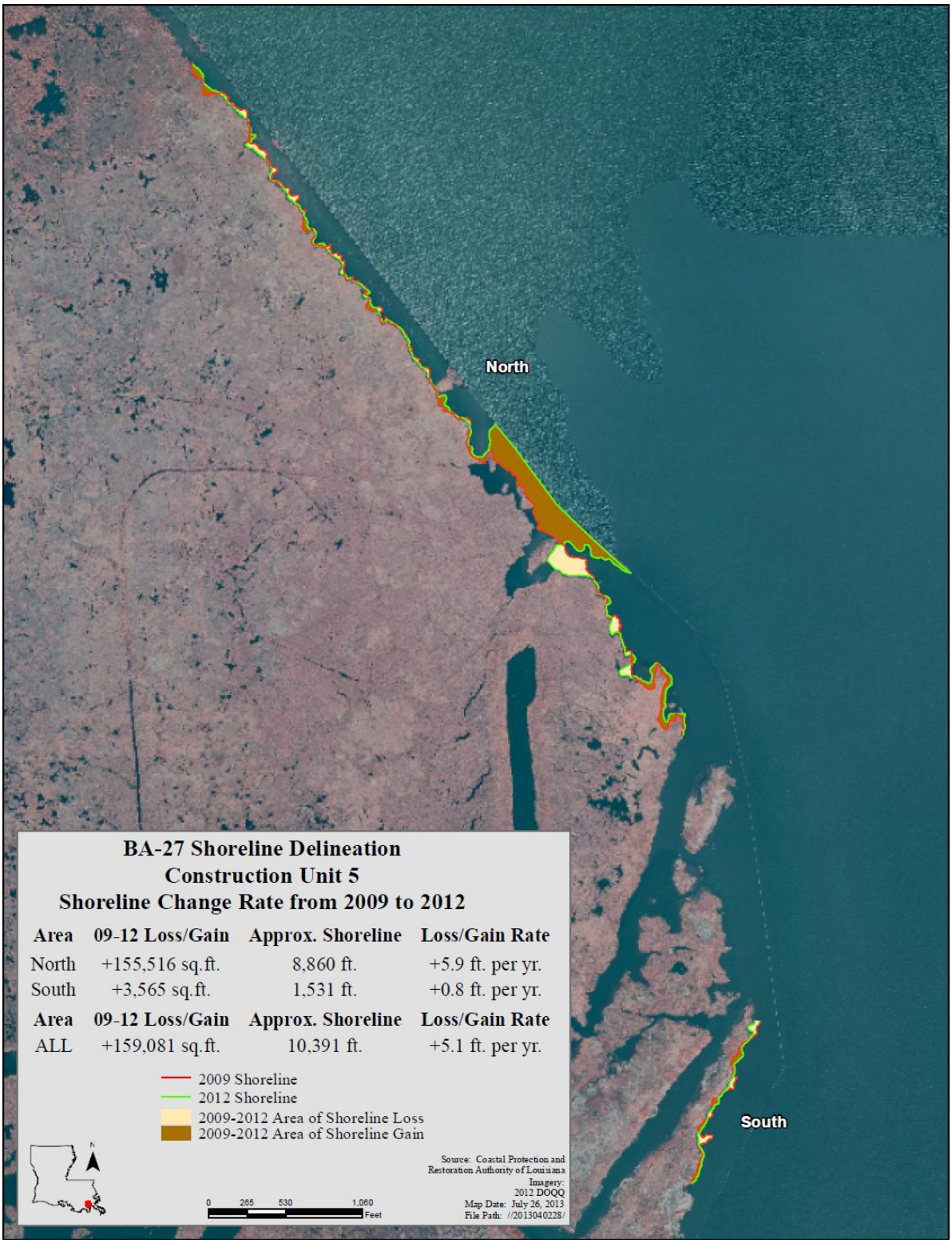

Figure 17. Post-construction shoreline change analysis for Construction Unit 5 of the Barataria Basin Landbridge Shoreline Protection Project (BA-27, Phase 1) from 2009 to 2012.

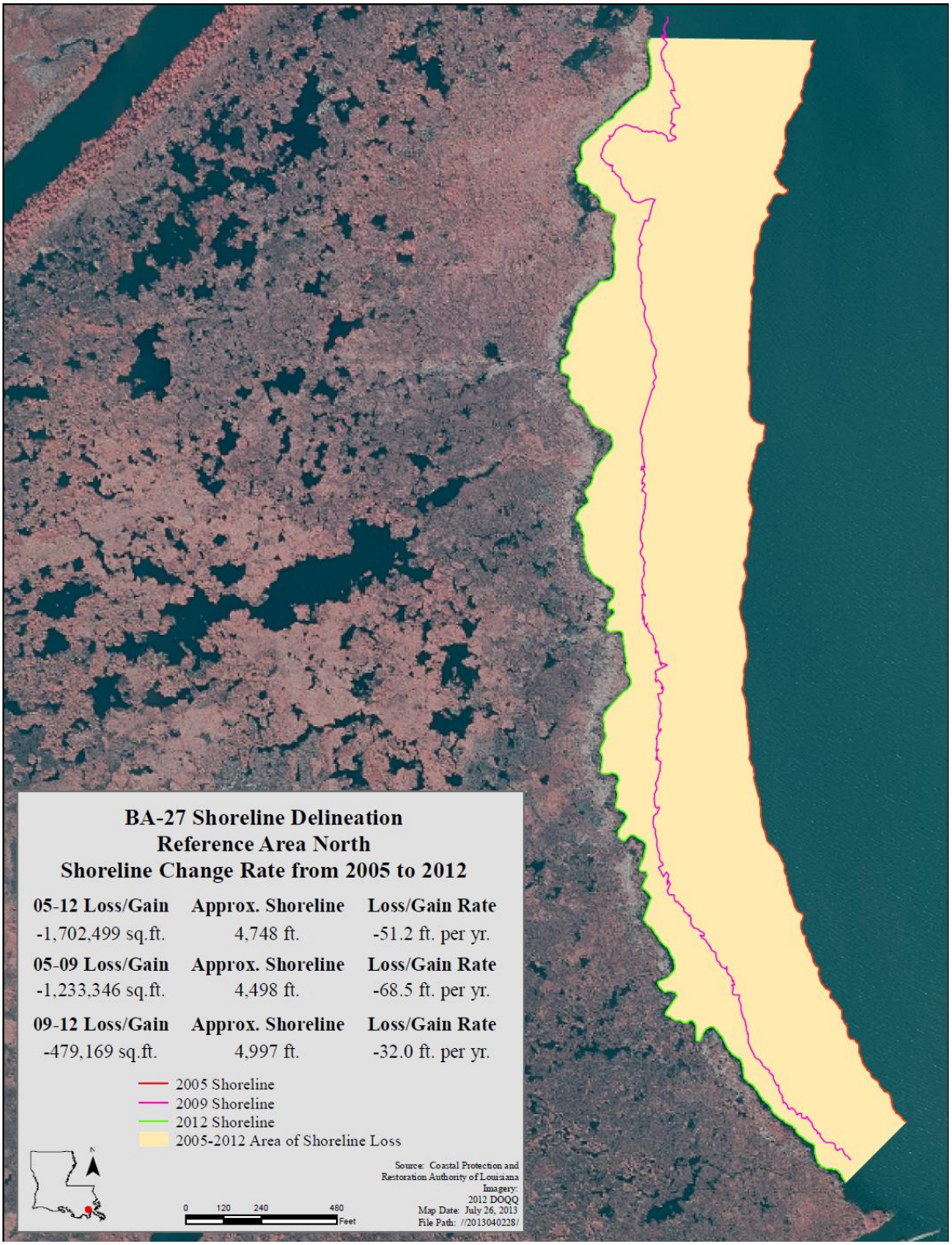

Figure 18. Shoreline change analysis for the northern reference area (Reference Area 1) of the Barataria Basin Landbridge Shoreline Protection Project (BA-27) from 2005 to 2012.

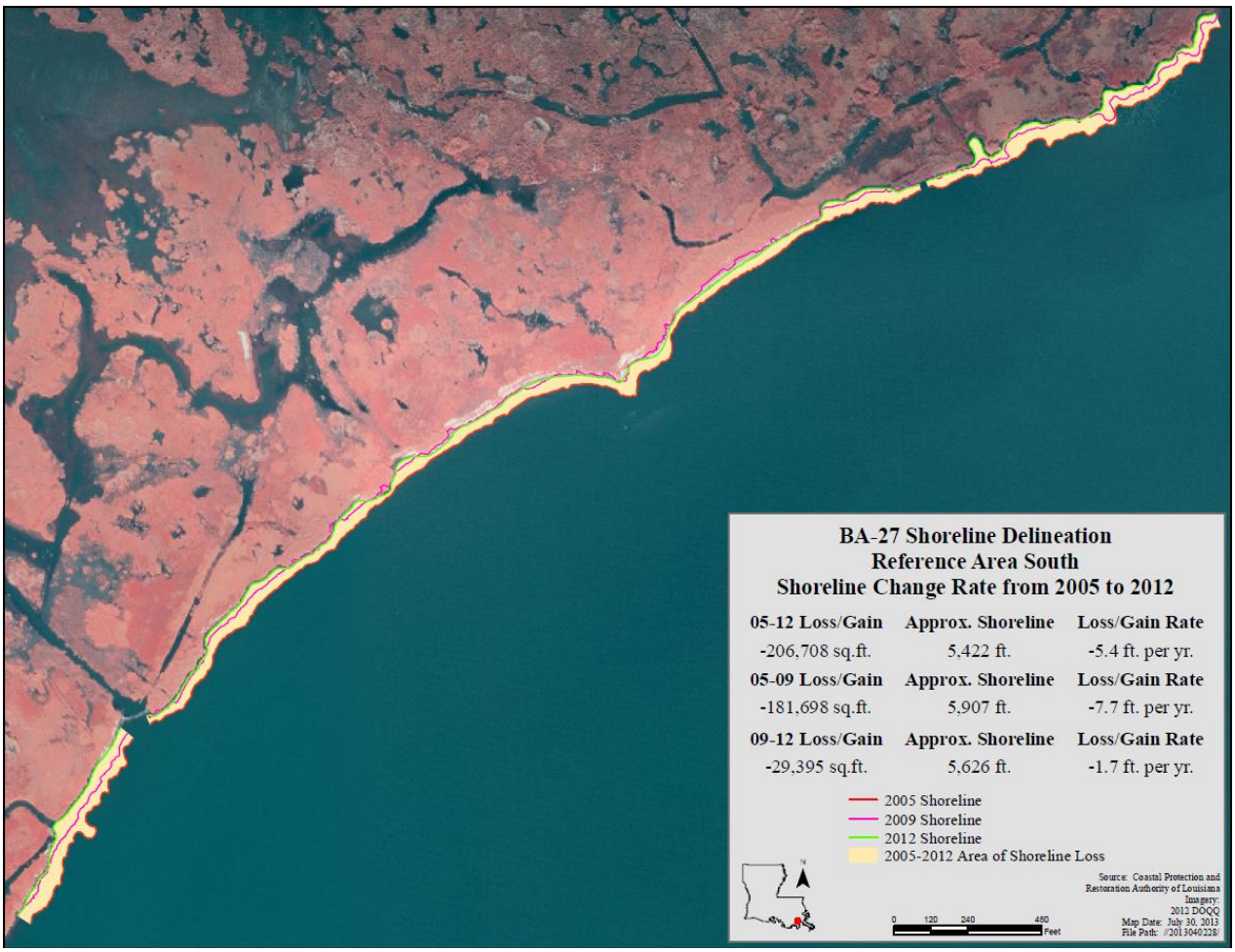

Figure 19. Shoreline change analysis for the southern reference area (Reference Area 2) of the Barataria Basin Landbridge Shoreline Protection Project (BA-27) from 2005 to 2012.

iii. CRMS Supplemental

Additional data have been collected at a Coastwide Reference Monitoring System (CRMS) site within the BA-27 project area since 2007. CRMS4218 is located behind the southernmost section of CU 4, which was completed in July 2009 (Figure 5).

Hydrographic Data. Continuous water level and salinity data have been collected hourly at CRMS4218 since February 2008 (Figure 20) using methods described in Folse et al (2012). The continuous recorder station is serviced approximately once a month to clean and calibrate the recorder and to download the data. During processing, the data are examined for accuracy and water level data are converted to a common vertical datum (NAVD88 in ft) in relation to the elevation of a surveyed 'mark' (nail). The data are then loaded to the CPRA database and are available for download from the CRMS website: http://www.lacoast.gov/crms2. During the monthly site visit, soil porewater salinity readings are also measured at depths of 10 cm and 30 cm using a sipper probe to aid in extracting interstitial water. Yearly mean salinity at CRMS4218 ranged from 1.1 to 2.9 ppt from 2008 to 2012 (Table 5), with monthly mean salinity ranging between 0.2 and 5 ppt. Brief salinity spikes were common during storm events with the highest recorded (27 ppt) during Hurricane Isaac in 2012. Mean yearly water level was about 1.2 ft NAVD88, with monthly means ranging from 0.5 to 2.2 ft NAVD88. Maximum water levels of 6 ft NAVD88 were recorded during Hurricanes Ike (2008) and Isaac (2012). Based on an average marsh elevation of 1.1 ft NAVD88, the marsh at CRMS4218 is flooded approximately 52% of the year.

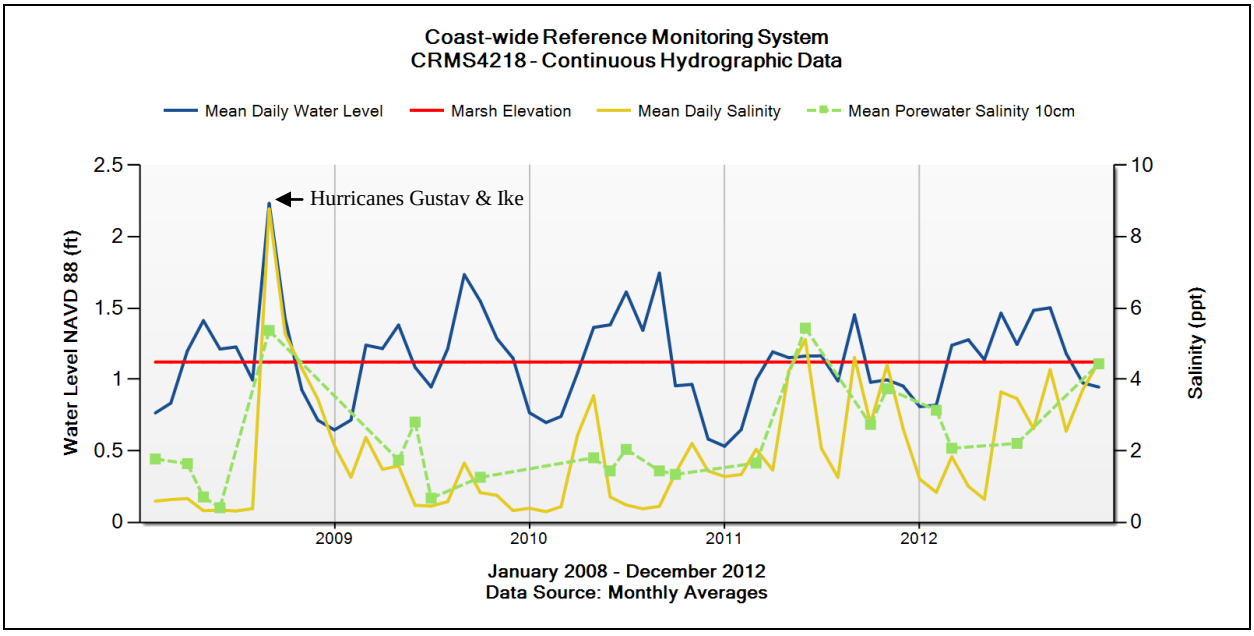

Figure 20. Mean monthly water level, salinity, and soil porewater salinity at CRMS4218 located within the BA-27 project area.

Table 5. Yearly mean, minimum, and maximum salinity (ppt) and water level (ft NAVD88) at CRMS4218 located within the BA-27 project area.

Station	Year	Mean Salinity (ppt)	Min Salinity (ppt)	Max Salinity (ppt)	Mean Water Level (ft NAVD88)	Min Water Level (ft NAVD88)	Max Water Level (ft NAVD88)
CRMS4218-H01	2008	2.32	0.16	24.10	1.21	0.22	6.05
CRMS4218-H01	2009	1.10	0.13	8.99	1.20	0.22	2.89
CRMS4218-H01	2010	1.23	0.11	16.49	1.15	0.20	2.98
CRMS4218-H01	2011	2.89	0.44	15.18	1.05	0.22	4.33
CRMS4218-H01	2012	2.53	0.30	27.33	1.18	0.22	6.02

Vegetation Data. There are 10 vegetation stations (plots) at CRMS4218 that have been sampled annually in late summer/early fall since 2007 using methods described in Folse et al (2012). Species composition and percent cover for each station are visually estimated following the Braun-Blanquet cover scale. A Floristic Quality Index (FQI) has been developed by the USGS for each CRMS site using the annual species composition and percent cover data (Cretini et al 2011). The FQI is used to evaluate the quality of a wetland based on its species composition, where invasive and disturbance species are assigned lower scores and species that are indicative of vigorous coastal wetland communities are assigned higher scores. All of the species at a site contribute to the final FQI score scaled from 0 to 100.

The vegetation community at CRMS4218 is characteristic of mesohaline wiregrass marsh. *Spartina patens* (saltmeadow cordgrass) was the dominant species from 2007 to 2012 with an annual mean percent cover ranging from 62-85% (Figure 21). *Schoenoplectus americanus* (chairmaker's bulrush) was the second most dominant species in all years except 2008, when *S. patens* was the only species present. Other common species include *Symphyotrichum tenuifolium* (perennial saltmarsh aster), *Typha domingensis* (southern cattail), *Lythrum lineare* (wand lythrum), and *Vigna luteola* (hairypod cowpea) (Table 6). While the annual mean percent cover of *S. patens* has remained relatively stable from 2007 to 2012, overall species coverage and diversity has been more variable (Figure 21). Nevertheless, the FQI score has remained fairly stable between 70 and 80 for all years except 2008, when it dropped to 59 due to low species diversity and cover. The 2008 vegetation survey was conducted in October after the passage of Hurricanes Gustav and Ike, which may have contributed to vegetative stress and dieback of species.

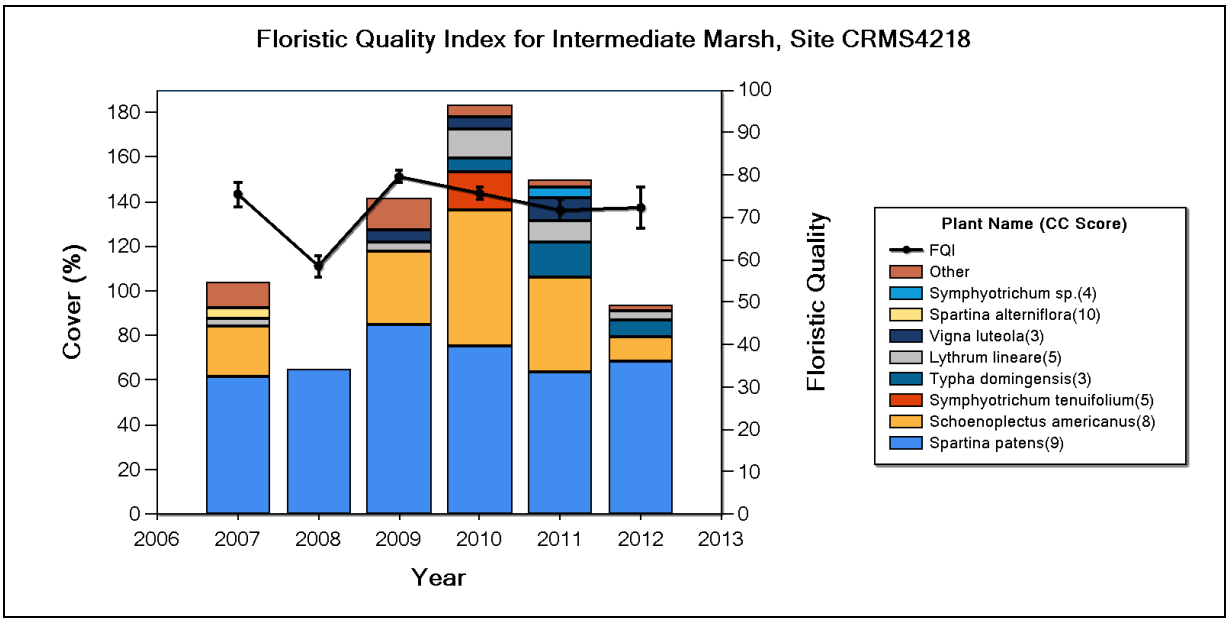

Figure 21. Mean percent cover of species and the Floristic Quality Index (FQI) score at CRMS4218 from 2007 to 2012.

Table 6. Mean % cover of species observed within 10 plots at CRMS4218 from 2007 to 2012. Species are listed in order of dominance.

Species	2007	2008	2009	2010	2011	2012	Mean
Spartina patens	62	65	85	75.5	64	68.5	70.0
Schoenoplectus americanus	22		33	60.5	42	11	33.7
Typha domingensis				6.2	16	7.8	10.0
Lythrum lineare	3.5		4.1	13	9.4	4	6.8
Symphyotrichum tenuifolium				17.5	0.6	0.3	6.1
Vigna luteola	1.5		5.5	5.1	10.6		5.7
Spartina alterniflora	5						5.0
Echinochloa walteri			4				4.0
Eleocharis spp.	4						4.0
Eleocharis parvula	3.5						3.5
Symphyotrichum spp.					4.8	0.3	2.6
Alternanthera philoxeroides	2.5						2.5
Amaranthus australis			2.7	0.8			1.8
Cyperus odoratus	1.8		1.7				1.8
Phragmites australis	1.5						1.5
Ammannia latifolia			1.4				1.4
Baccharis halimifolia				1.5	1.7	0.8	1.3
Polygonum punctatum	0.7		1.6	1.7			1.3
Pluchea odorata			1.8	0.7			1.3
Ipomoea sagittata				1	0.2	0.6	0.6
Schoenoplectus robustus			0.7		0.2		0.5
Setaria parviflora			0.2		0.8	0.3	0.4
Sabatia calycina			0.4				0.4
Sagittaria lancifolia				0.2			0.2

Soil Analysis. Three soil cores were extracted at CRMS4218 on June 4, 2008 and were analyzed for bulk density and % organic content in 4-cm increments down to 24 cm. Mean % organic content was 38%, while mean bulk density ranged from 0.1 to 0.2 g cm^{-3} (Figure 22). Marsh elevation change and vertical accretion data have also been collected at CRMS4218 since early 2008, but the current estimates are preliminary and will not be presented until five years of data have been collected.

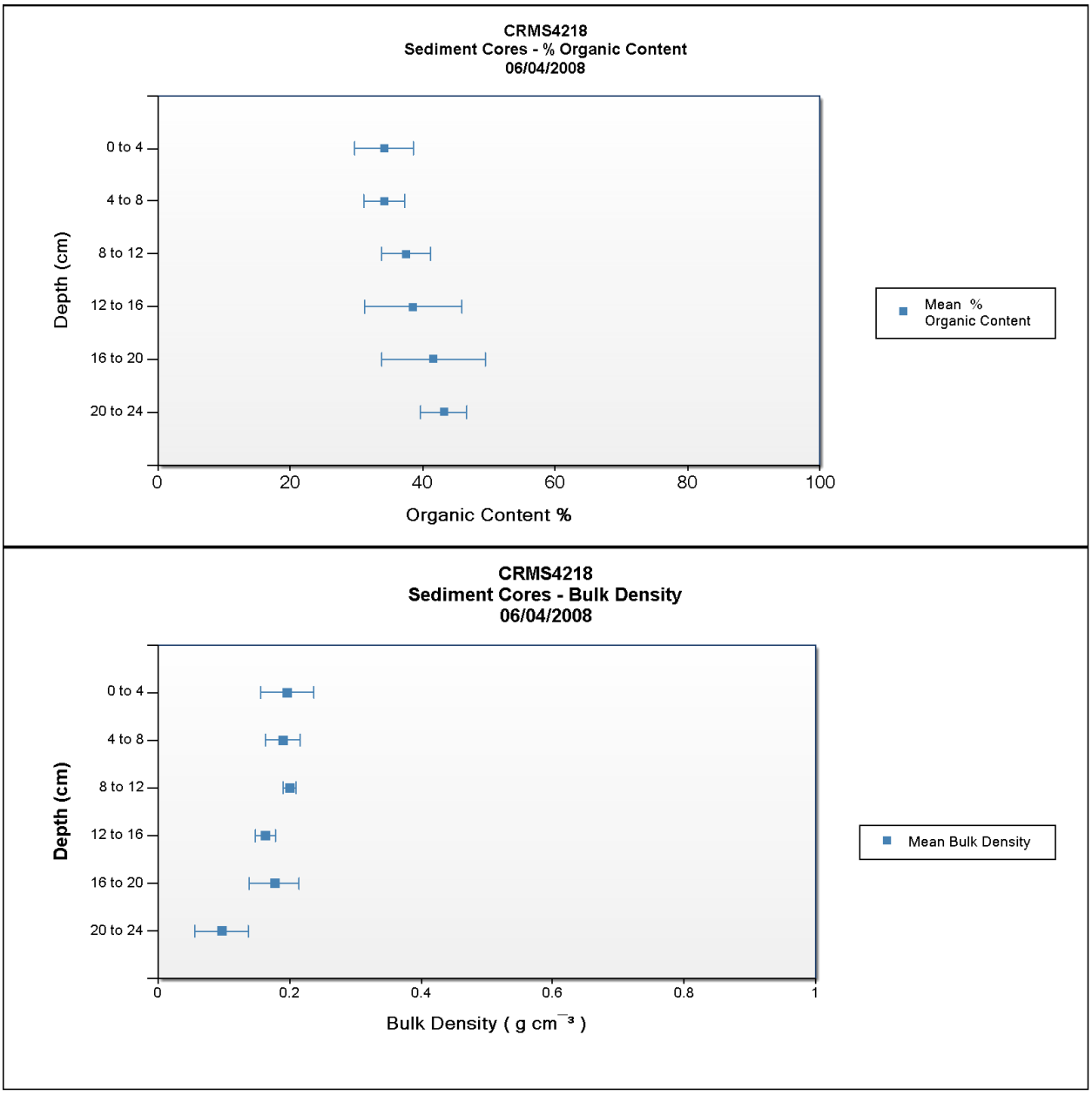

Figure 22. Percent organic content (%) and bulk density (g cm^{-3}) of the CRMS4218 baseline soil samples collected in June 2008.

Land/Water Analysis. Coast-wide digital imagery (Z/I Imaging digital mapping camera) with 1-meter resolution was acquired through the CRMS program in 2005, 2008, and 2012. The 1-km^2 area surrounding each CRMS site was geo-rectified and analyzed with GIS for land/water ratios according to Folse et al. (2012). The analysis of the 1-km^2 area at CRMS4218 showed a 4% loss of land area from 2005 to 2008. This is comparable to the 5% loss (2002-2008) observed within Phase 3, Area 2 of the BA-27 project, where CRMS4218 is located (Table 3). Results of the 2012 land/water analysis at CRMS4218 are not yet available.

V. Conclusions

a. Project Effectiveness

Although construction of the Barataria Landbridge Shoreline Protection project (BA-27) is still ongoing, monitoring of constructed units indicates project success. Shoreline position data associated with CU's 2, 3, 4, and 5 indicate that these units are achieving the goal of decreasing rates of shoreline erosion. Not only was shoreline erosion reduced, but positive shoreline change rates were observed for all areas analyzed. The two reference areas, however, continue to experience high rates of shoreline erosion. Shoreline position data will continue to be collected in CU's 4 and 5, as well as in CU's 7 and 8 once project features are constructed.

b. Maintenance Recommendations

The Barataria Landbridge Shoreline Protection project is in good overall condition with only previously reported minor deficiencies in isolated locations. The structures in this project appear to be stable, with no additional deficiencies identified during the 2013 inspection and no increase in severity of the deficiencies already recorded. These deficiencies included a low area in the rock dike in CU 2 and a single warning sign down from broken timber support in CU 4. The only recommendation for corrective action is the removal and replacement of the broken warning signs. There is no recommendation for corrective action to repair the low section of the rock dike due to the extreme construction cost associated with repairing this small section and the observation that it has not been detrimental to the interior marsh.

c. Lessons Learned

<u>Construction Unit 1</u>

During construction of the test sections of CU 1, excessive amounts of settlement occurred with the placement of sections A and A1 (rock dike above freshly excavated spoil and rock dike above geotextile fabric) which caused the stoppage of work at these locations. The project completion report prepared by NRCS recommends that work of this type in areas of poor and unstable substrate conditions on long reaches should include the flexibility of relocating "fish dips" to utilize areas of excessive settlement rather than terminating work

(NRCS 2001). Other problems encountered with the construction of CU 1 included the chipping of the corners of the concrete panels while being installed into notches of the piles. It is recommended that stainless steel shoes be designed on future projects to protect both the bottom of the concrete panel and the pile notch providing a bearing surface to prevent chipping. It is also recommended that each panel be grouted to one side of the notched pile to prevent rocking motion which could break and wear the surface of the concrete panel and pile notch. Varying lengths of panels should also be specified on long reaches to compensate for any obstruction encountered during construction (NRCS 2001).

Construction Unit 2

Stage placement technique was used in the construction of the rock dike of CU 2 with great success. On similar projects, it is recommended that the entire first lift be constructed to an elevation of 0.5 ft above the average water elevation and the final lift be placed after a specified number of days to allow for any initial consolidation of the soils. This method is recommended for rock dikes with a total height of 4.5 ft or less. The rock dike constructed under this unit experienced very little consolidation between the initial lift of rock and the final lift (NRCS 2003).

Construction Unit 3

During construction of this unit, the spoil material resulting from excavation of access channels was successfully used to fill seven small open water ponds located landward of the rock dike. In areas where beneficial use of spoil material is practical, it is recommended that this material be utilized for marsh creation.

Monitoring

Interpretation of some data variables can be complicated by a staggered, long-term construction regime. Impacts from other restoration projects, while beneficial, may also confound measures of project effectiveness such as land loss/gain.

VI. References

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Appendix A
(Three Year Budget Projection)

BARATARIA LAND BRIDGE, PH 1 & 2 / BA27 / PPL7

Three-Year Operations & Maintenance Budgets 07/01/2013- 06/30/16

Project Manager	O & M Manager	Federal Sponsor	Prepared By
	Ledet	*NRCS*	*Ledet*

	2013/2014	2014/2015	2015/2016
Maintenance Inspection	$ 2,898.00	$ 2,985.00	$ 3,074.00
Structure Operation	$ -	$ -	$ -
Administration	$ -	$ 4,000.00	$ -
COE Administration	$ 1,295.00	$ 1,334.00	$ 1,374.00
Maintenance/Rehabilitation			

13/14 Description:

E&D	$ -
Construction	$ -
Construction Oversight	$ -
Sub Total - Maint. And Rehab.	$ -

14/15 Description: Survey profile of rock dike and settlement plates

E&D	$ 22,500.00	
Construction	$ -	
Construction Oversight	$ -	
Sub Total - Maint. And Rehab.	$ 22,500.00	

15/16 Description:

E&D			$ -
Construction			$ -
Construction Oversight			$ -
		Sub Total - Maint. And Rehab.	$ -

	2013/2014	2014/2015	2015/2016
Total O&M Budgets	$ 4,193.00	$ 30,819.00	$ 4,448.00

O&M Budget (3 Yr Total)	$ 39,460.00
Unexpended O&M Funds	$ 1,344,328.75
Remaining O&M Funds	$ 1,304,868.75

BARATARIA LAND BRIDGE, PH 3 / BA27c / PPL9

Three-Year Operations & Maintenance Budgets 07/01/2013 - 06/30/16

Project Manager	O & M Manager	Federal Sponsor	Prepared By
	Ledet	*NRCS*	*Ledet*

	2013/2014	2014/2015	2015/2016
Maintenance Inspection	$ 2,898.00	$ 2,985.00	$ 3,075.00
Structure Operation	$ -	$ -	$ -
Administration	$ -	$ 4,000.00	$ -
COE Administration	$ 1,295.00	$ 1,334.00	$ 1,374.00

13/14 Description:

E&D	$ -
Construction	$ -
Construction Oversight	$ -
Sub Total - Maint. And Rehab.	$ -

14/15 Description: Survey profile of rock dike and settlment plates

E&D	$ 18,600.00
Construction	$ -
Construction Oversight	$ -
Sub Total - Maint. And Rehab.	$ 18,600.00

15/16 Description:

E&D	$ -
Construction	$ -
Construction Oversight	$ -
Sub Total - Maint. And Rehab.	$ -

	2013/2014	2014/2015	2015/2016
Total O&M Budgets	$ 4,193.00	$ 26,919.00	$ 4,449.00

O&M Budget (3 Yr Total)	**$ 35,561.00**
Unexpended O&M Funds	**$ 45,863.88**
Remaining O&M Funds	**$ 10,302.88**

Note: Unexpended O&M budget includes a deduction of $10,008 for MIPR O&M funds allocated for NRCS

BARATARIA LAND BRIDGE, PH 4 / BA27d / PPL11

Three-Year Operations & Maintenance Budgets 07/01/2013 - 06/30/16

Project Manager	O & M Manager	Federal Sponsor	Prepared By
	Ledet	NRCS	Ledet

	2013/2014	2014/2015	2015/2016
Maintenance Inspection	$ 2,898.00	$ 2,985.00	$ 3,075.00
Structure Operation	$ -	$ -	$ -
Administration	$ -	$ 4,000.00	$ -
COE Administration	$ 1,334.00	$ 1,374.00	$ 1,415.00
Maintenance/Rehabilitation			

13/14 Description:

E&D	$ -
Construction	$ -
Construction Oversight	$ -
Sub Total - Maint. And Rehab.	$ -

14/15 Description: Survey profile of rock dike and settlement plates

E&D	$ 28,500.00	
Construction	$ -	
Construction Oversight	$ -	
Sub Total - Maint. And Rehab.	$ 28,500.00	

15/16 Description:

E&D		$ -
Construction		$ -
Construction Oversight		$ -
Sub Total - Maint. And Rehab.		$ -

	2013/2014	2014/2015	2015/2016
Total O&M Budgets	**$ 4,232.00**	**$ 36,859.00**	**$ 4,490.00**

O&M Budget (3 Yr Total)	**$ 45,581.00**
Unexpended O&M Funds	**$ 6,144,123.43**
Remaining O&M Funds	**$ 6,098,542.43**

Note: Unexpended O&M budget includes a deduction of $463,509 for MIPR O&M funds allocated for NRCS

Appendix B
(Inspection Photographs)

Photo 1: View of transition from CU#4 concrete wall to CU#2 rock dike

Photo 2: View of CU#2 rock dike along the southern end of Bayou Perot looking east

Photo 3: View of a low section of the CU#2 rock dike along the southern end of Bayou Perot

Photo 4: View of CU#2 embankment tie-in on west side of oilfield canal

Photo 5: View of CU#2 embankment tie-in on east side of oilfield canal

Photo 6: View of CU#2 rock dike along the southern end of Bayou Rigolettes looking northeast

Photo 7: View of a low section along the CU#2 rock dike near the Harvey Cutoff canal

Photo 8: View of the southern embankment tie-in of CU#3 along the eastern edge of Little Lake

Photo 9: View of CU#3 rock dike and warning signs on the eastern edge of Little Lake

Photo 10: View of CU#3 rock dike on the eastern edge of Little Lake looking north

Photo 11: View of a rock dike opening and warning signs along CU#3

Photo 12: View of a rock dike opening and warning signs along CU#3

Photo 13: View of the CU#3 rock dike along the southern end of Bayou Perot

Photo 14: View of the CU#3 rock dike along the southern end of Bayou Perot

Photo 15: View of rock revetment tie-in on the western end of CU#4

Photo 16: View of data station illicitly installed on the CU#4 concrete wall

Photo 17: View of damaged warning sign along CU#4 concrete wall near an oilfield canal

Photo 18: View of CU#4 rock tie-in on south side of oilfield canal

Photo 19: View of CU#4 rock tie-in on north side of oilfield canal

Photo 20: View of CU#4 concrete wall along southern end of Bayou Perot looking east

Photo 21: View of CU#4 concrete wall along southern end of Bayou Perot looking south

Photo 22: View of the CU#4 concrete wall near the Harvey Cutoff canal

Photo 23: View of the CU#4 rock tie-in on the west side of Harvey Cutoff canal

Photo 24: View of the CU#4 rock tie-in on the east side of Harvey Cutoff canal

Photo 25: View of rope hanging off of warning sign in the Harvey Cutoff canal

Photo 26: View of the CU#4 concrete wall along the east side of Harvey Cutoff canal

Photo 27: View of timber piling resting on top of the CU#4 concrete wall near Harvey Cutoff canal

Photo 28: View of a bent warning sign along CU#4 concrete wall near Harvey Cutoff canal

Photo 29: View of steel bulkhead placed to close gap left in CU#4 concrete wall

Photo 30: View of CU#4 concrete wall along the eastern side of Bayou Rigolettes

Photo 31: View of warning sign and CU#4 concrete wall transition to rock revetment tie-in

Photo 32: View of CU#4 rock embankment tie-in on south side of oilfield canal

Photo 33: View of rock revetment embankment tie-in on the north end of CU#5

Photo 34: View of transition between rock revetment and concrete wall on north end of CU#5

Photo 35: View of concrete wall and warning sign along CU#5

Photo 36: View of concrete wall of CU#5 along Bayou Perot looking south

Photo 37: View of rock revetment embankment tie-in on the south end of CU#5

Photo 38: View of CU#6 rock embankment tie-in on north side of oilfield canal

Photo 39: View of CU#6 rock dike along the eastern side of Bayou Rigolettes

Photo 40: View of warning signs and CU#6 rock dike along eastern side of Bayou Rigolettes

Photo 41: View of CU#6 rock dike from Bayou Rigolettes looking northeast

Photo 42: View of warning signs and CU#6 rock dike along eastern side of Bayou Rigolettes

Photo 43: View of intersection of CU#6 rock dike and pipeline timber bulkhead looking north

Photo 44: View of intersection of CU#6 rock dike and pipeline timber bulkhead looking east

Photo 45: View of CU#6 rock dike from Bayou Rigolettes looking north

Photo 46: View of warning signs and CU#6 rock dike along eastern side of Bayou Rigolettes

Photo 47: View of CU#6 rock dike from Bayou Rigolettes looking east

Photo 48: View of northern CU#6 rock dike embankment tie-in near Laffite

Appendix C
(Monitoring Budget)

Barataria Basin Landbridge, phases 1, 2, 3 (BA-27abc) - NRCS - Priority List 7, 8, 9																										
Infl. Rate	2.60%																									
Price Level	1998	**Round Trip Mileage**		80																						
		Monitoring Budget		$ 262,547																						
Barataria Basin Landbridge, phases 1, 2, 3 (BA-27abc) - NRCS - Priority List 7, 8, 9																										
	Year	**Prior**	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Daily Rate Items	**Rates**																									
Differential GPS	144.92						481.77	494.30	507.15	520.33	533.86	547.74	561.98	576.59	591.59											
Base Field Equipment	160.90						534.89	548.80	563.06	577.70	592.72	608.13	623.95	640.17	656.81											
20' Aluminum	282.15						937.97	962.36	987.38	1,013.05	1,039.39	1,066.42	1,094.15	1,122.59	1,151.78											
Two Man Crew	395.06						1,313.33	1,347.48	1,382.52	1,418.46	1,455.34	1,493.18	1,532.00	1,571.84	1,612.70											
2 Man Per Diem	48.00						159.57	163.72	167.98	172.34	176.82	181.42	186.14	190.98	195.94											
Vehicle (per mile)	0.29						63.16	64.81	66.49	68.22	69.99	71.81	73.68	75.60	77.56											
Annual Rate Items																										
Misc. Supplies	200.00																									
Computer Database	566.00						627.20		660.24	677.40		713.09	731.63		770.17											
Comprehensive Monitoring Report	3,956.57									4,735.33			5,114.37			5,523.75			5,965.90					6,782.86		
TAG Meetings	1,468.74				1,546.11																					
Quality Assurance	200.00						221.63		233.30	239.37		251.97	258.53		272.14											
***Aerial Photography**	-						29,334.37						34,720.74					39,720.74					45,160.02			
Monitoring Plan Dev.	8,868.00				9,335.13																					
Total		0.00	0.00	0.00	10,881.24	0.00	33,673.89	3,581.46	4,568.11	9,422.21	3,868.14	4,933.77	44,897.16	4,177.77	5,328.70	5,523.75	0.00	39,720.74	5,965.90	0.00	0.00	0.00	45,160.02	6,782.86	0.00	0.00	0.00
Projected - Running Total		0.00	0.00	0.00	10,881.24	10,881.24	44,555.13	48,136.59	52,704.71	62,126.92	65,995.06	70,928.83	115,825.98	120,003.75	125,332.45	130,856.20	130,856.20	170,576.94	176,542.84	176,542.84	176,542.84	176,542.84	221,702.86	228,485.72	228,485.72	228,485.72	228,485.72
Projected Grand Total		228,485.72																								
BA-27	**159,001.00**	0.00	0.00	0.00	10,881.24	0.00	33,673.89	3,581.46	4,568.11	9,422.21	3,868.14	4,933.77	44,897.16	4,177.77	5,328.70	5,523.75	0.00	28,144.80									
BA-27c	**69,484.72**																	11,575.94	5,965.90	0.00	0.00	0.00	45,160.02	6,782.86	0.00		