Coastal Protection and Restoration Authority of Louisiana (CPRA)

2016 Operations, Maintenance and Monitoring Report

for

Oaks/Avery Canals Hydrologic Restoration

State Project Number T/V-13a
Priority Project List 6

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Iberia/Vermilion Parishes

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2016 Operations, Maintenance, and Monitoring Report
For
Oaks/Avery Canals Hydrologic Restoration (TV-13a)

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Preface

This report includes monitoring data collected through September 2015, and annual Maintenance Inspections through June 2014. The Oaks/Avery Canals Hydrologic Restoration (TV-13a) project is federally sponsored by the Natural Resources Conservation Service (NRCS) and locally sponsored by the Coastal Protection and Restoration Authority of Louisiana (CPRA) under the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA, Public Law 101-646, Title III). TV-13a is listed on the 6th CWPPRA Priority Project List (PPL-6).

The 2016 report is the 3rd report in a series of reports. For additional information on lessons learned, recommendations and project effectiveness please refer to previous OM&M reports (2008 and 2011) as well as annual O&M inspection reports (2005-2014) on the CPRA website: http://cims.coastal.la.gov/.

I. Introduction

The Oaks/Avery Canals Hydrologic Restoration project area encompasses 2,876 acres (1,164 ha) located in the southeastern portion of Vermilion Parish and southwestern portion of Iberia Parish, north of Vermilion Bay (Figure 1). The Vermilion Bay shoreline makes up most of the southern boundary of the project area. The major tributaries and waterways within the project area are Oaks Canal to the west, Avery Canal on the east, and the Gulf Intracoastal Waterway (GIWW) traversing the project area east to west. Union Oil Canal makes up the eastern boundary of the hydrologic unit of the project north of the GIWW. Most soils in this area are classified as Lafitte Muck, which are very poorly drained, very fluid, organic soils in brackish marshes. In 1998 the area was composed of approximately 1,936 acres (783 ha) of brackish marsh and 791 acres (320 ha) of open water, 4.8% of which was dominated by submerged aquatic vegetation (SAV), with the remainder made up of non-marsh habitats (Natural Resources Conservation Service 1998). The dominant SAV species was *Myriophyllum spicatum* (Eurasian watermilfoil). The vegetation in the area has historically been classified as brackish and intermediate marsh (O'Neil 1949, Chabreck and Linscombe 1968, 1978, 1988). Land loss rates in the project area averaged -8 acres/yr from 1956-1978. Pre-project erosion rate estimates for the Vermilion Bay shoreline and the GIWW bank in the project area were -13 ft/yr (4 m/yr) and -5 to -10 ft/yr (1.5-3 m/yr) respectively.

This project consists of the following unrelated restoration components designed to address different land loss problems within the project area: protection of Vermilion Bay shoreline with vegetative plantings; protection of GIWW bankline with rock dikes; stabilization of water level variability north of the GIWW and east of Oaks Canal by installation of a steel sheetpile weir in the "Cowpath" canal, a rock plug in a large breach in the north bank of an oilfield canal, spoilbank restoration along sections of the western bank of Union Oil Canal, and bank paving of the east and west banks of Oaks Canal at its convergence with Vermilion Bay. Approximately 1,200 ft of bankline protection was installed on the south bank of the GIWW adjacent to the area where Bayou Petite Anse exits Tigre Lagoon and enters Vermilion Bay. The remaining 6,300 ft of bankline stabilization was installed on the north bank of the GIWW immediately west of Oaks Canal.

During the life of the 20 year project, 160 acres (65 ha) of wetlands are projected to be protected. Approximately 34,000 *Spartina alterniflora* (smooth cordgrass) plants were planted along 5.1 miles of the Vermilion Bay shoreline in the summer of 2000. Project construction of structural components began on June 25, 2002 with the construction of approximately 7500 linear feet of rock dikes to protect the shoreline of the GIWW by contractor Luhr Brothers, Inc. of Columbia, Illinois. Subcontractors Bertucci Construction Company of Jefferson, Louisiana and Berry Brothers General Contractors, Inc. of Berwick, Louisiana completed project construction with the installation of a low sill sheetpile structure, low sill rock weir, spoilbank refurbishment, and navigation aids. Construction of the $2.8 million project was completed on October 14, 2002.

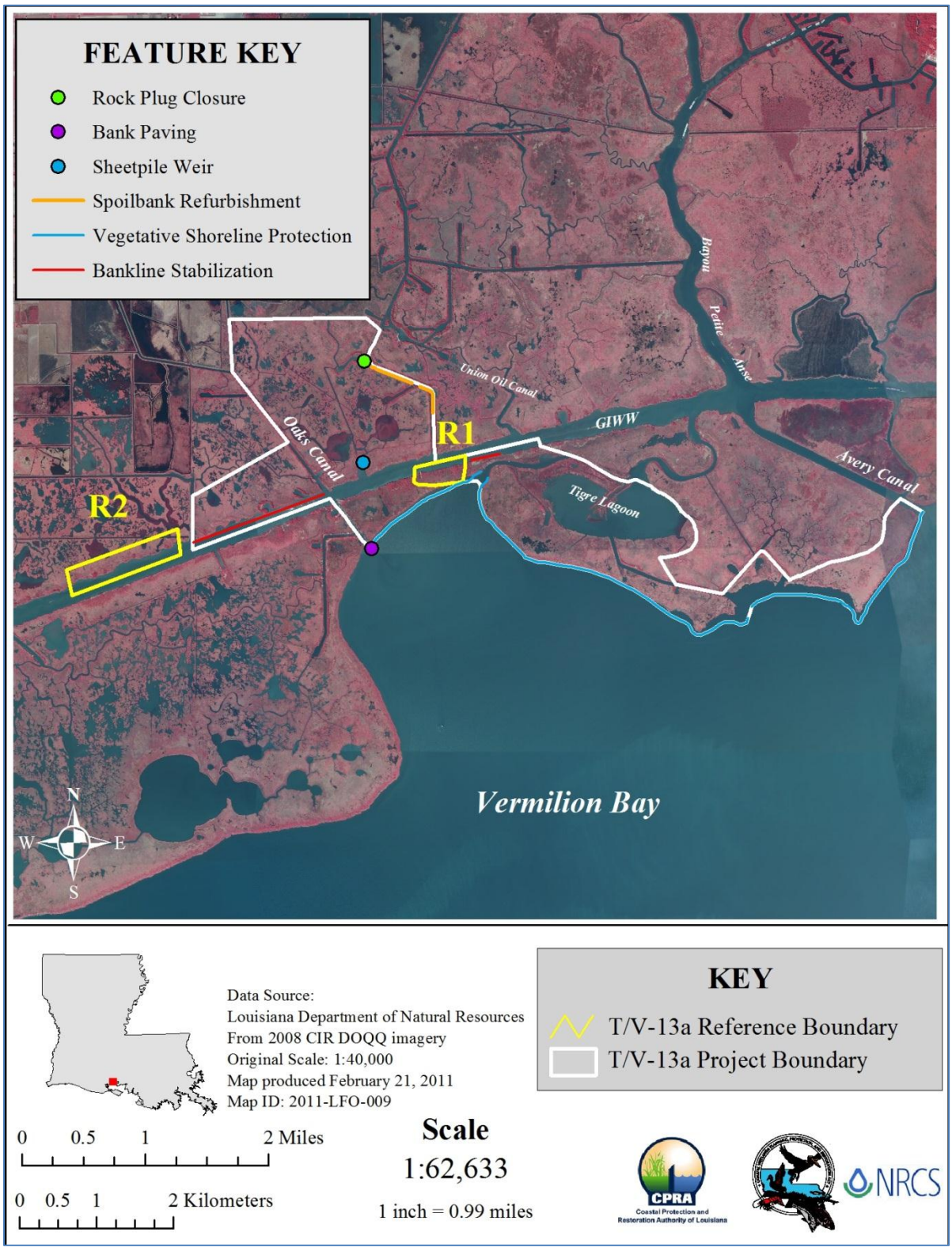


Figure 1. Locations of the TV-13a project and reference areas and project features.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Oaks/Avery Canals Hydrologic Restoration Project (TV-13a) 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, OCPR 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. The annual inspection report also contains a summary of maintenance projects which were completed since completion of constructed project features and an estimated projected budget for the upcoming three (3) years for operation, maintenance and rehabilitation. The three (3) year projected operation and maintenance budget is shown in Appendix B. A summary of past operation and maintenance projects completed since completion of the Oaks/Avery Canals Project are outlined in Section II.d.

An inspection of the Oaks/Avery Canals Hydrologic Restoration Project (TV-13a) was held on June 18, 2014 under sunny skies and warm temperatures. In attendance were Dion Broussard, Stan Aucoin, and Bernard Wood; Loland Broussard, Dale Garber, Brandon Samson, and Cody Lafleur of NRCS. Parties met at the Lafayette Field Office of CPRA and proceeded to the TV-13a project area. The annual inspection began at the rock dike at the East end of the South bank of the GIWW shoreline protection.

The field inspection included a complete visual inspection of the entire project site. Staff gauge readings, when available, and existing temporary benchmarks were used to determine approximate elevations of water, rock dikes, earthen embankments, low sill sheet pile weir and other project features. Photographs were taken at each project feature (see Appendix A) and Field Inspection notes were completed in the field to record measurements and deficiencies (see Appendix C).

b. Inspection Results

<u>Site 1—Rock dike/North bank</u>

The dike is in excellent condition. Approximately 50 linear feet on the eastern end at an oilfield location canal continues to settle but is in no need of any repairs. This low area is located at N 29° 49’ 58.3” and W 91° 59’ 25.9”. East and west tie-ins are stable; however, there is some minor erosion occurring at the east tie-in which will be monitored on future inspections. (Appendix A; Photo 1)

Site 2—Rock paving at Oaks Canal

No worsening in this area was evident. The bank between the bay and Bayou Hebert is still only about 6 feet wide and has not gotten any worse. Additional rock has been added to connect the end of the existing rock paving to the rock island protecting two pipelines located on the eastern side of the Oaks Canal. This work was performed by ChevronTexaco Pipeline, LLC-Erath in 2009 through CUP No. 20070581. At the time of inspection the Vermilion Parish Gravity Drainage District was placing dredged spoil on the west side of the mouth of the Oaks Canal at Vermilion Bay. (Appendix A; Photos 2-5)

Site 3—Cow path Structure

The structure is in good condition and both bank tie-ins are secure. (Appendix A; Photo 6)

Site 4—Spoilbank Maintenance (Union Canal)

Spoilbank maintenance done in a previous maintenance event looks good and is in the same condition as last inspection.

Site 5—Rock plug

The rock plug located on the north section of the project area near Union Canal has been gapped with the latest maintenance event. This rock plug is no longer accessible and will not be inspected. (Appendix A; Photo 4)

Site 6—Rock dike/South bank

The rock dike is similar to immediate post construction condition and in no need of any repairs. (Appendix A; Photo 8)

Site 7—Vegetation plantings

The shoreline plantings were not directly inspected on this trip due to time and wave constraints. The vegetation near the mouth of Oaks Canal is in fair condition and it is expected that this condition was typical along the remainder of the bay shore.

Site 8 – Spoilbank Maintenance (Oaks Canal)

The recently completed spoilbank maintenance on the Oaks canal looks great and was built to a +5.0’ elevation. As part of the spoilbank maintenance an old slip that provided access to a landowner camp was plugged. The spoilbank has maintained the constructed elevation. It looks like the Vermilion Parish Drainage District has recently added more dredge material to the plug and it is now at the +5.0’ elevation across its length. There is a section of levee within the project boundary, but not a part of the levee refurbishment, that has been damaged (presumably by Slemco’s maintenance activities). The land owner representative, Jimmy Delcambre, has been notified of the damage to the Oaks Canal levee. He is pursuing Slemco to seek repair of the damage. (Appendix A; Photo 9-11)

Site 9 – Earthen Canal Plug (Union Canal)

The Earthen Canal plug has experienced some settlement in a 50’ section and is approximately at a +2.5’ elevation where the settlement occurred. No further settlement has occurred and the vegetation is flourishing. (Appendix A; Photo 12-13)

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

None

ii. Programmatic/ Routine Repairs

None

d. Maintenance History

General Maintenance: Below is a summary of completed maintenance projects and operation tasks performed since October 2002, the construction completion date of the Oaks/Avery Canals Hydrologic Restoration Project.

2007 Acadian Engineers – Post construction surveys were conducted to establish inlet/outlet baseline channel conditions adjacent to the Cowpath weir. These were performed by Acadian Engineers at a cost of $5,194.15.

2012 Southern Delta Construction – A breach occurred off of the eastern embankment of Oaks Canal which was circumventing the hydrologic boundary of the project, additionally there were some low spots along the same embankment south of the breach. The project included:

1. Approximately 800 feet (including the creation of an earthen canal plug) of levee was refurbished and raised to a grade of approximately +5 ft along the Oaks Canal.
2. An earthen canal plug was constructed on the Union Canal approximately 200 ft in length across the channel. The intended elevation was to be +5 ft across the entire plug. Due to continuous problems with base failure and poor borrow material, approximately 50 ft section of the plug has settled to approximately +3 ft elevation. The rest of the plug is at or near the intended +5 ft elevation.
3. The existing rock plug was gapped to allow for fisheries movement.
4. A navigation aid was installed at the newly constructed earthen canal plug on the Union Canal.

Construction----------	$153,413.75
E&D, Construction Oversight, As-Builts ----------	$15,000.00
Total Project Cost	**$168,413.75**

Structure Operations: There are no active operations associated with this project.

III. Operation Activity

a. Operation Plan

There are no water control structures with operational features associated with this project; therefore, no Structural Operation Plan is required.

b. Actual Operations

There are no water control structures with operational features associated with this project, therefore no required structural operations.

IV. Monitoring Activity

a. Monitoring Goals

The objectives of the Oaks/Avery Hydrologic Restoration Project are:
1. Protect the Vermilion Bay shoreline through the planting of *S. alterniflora*.
2. Protect sections of the GIWW bank from erosion through use of rock dikes.
3. Stabilize water levels in the hydrologic unit.

The following goals will contribute to the evaluation of the above objectives:
1. Reduce erosion rate on the northern shoreline of Vermilion Bay.
2. Reduce erosion rate of specific high-risk portions of the GIWW bank.
3. Attenuate rapid water level fluctuations in hydrologic unit.
4. Reduce rate of loss of emergent vegetated marsh area in the hydrologic unit.

b. Monitoring Elements

Aerial Photography:
Near-vertical color-infrared aerial photography (1:12,000 scale) was used to measure vegetated and non-vegetated areas for the project and reference areas. The photography was obtained in 2000 (pre-construction), 2002, 2006 (post-construction) and for a final time in 2014. 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 (Steyer et al. 1995, revised 2000).

Shoreline Change:

The shoreline position was monitored along Vermilion Bay, along sections of the GIWW bank where rock dikes were constructed, and along the reference area bankline in R1 and R2. A differentially corrected Global Positioning System (dGPS) was used to map the Vermilion Bay shoreline in 2000 (immediately following planting of vegetation), 2003, 2007, 2010 and 2015. A final shoreline position will be surveyed in 2018. The bankline along the GIWW in the project and reference areas was mapped in 2003 immediately following construction of the rock dike, in 2006, and in 2014. Future surveys will follow the schedule listed above. The difference between bankline change in the reference areas and the project will be used to estimate the area of wetlands protected by the rock dikes along the GIWW. Because of the lack of a suitable reference area for the Vermilion Bay shoreline, the benefits of the plantings will be inferred from the survival of the plantings and temporal changes in shoreline position, from which changes in rate of loss can be calculated.

Water Level:

Salinity and water level data were collected in 1999 and 2003 at four recorder stations (Figure 2) to monitor hydrologic conditions (water depth, salinity) and document water levels within the hydrologic unit. One data recorder was placed inside the unit and three recorders were placed outside the project area at three locations along a semi-natural waterway at increasing distances from the GIWW (Figure 2). Water level data were used to document the water level variability in the project area relative to the reference data recorders. Water level data were collected at the shortest interval possible with the recorders (every 30 seconds) for 10 days each month during a 6-month period for the year 1999 (pre-construction) and year 2003 (post-construction). Specifically, water level data have been collected at the above-mentioned stations from 02/05/1999 – 09/02/1999 and 02/24/2003 – 09/06/2003.

Vegetative Shoreline Protection:

The general condition of *S. alterniflora* plantings along Vermilion Bay (installed in the summer of 2000) was documented in July 2001 by monitoring twenty 40-ft long vegetation sampling plots (3% of entire planted area) (Figure 3). Each plot consisted of 16 plantings with the sampling location determined by a random numbers table based on distance and marked with a pole. Species composition and percentage cover for the 16-plant plot was documented using the Braun-Blanquet procedure. Survival was determined as a percentage of the number of live plants to the number planted (within the plot) (Mendelssohn et al. 1991).

CRMS-*Wetlands* (CRMS) Supplemental

In addition to project specific monitoring elements, other data types are collected at CRMS sites which can be used as supporting or contextual information (Figure 4). Data types collected at CRMS sites include hydrologic from continuous recorder, vegetative, physical soil characteristics, discrete pore water, surface elevation, and land:water analysis of 1 km^2 area encompassing the station. For this report, soil properties, vegetation, and hydrologic data from one site within the project area (CRMS0532) and two sites outside the project area (CRMS0527 and CRMS0531) are presented. Data collected from the CRMS network over a sufficient amount of time to develop valid trends is being used to develop integrated data indices (hydrology, plant

productivity, and soil surface elevation change) at different spatial scales (local, basin, coastal) to which we can compare project performance.

Soil cores were collected one time to describe soil properties (bulk density and percent organic matter). Three, 4" (10.16-cm) diameter cores were collected to a depth of 24 cm and divided into 6, 4-cm sections at each site. The Department of Agronomy and Environmental Management at Louisiana State University processed the soil. Cores were collected at the site inside the project area, and suitable cores (quality or same marsh type) were collected from one site (CRMS0527) outside the project area.

Emergent vegetation parameters are evaluated at each CRMS site using techniques described in Steyer et al (1995) to describe species composition, richness, and relative abundance; in addition, overall percent cover and height of the dominant species are monitored. Annually at each site, data are collected and averaged from ten, 4-m^2 sample plots randomly established along a 282.8 m transect that crosses diagonally through a 200-m × 200-m vegetation plot in middle of the CRMS site.

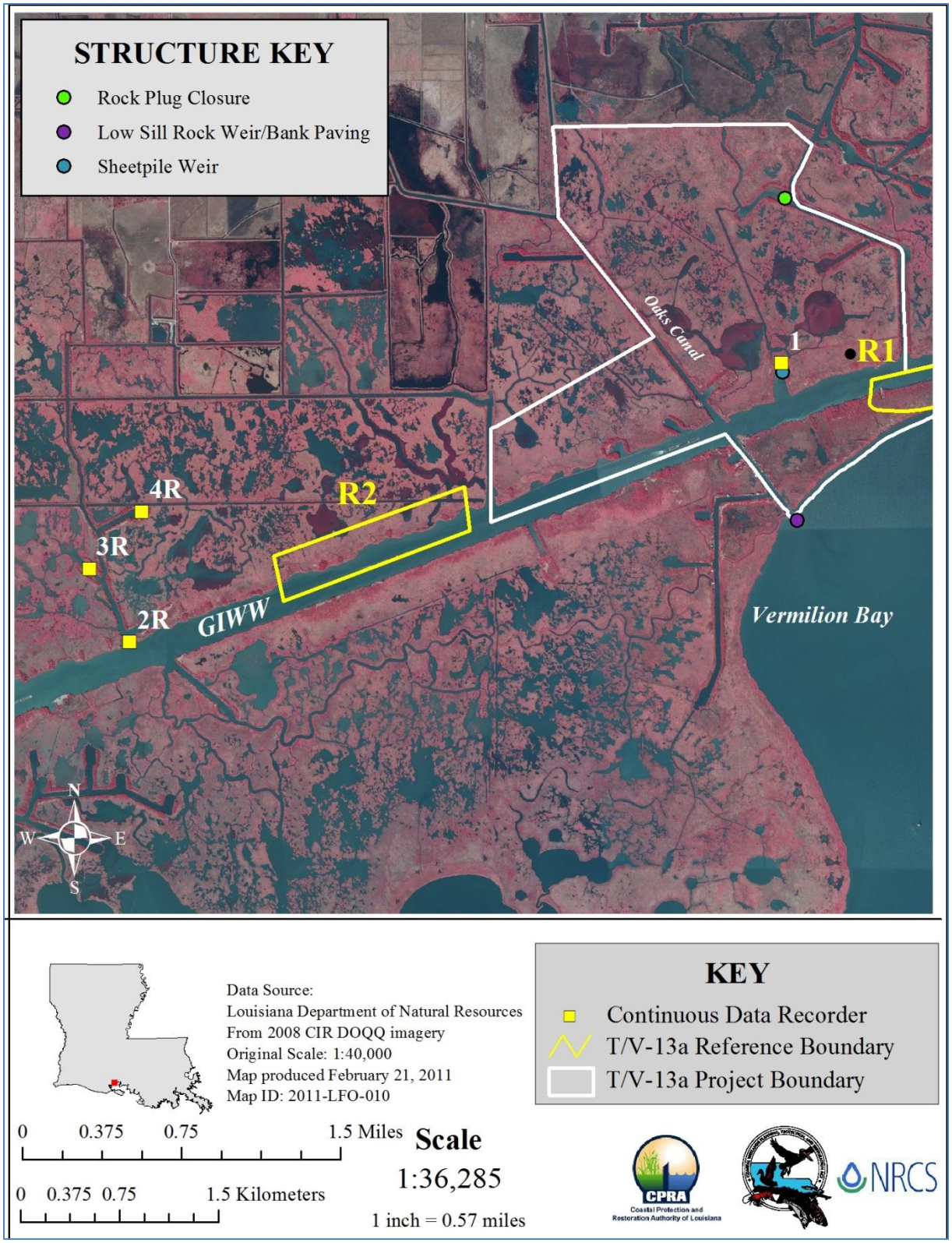


Figure 2. Locations of hydrographic monitoring stations in the TV-13a project and reference areas.

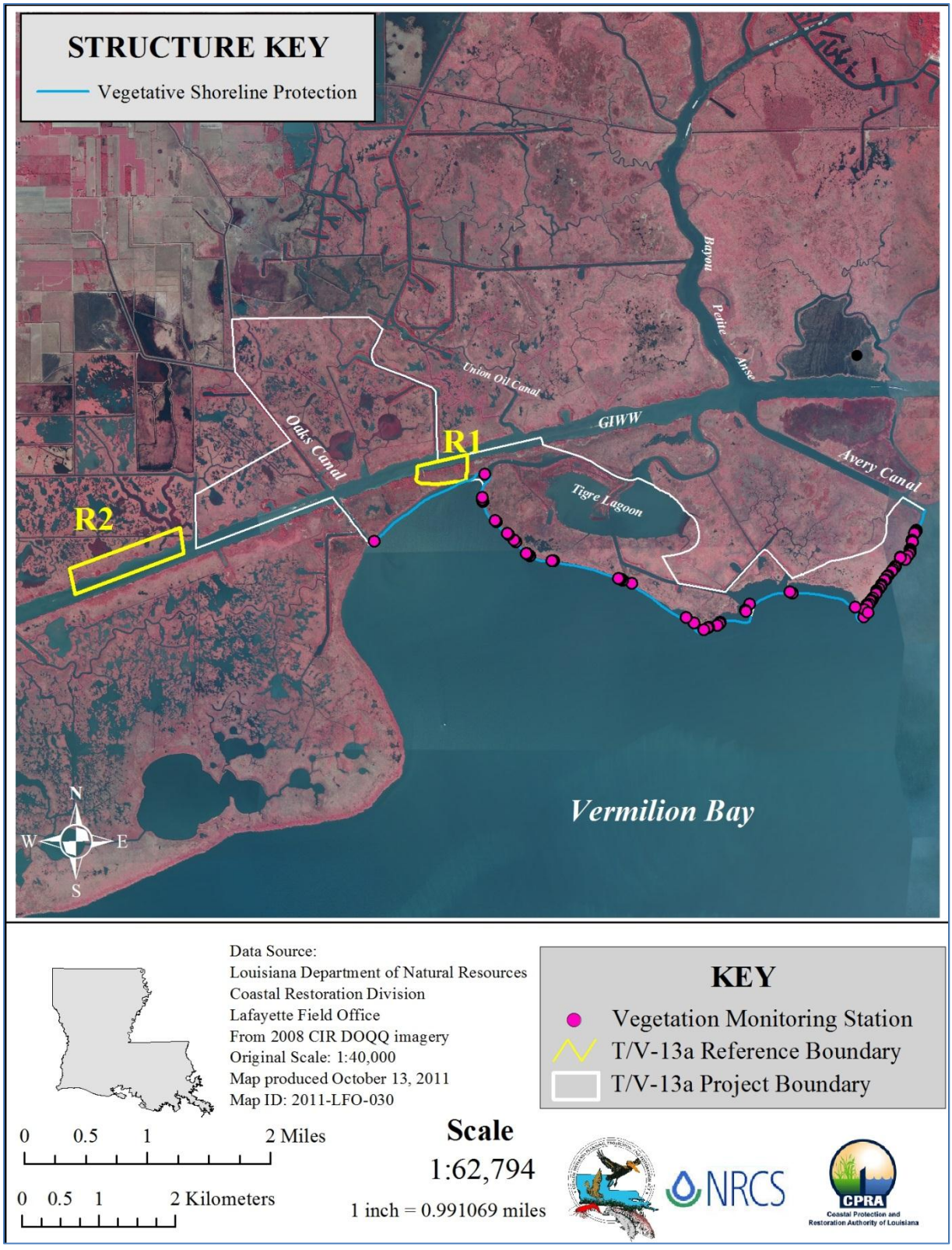


Figure 3. Locations of planted vegetative survey stations in the TV-13a project area.

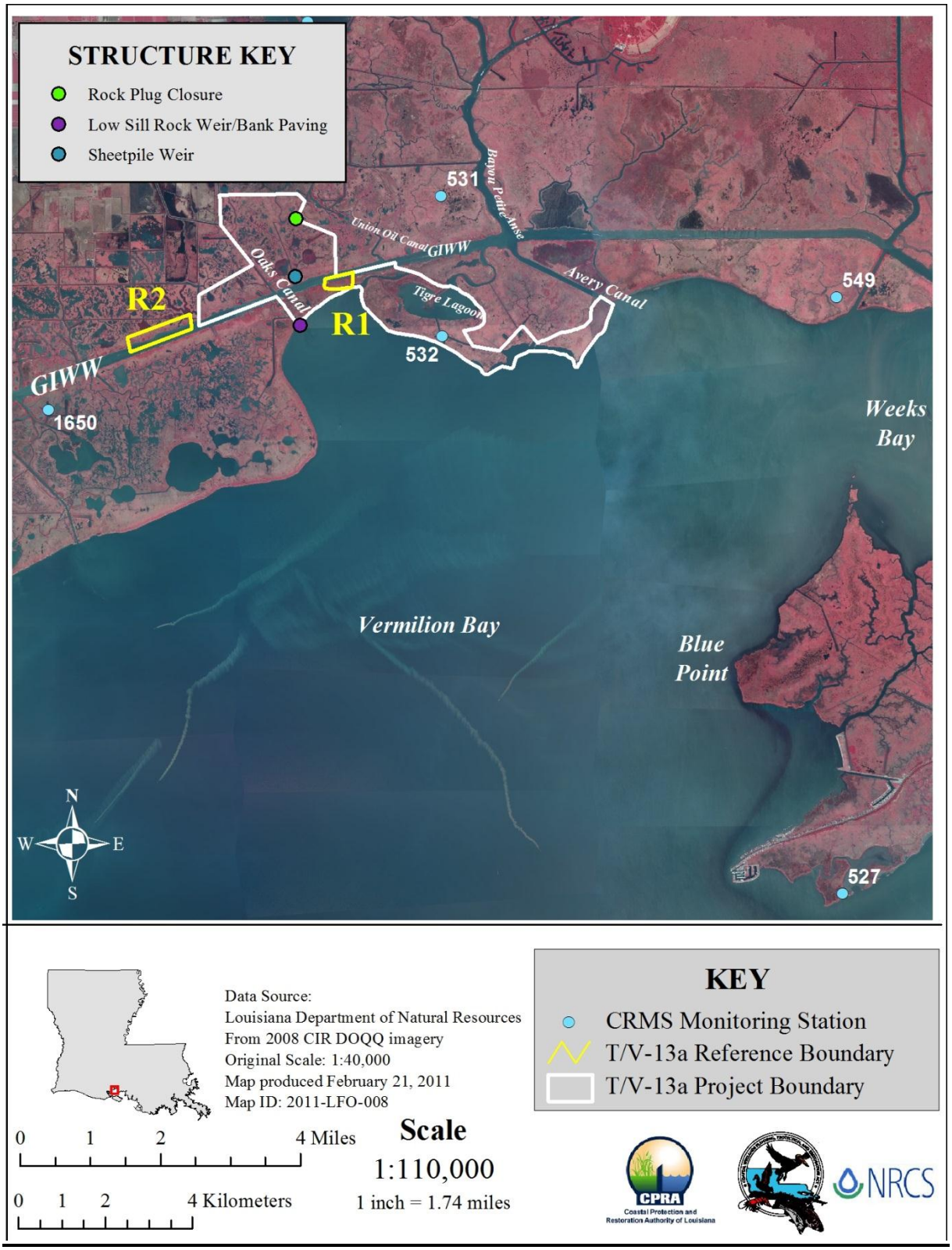


Figure 4. Location of CRMS monitoring sites within and near the TV-13a project area.

The percent cover of the plot and of each species is fed into a floristic quality index based on the marsh type the data was collected. Floristic Quality Indices (FQIs) have been developed for several regions to determine the quality of a wetland based on its species composition (Cohen et al., 2004; Bourbaghs et al., 2006). This FQI was developed by Jenneke Visser and an expert panel on Louisiana coastal vegetation as part of CRMS analytical working group in 2007 to develop integrated data indices (hydrology, plant productivity, and soil surface elevation change) at different spatial scales (local, basin, coastal) to which we can compare project performance. The panel provided an agreed upon score (Coefficient of Conservatism or CC Score) from 0 to 10 for each species in a list of ~500 plant species occurring in Louisiana's coastal wetlands. CC scores are weighted by percent vegetative cover and summed to determine the FQI for the CRMS site. CRMS sites inside and outside the project area were used for this report.

Continuous salinity data are collected hourly. Discrete pore-water from the soil salinity at 10 and 30 cm are collected at five of the vegetation plots during vegetation sampling. Pore water is extracted with a sipper tube assembly (rigid aquarium tubing, flexible hose, and syringe), and salinity is measured using a hand held salinity meter (YSI 30 Salinity, Conductivity, Temperature Meter).

The CRMS0532 is located within the project area. This site is in the portion of the project area affected by the shoreline restoration, but is not affected by the hydrologic management aspect of the project. Reference stations locations were chosen based on tidally influenced marsh in the Acadiana Bays complex which differs from the rest of the coast because the marsh is protected by Marsh Island and not protected by weirs so to limit other hydrologic influences. CRMS0527 and CRMS0531 are utilized as reference sites for this report. CRMS0527 is similar to the project site, but without any shoreline protection measures. CRMS0531 is nearer to the project than CRMS0527. However, this site is farther inland and may not be experiencing the same conditions as the project area site. All three sites are in intermediate marsh.

c. Monitoring Results and Discussion

Aerial Photography:

Aerial photography collected between 2002 and 2014 (post-construction) of the TV13a project area showed a decrease of -0.7% acres of land (Figures 5-9). The reference areas post-construction have lost -4.6% land acreage since 2002. (Figures 5-8). The 2006 classification indicated a loss of 1.6% land in the project area and a further loss of 8.6% land in the reference areas for the period 2002-2006 (Figure 7). It is not known to what extent Hurricane Rita caused this increased loss of land in both the project and reference areas. However, land: water analyses for other CWPPRA projects following the hurricane exhibited similar effects. Additionally, these other projects also showed areas of marsh scoured by the storm as observed on the ground. It is believed that this hurricane induced land loss also occurred in the Oaks-Avery project and reference areas as well. Post-storm years 2006-2014 show a rise in land acreage of 0.9% in the project area as well as a rise in the reference areas of 4 %.). The goal of reducing the rate of land change was affected by past storm events, yet currently is on the mend and indicating increases in land percentages.

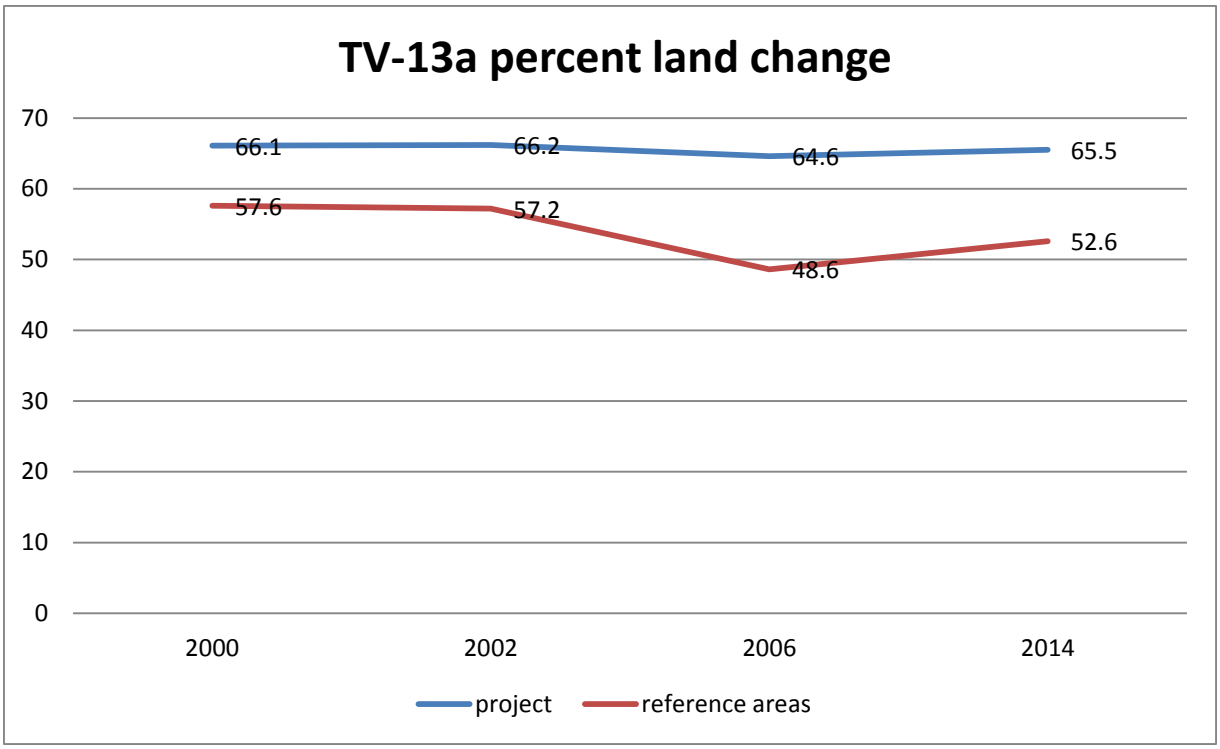


Figure 5. Percent land change over time comparing TV13-a project and reference areas.

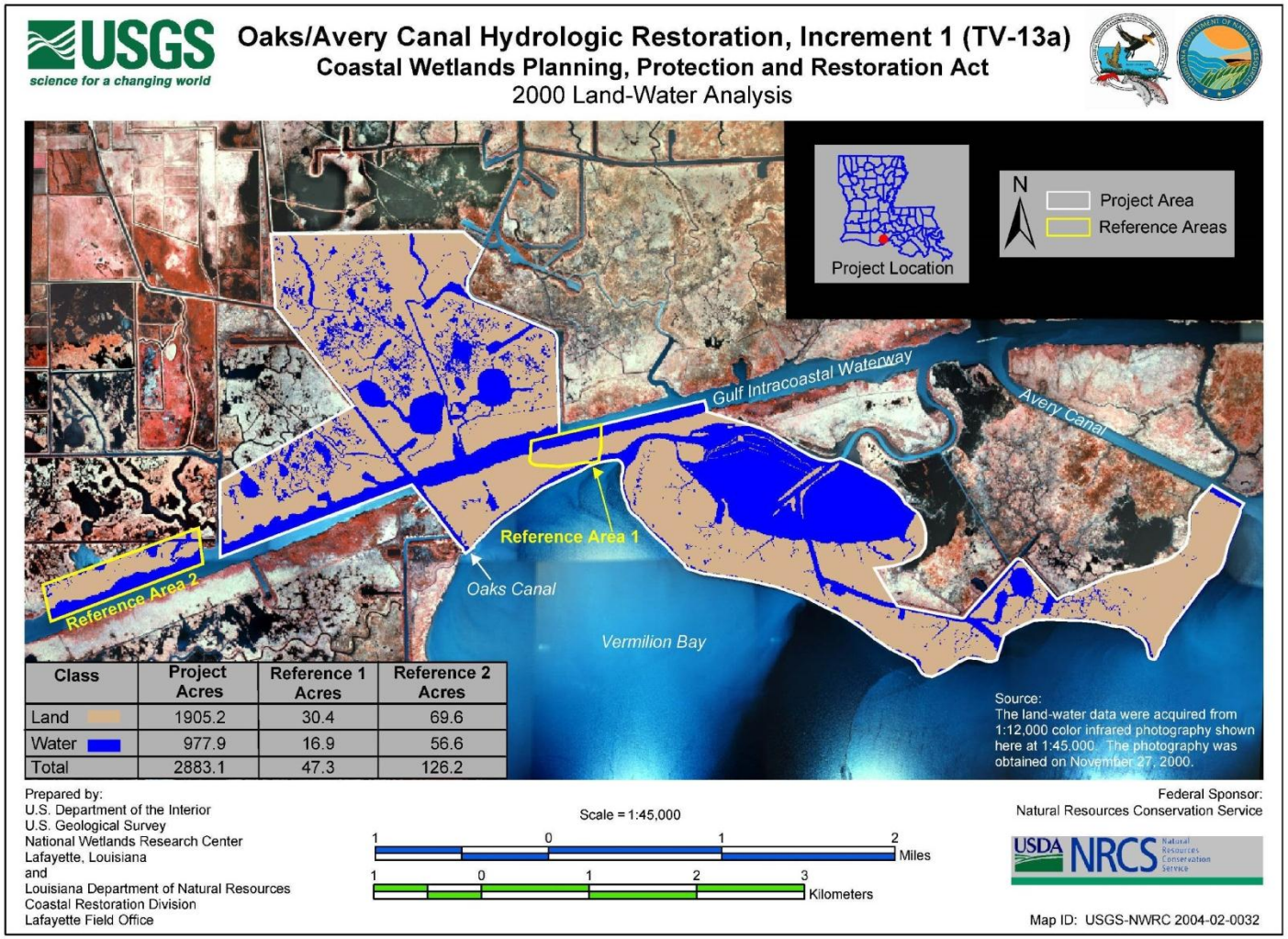


Figure 6. Results of the 2000 Land:Water GIS image classification for the TV-13a project and reference areas.

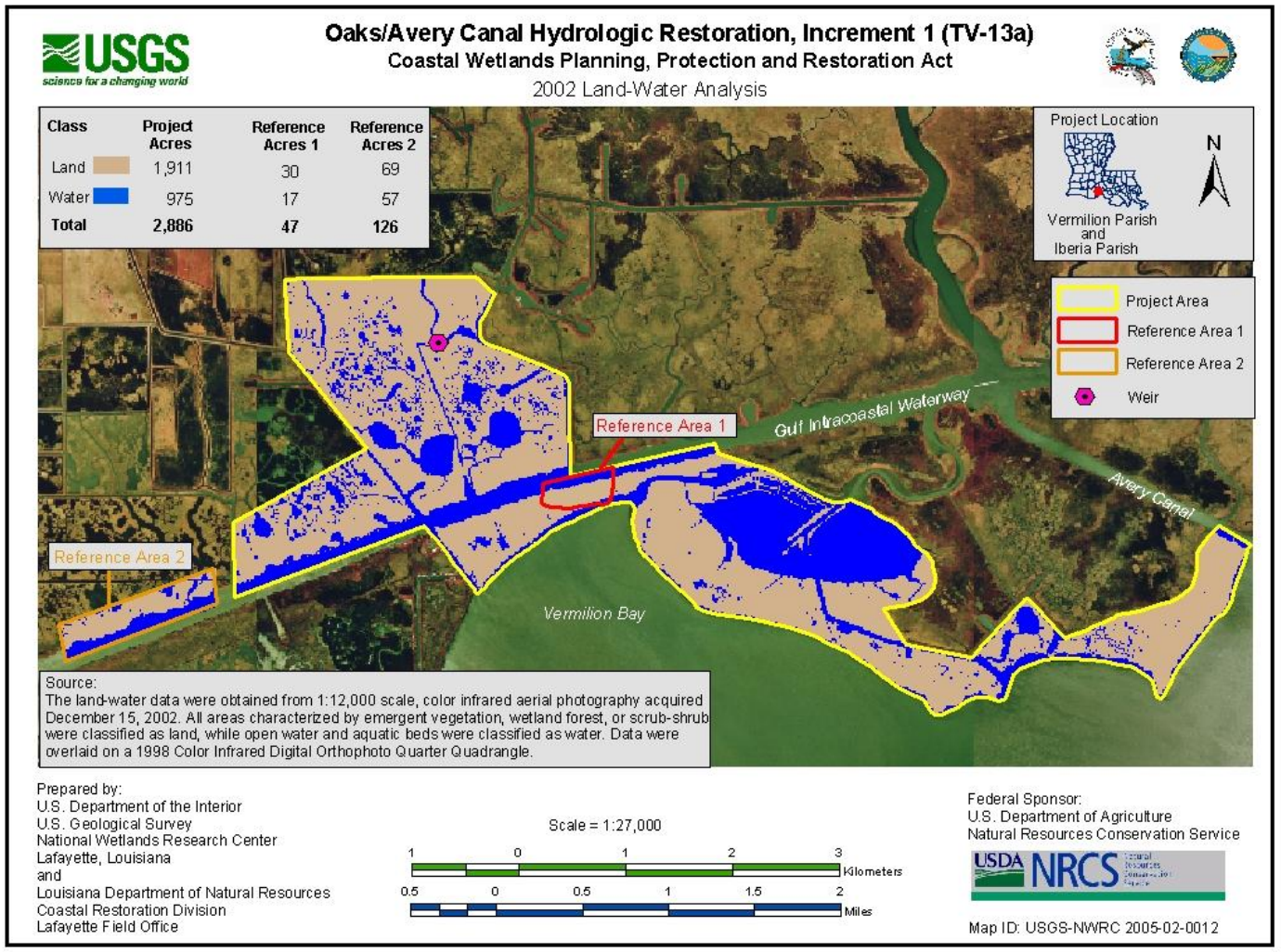


Figure 7. Results of the 2002 Land:Water GIS image classification for the TV-13a project and reference areas.

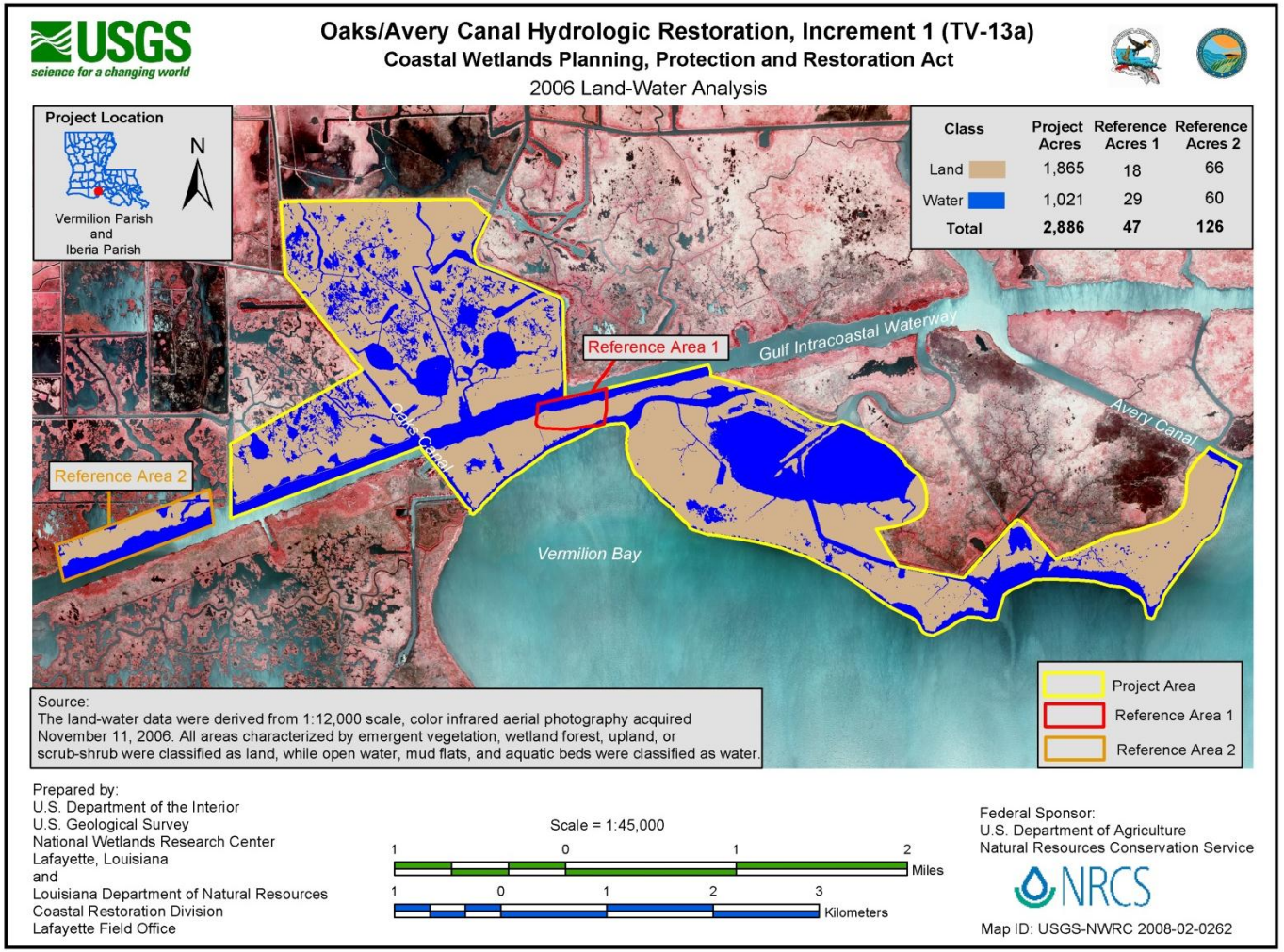


Figure 8. Results of the 2006 Land:Water GIS image classification for the TV-13a project and reference area.

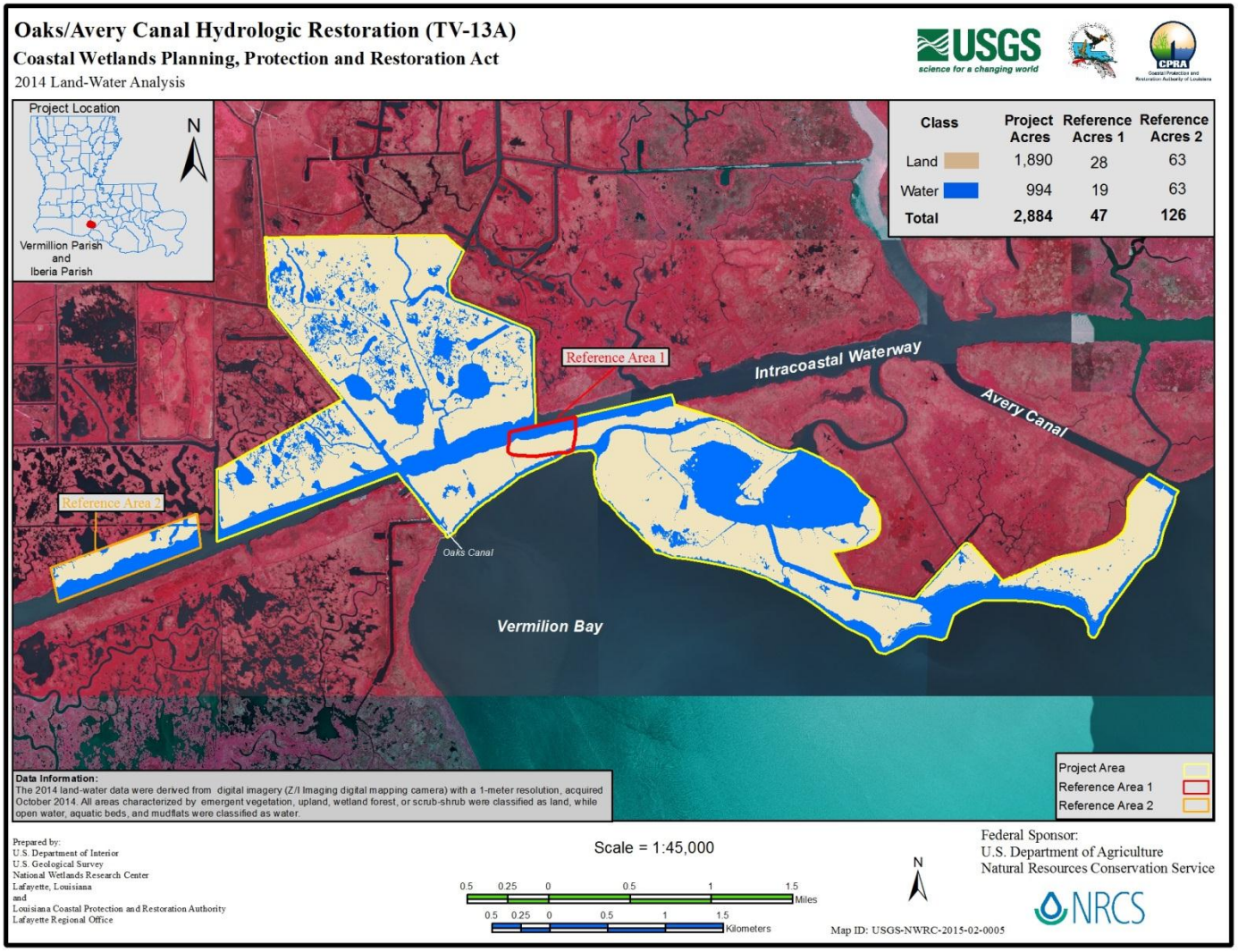


Figure 9. Results of the 2014 Land:Water GIS image classification for the TV-13a project and reference area.

Shoreline Change:

Shoreline protection along the GIWW prevented erosion and allowed for bank expansion. As-built (immediately post-construction) bankline positions for the project and reference areas along the GIWW were collected following rock dike construction and again in 2006/7, 2010 and 2015 (Table 1). Since, 2010, the project bankline prograded at a mean rate of 1.7 m/yr (5.6 ft/yr) and the unprotected reference area eroded at a rate of -0.9 m/yr (-3 ft/yr) (Figure 10). These data are consistent with shoreline change in other rock dike projects built along the GIWW. Sediment appears to be accumulating between the shore and the rock dike, resulting in the progradation of the bankline, successfully reducing the erosion rate along the GIWW.

The Vermilion Bay shoreline continued to erode throughout the project area with the most erosion seen in periods that included hurricanes. Data were collected in 2000 (pre-construction), 2003 (post-planting), 2007, 2010 and 2015 for the Vermilion Bay shoreline (Table 1, Figures 10 and 11). Shoreline loss was minimal, -2.7 m/yr since 2010, for the majority of the project area, with the exception of the area near the mouth of the canal connecting Tigre Lagoon to Vermilion Bay (-6.7 m/yr). It is highly possible that erosion rates from 2003-2007 increased due to Hurricane Rita, which battered the shoreline of the project with high winds and a storm surge of as much as 11-12 ft. During the entire monitoring period (2000-2015), the shoreline retreated at a rate of -2.7 m/yr (-8.9 ft/yr). The area near the mouth of the canal connecting Tigre Lagoon to Vermilion Bay eroded at a mean rate of -15.9 m/yr (-52.2 ft/yr). Loss in this area was as much as –19.82 m/yr (-65.0 ft/yr) (Figure 11).

Table 1. Shoreline change rates derived from dGPS surveys. Initial construction was completed in October 2002; Hurricane Lili occurred in October 2002, Hurricane Rita occurred in September 2005, and Hurricane Ike occurred in September 2008.

	Shoreline Change Rate (m/yr)-Mean	SE +/-	Shoreline Change Rate (m/yr)-Max Loss	Shoreline Change Rate (m/yr)-Max Gain
Vermilion Bay				
2000-2003	-1.5	8.0	-30.7	49.2
2003-2007	-7.7	12.5	-60.6	2.4
2007-2010	-3.4	4.5	-28.5	1.7
2010-2015	-1.2	3.4	-36.9	36.8
2000-2015	-2.7	4.7	-19.8	13.7
GIWW				
2003-2006/7 Project	0.4	1.5	-9.0	3.0
2003-2006/7 Ref 2	-0.9	0.5	-3.5	0.3
2006/7-2010 Project	1.0	1.5	-1.7	9.2
2006/7-2010Ref 2	-2.1	1.0	-5.0	0.2
2010-2015 Project	1.7	2.4	-1.8	8.5
2010-2015 Ref 2	-0.9	0.5	-2.9	1.0

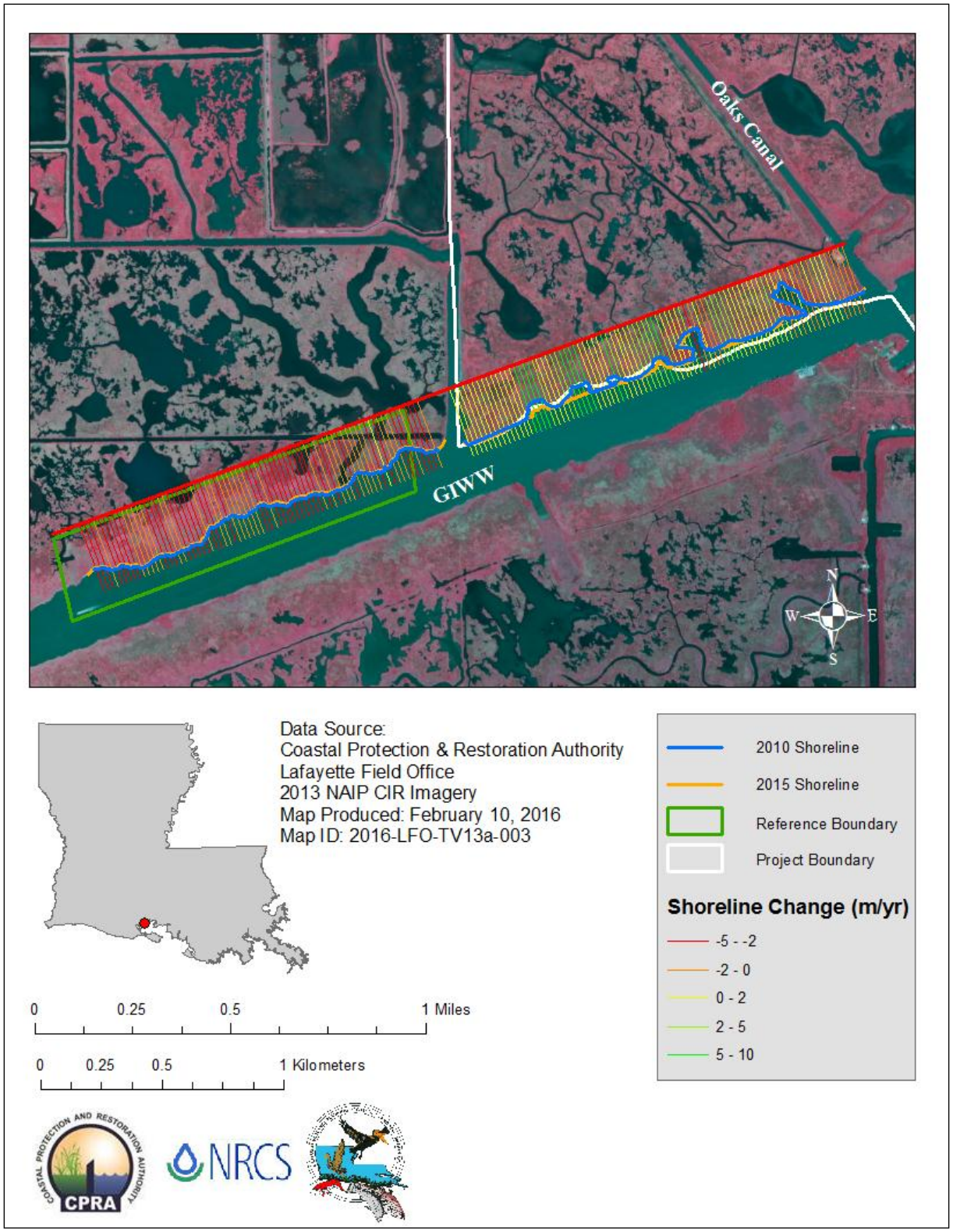


Figure 10. Shoreline change in the TV-13a project area along the GIWW for the period 2010-2015.

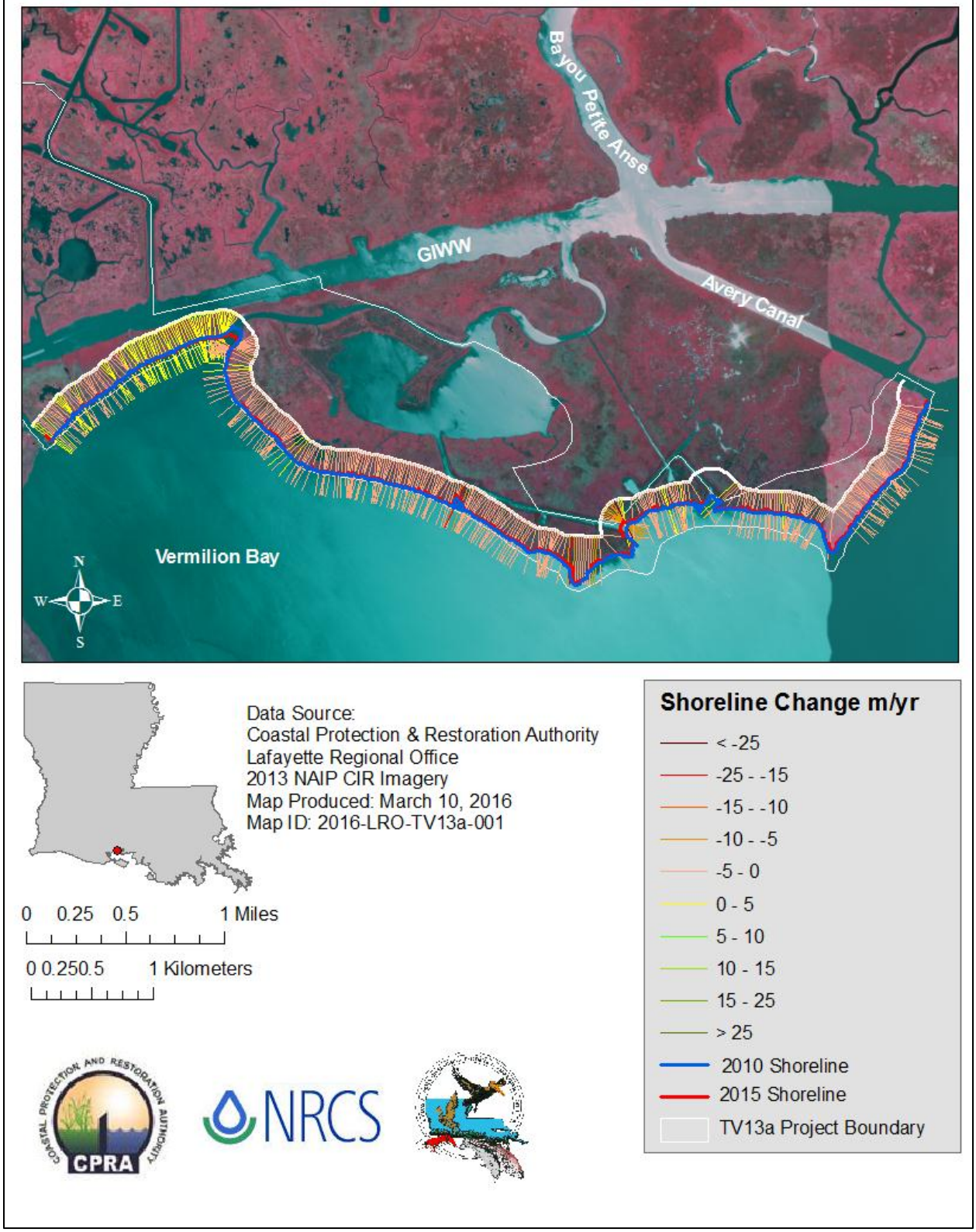


Figure 11. Shoreline change along the shore of Vermilion Bay during the period 2010-2015.

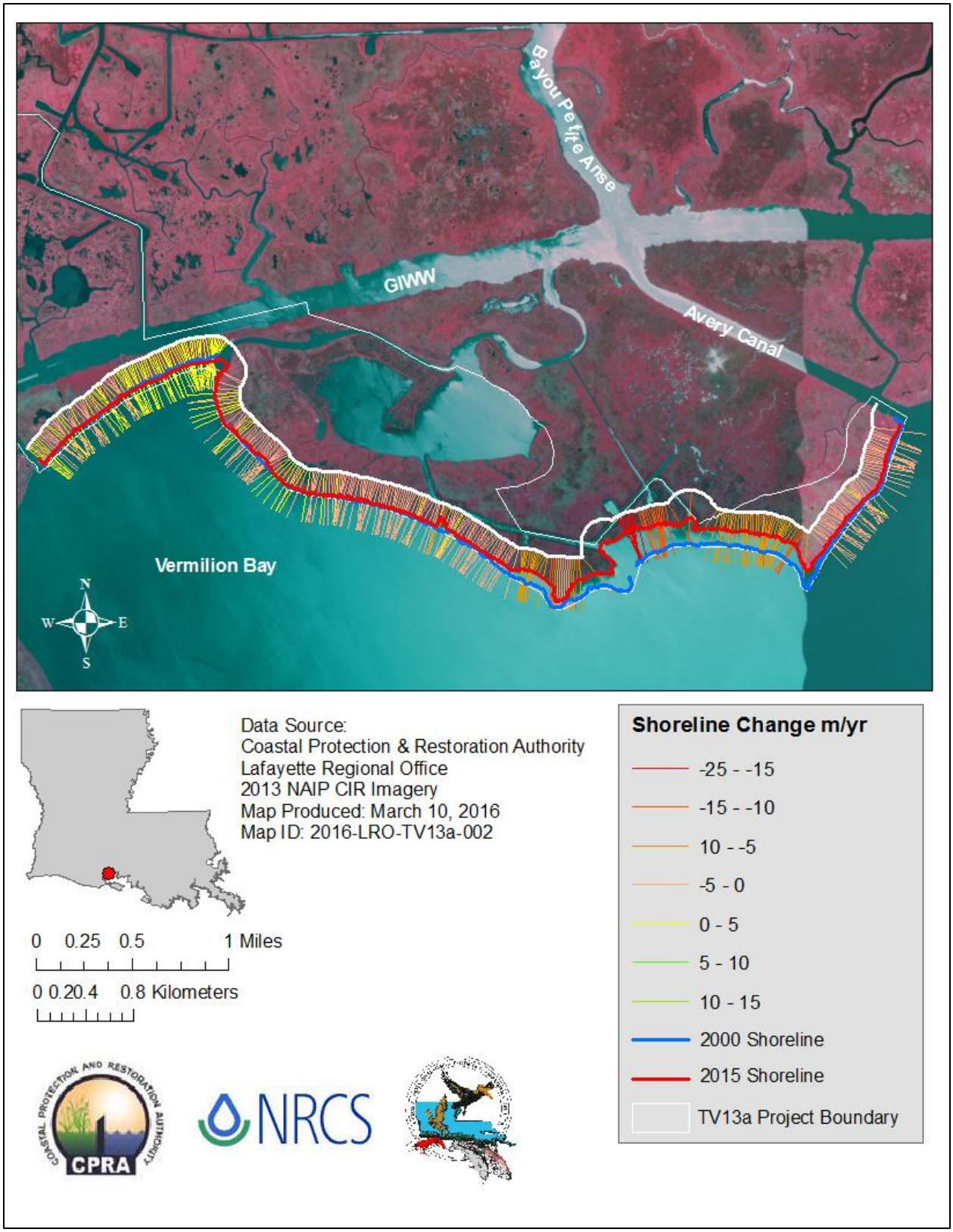


Figure 12. Shoreline change along the shore of Vermilion Bay during the period 2000-2015.

Water Level:
Pre- and post-construction data for the project area station TV13-01 and reference stations TV13-2R, TV13-3R, and TV13-4R was collected in 30 s intervals from 02/05/199 – 09/02/199 and 02/24/2003 – 09/09/2003 (Figure 13). This time interval illustrates the rapid water level changes (boat wake induced) common in the project and reference areas. Short-term water level variability (<1 hr) decreased in the reference stations as a function of distance from the source of disturbance (i.e. the GIWW). Short-term water level variability was significantly lower in the project area following construction and significantly lower than the reference stations (P<0.0001).

Vegetative Shoreline Protection:
Prior to the installation of *Spartina alterniflora* plantings in 2000, shoreline vegetation consisted mainly of *Spartina patens*, *Schoenoplectus americanus* and *Vigna luteola*. Vegetation surveys conducted on 7/24/2001 indicated overall survival of *S. alterniflora* plants was 80%. Individual plants were indistinguishable from each other in all plots where plants survived. The remaining plots had no surviving vegetation. Cover estimates ranged from 3-100% with mean cover for surviving plots at 59%. Average plant height was 45.9 in (116.6 cm). Because individual plants were indistinguishable in all surviving plots in 2001, no further surveys will be conducted.

CRMS Supplemental

Hydrologic:
Hydrologic indices were lower in 2015 at both reference sites and the project site compared to index values in 2014 (Table 2). Reference site CRMS0527 had the largest HI drop from 94 in 2014 to 48 in 2015. This is due to percent time flooded values increasing from 19.34 % in 2014 to 25.32% in 2015 as this site is most exposed. As expected this site scored much lower when compared to other intermediate sites, the Teche/Vermilion Basin and Coastwide (Figure 14). Reference site CRMS0531 and project site CRMS0532 remained relatively stable. CRMS0531 scored similarly to other intermediate site as well as the Teche/Vermilion basin and Coastwide while CRMS0532 scored in line with other brackish sites but scored lower when compared to the Teche/Vermilion basin and Coastwide (Figures 15 and 16).

Elevation Change and Accretion:
Elevation change at both reference (CRMS0531 and CRMS0527) and project (CRMS0532) sites has been slightly rising since 2008 (Figures 17, 18 and 19) at 0.61 cm/yr, 0.56 cm/yr and 0.43 cm/yr, respectively. Similarly accretion rates have risen slightly as well. From 2008-2015 accretion rates at CRMS0531 were 0.55 cm/yr; during 2008-2014 rates at CRMS0527 were 1.31 cm/yr and for CRMS0532 from 2008-2015 rates were 1cm/yr.
Soil elevation change when compared to original marsh elevations and hydrologic prisms generate the CRMS site Submerged Vulnerability Index (SVI) values (Figures 20, 21 and 22). SVI at CRMS0527 and CRMS0531 (reference sites) as well as at CRMS0532 (project site) are above the 90th percentile of the hydrologic datum. This indicates that these sites rarely see surface flooding during normal water levels. These SVI scores can then be compared on larger

spatial scales such as marsh type, basin and coastwide (Figures 23, 24 and 25). Again, when compared to these larger spatial scales all three CRMS sites are at the top of the SVI values.

Vegetative Plantings:

Analysis of the vegetation data indicated that percent cover has been decreasing since 2014 at CRMS0527 (reference area) and CRMS0532 (project area) but has increased at CRMS0531 (reference area) (Figures 26-28). FQI scores dropped from 48.9 to 36.3 at CRMS0527 and increased from 56.5 to 62.4 at CRMS0531. When compared to other intermediate sites, the Teche/Vermilion basin and coastwide CRMS0527 scored much lower on the FQI scale while CRMS0531 scored on the higher end compared to these other scales (Figures 29 and 30). The project area showed an increase in percent cover through 2009, with a large decline in 2010 where it then began to stabilize until 2014 (FQI 57.8) before decreasing again in 2015 (FQI 48.3) (Figure 28). FQI score increased from 2007 to 2009 in the project area but decreased greatly in 2010. This is mostly the result of a large drop in percent cover of *Schoenoplectus americanus*. This decrease does not appear to be related to Hurricanes Gustav and Ike, which affected the southwestern coast of Louisiana in 2008. In fact, these two hurricanes appear to have had no impact on percent cover and FQI at any of these CRMS sites. Compared to other brackish sites, CRMS0532 had a significantly lower FQI score; however, FQI scores for CRMS0532 were comparable to those in the rest of the Teche/Vermilion basin and coastwide (Figure 31).

Soils:

The soil properties data for the project and reference (CRMS0527) showed soil bulk density was lower in the project area than the reference and tended to be highest at the surface and below 20 cm (Figures 32a,b and 33a,b). Overall, bulk densities for both sites were relatively low, ranging from approximately 0.3-0.5 g/cm^3. Analysis of soil organic matter content indicated that organic content was higher in the project area than the reference site. This is also reflected in the project site's lower bulk density as bulk density usually decreases as organic matter content increases. Organic matter content was lowest at the surface and increased with depth for both sites.

Soil porewater salinities for both reference sites (CRMS0527 and CRMS0531) and the project site (CRMS0532) ranged from around 0.5 ppt to around 10 ppt (Figures 34-36). Porewater salinity in the project area, however, was slightly higher than surface salinities while the reference areas tracked well with surface salinities. Data collected since site installation was summarized by calculating daily means from the hourly data and then calculating monthly means of the daily means.

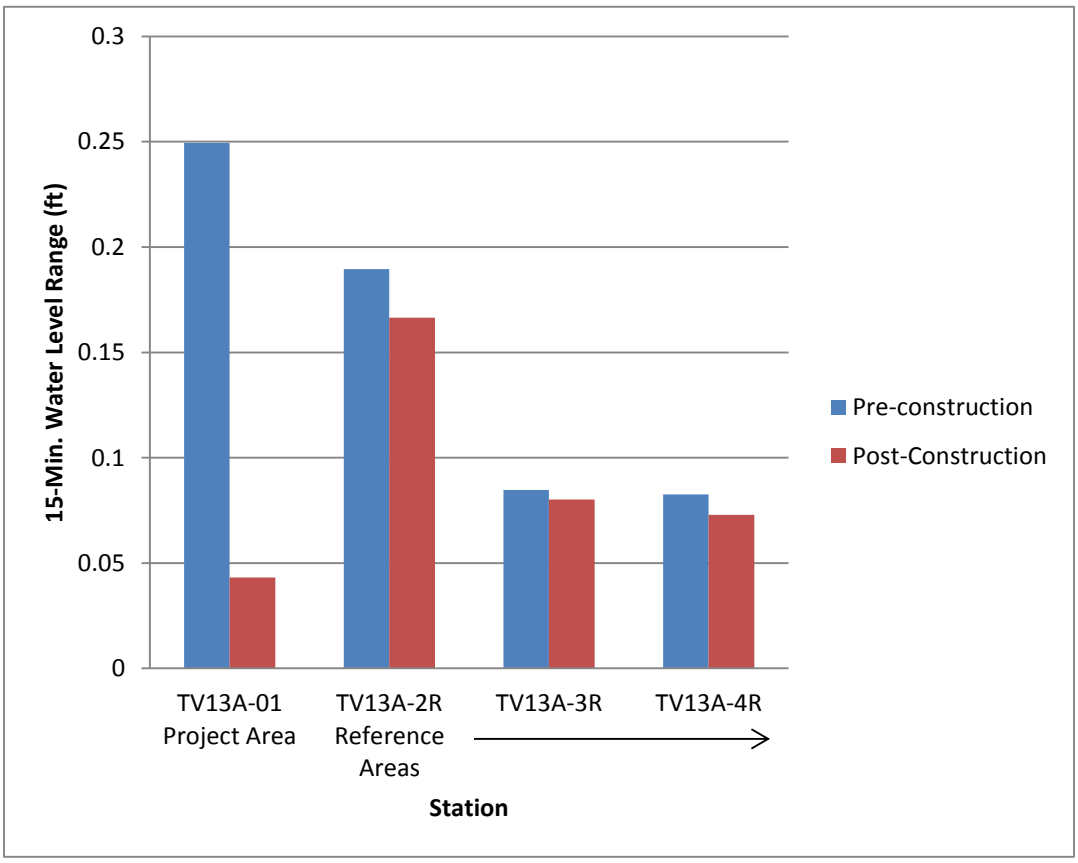


Figure 13. Relative daily water level variability (ft) both pre- and post-construction for the project and reference stations.

Table 2. Comparison of Hydrologic Index at CRMS0527, CRMS0531 and CRMS0532 between 2014 and 2015.

	Hydrologic Index	
	2014	2015
CRMS0527 (Reference)	94	48
CRMS0531 (Reference)	78	81
CRMS0532 (Project)	67	62

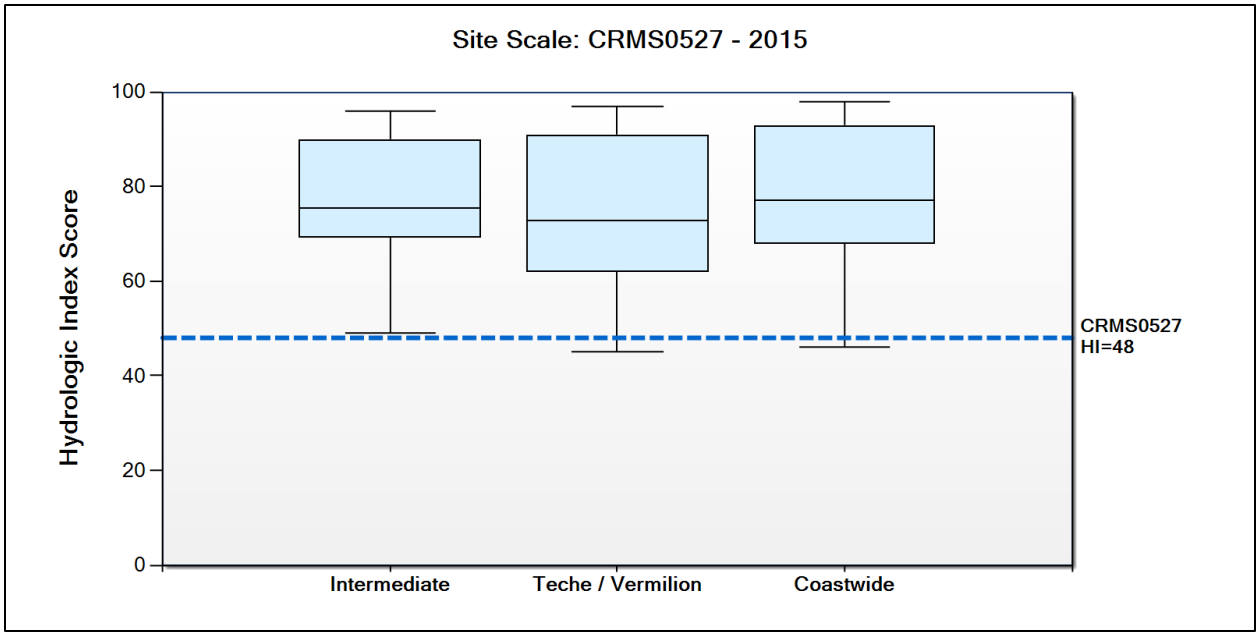


Figure 14. Hydrologic Index Score for CRMS0527 (Reference) in 2015 compared to the distribution of scores for all coastwide sites within the intermediate marsh type, within the Teche/Vermilion basin, and across the entire Louisiana coastal zone.

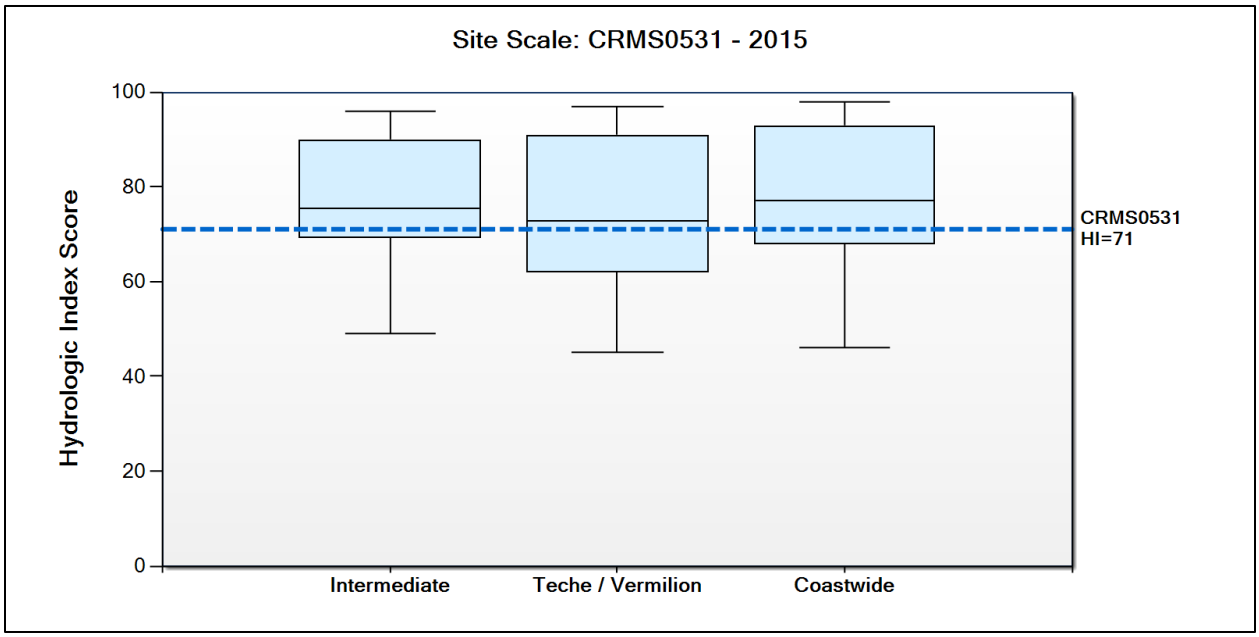


Figure 15. Hydrologic Index Score for CRMS0531 (Reference) in 2015 compared to the distribution of scores for all coastwide sites within the intermediate marsh type, within the Teche/Vermilion basin, and across the entire Louisiana coastal zone.

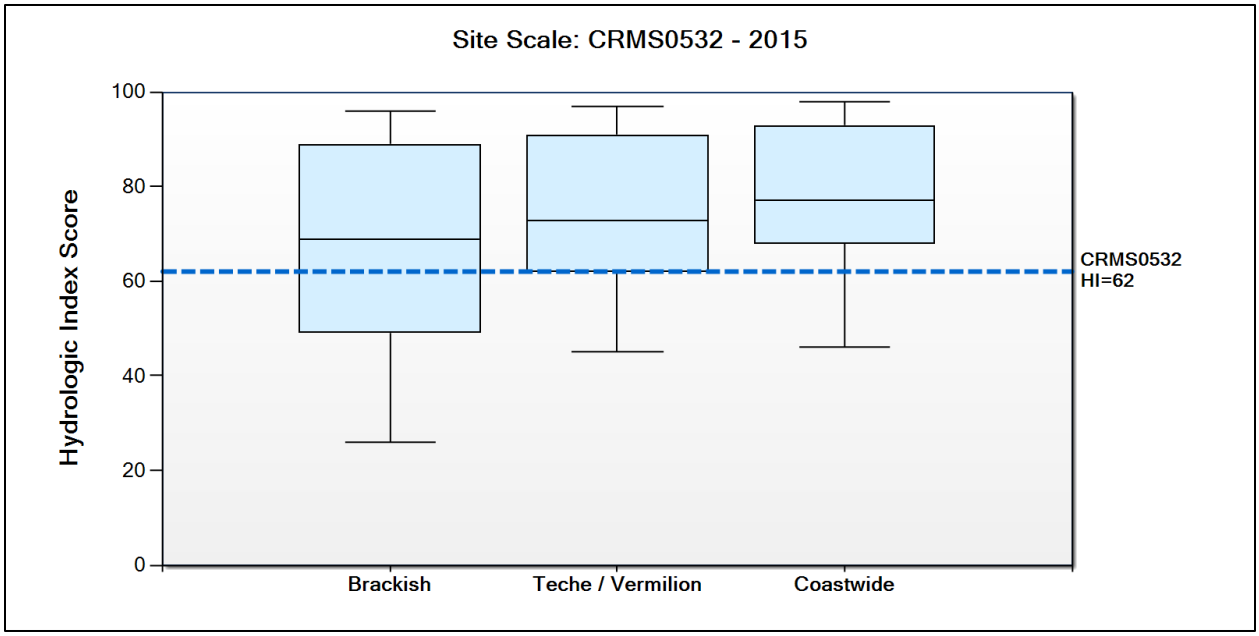


Figure 16. Hydrologic Index Score for CRMS0532 (Project) in 2015 compared to the distribution of scores for all coastwide sites within the intermediate marsh type, within the Teche/Vermilion basin, and across the entire Louisiana coastal zone.

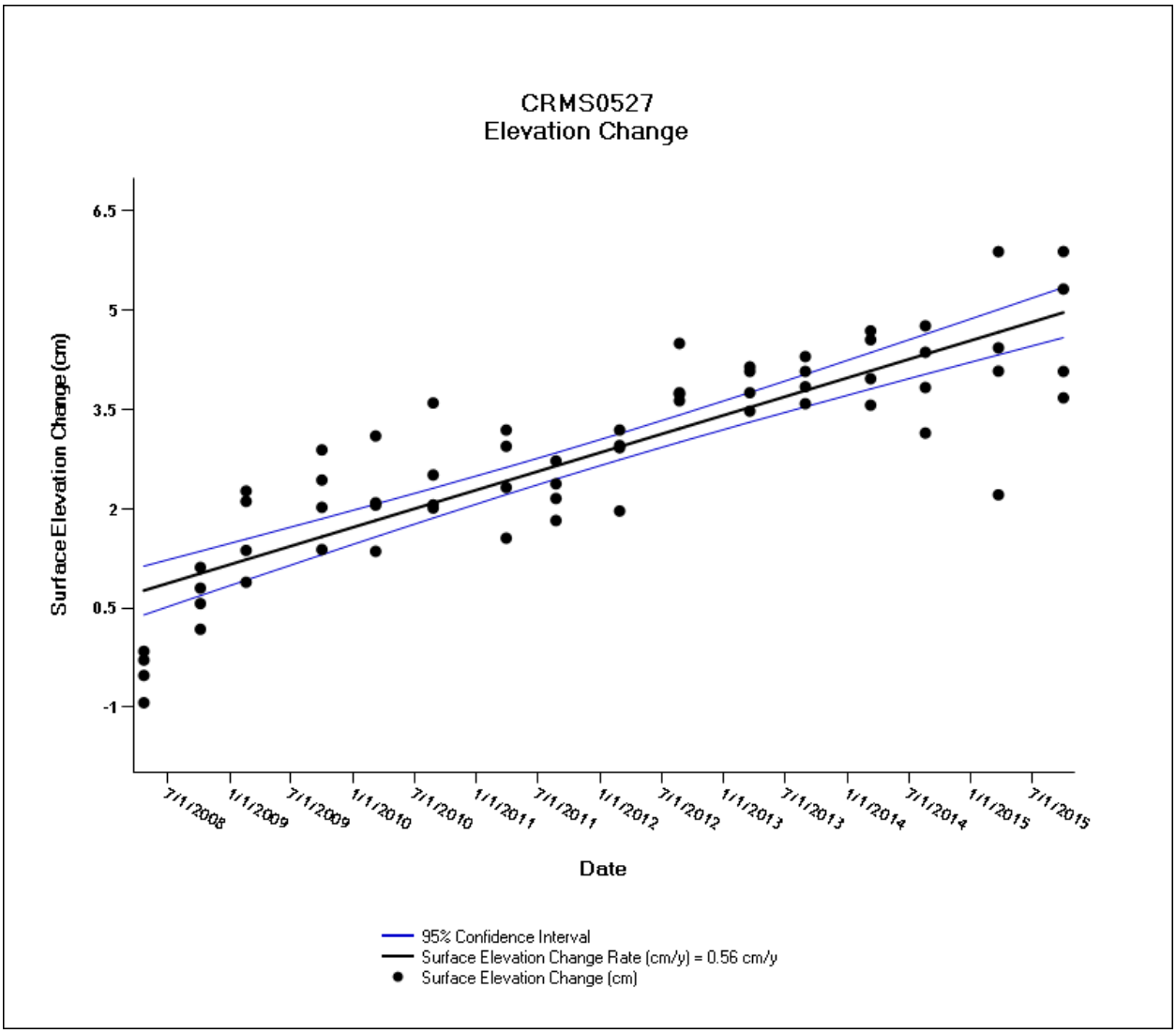


Figure 17. Elevation change per year at CRMS0527 (Reference).

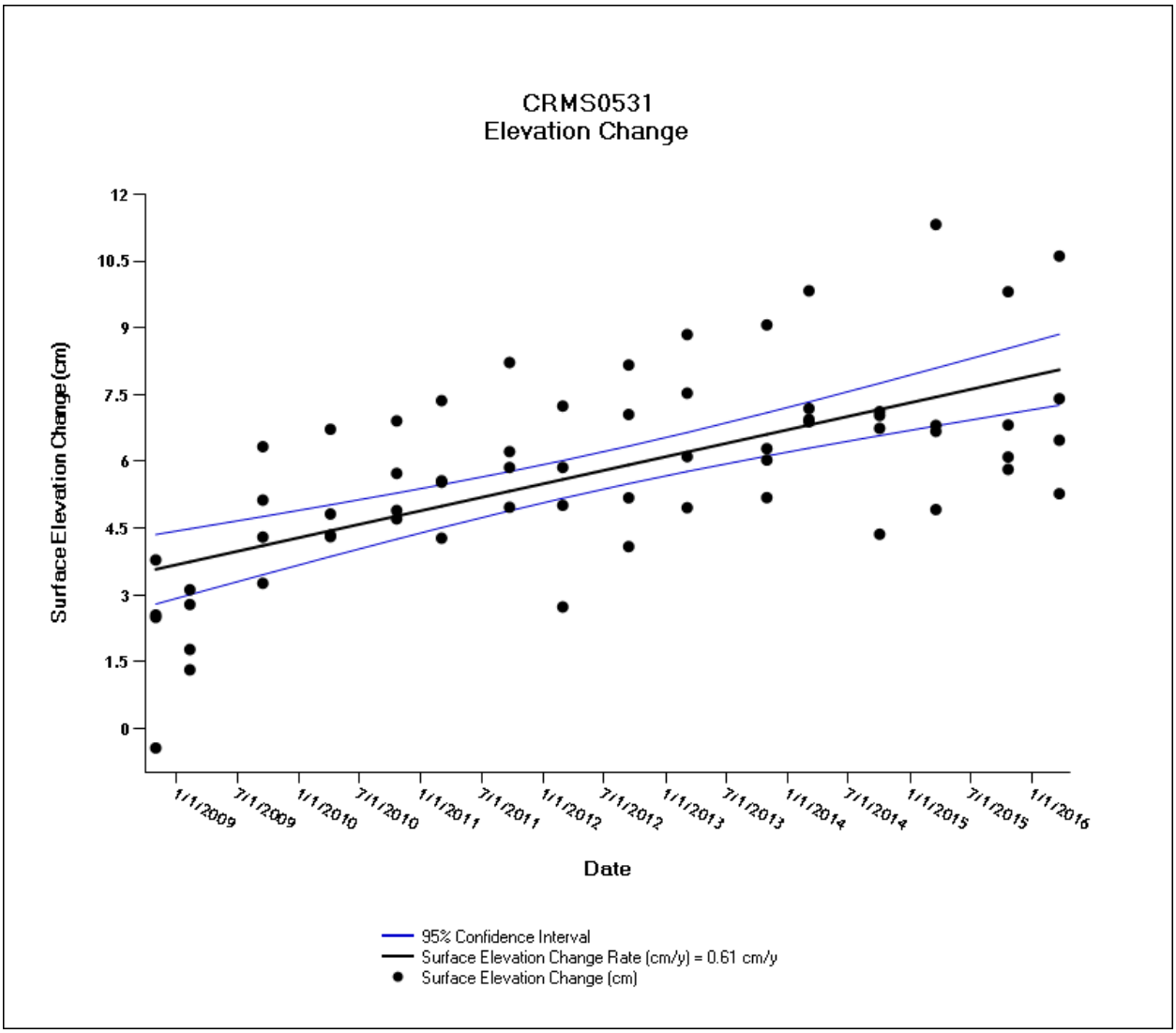


Figure 18. Elevation change per year at CRMS0531 (Reference).

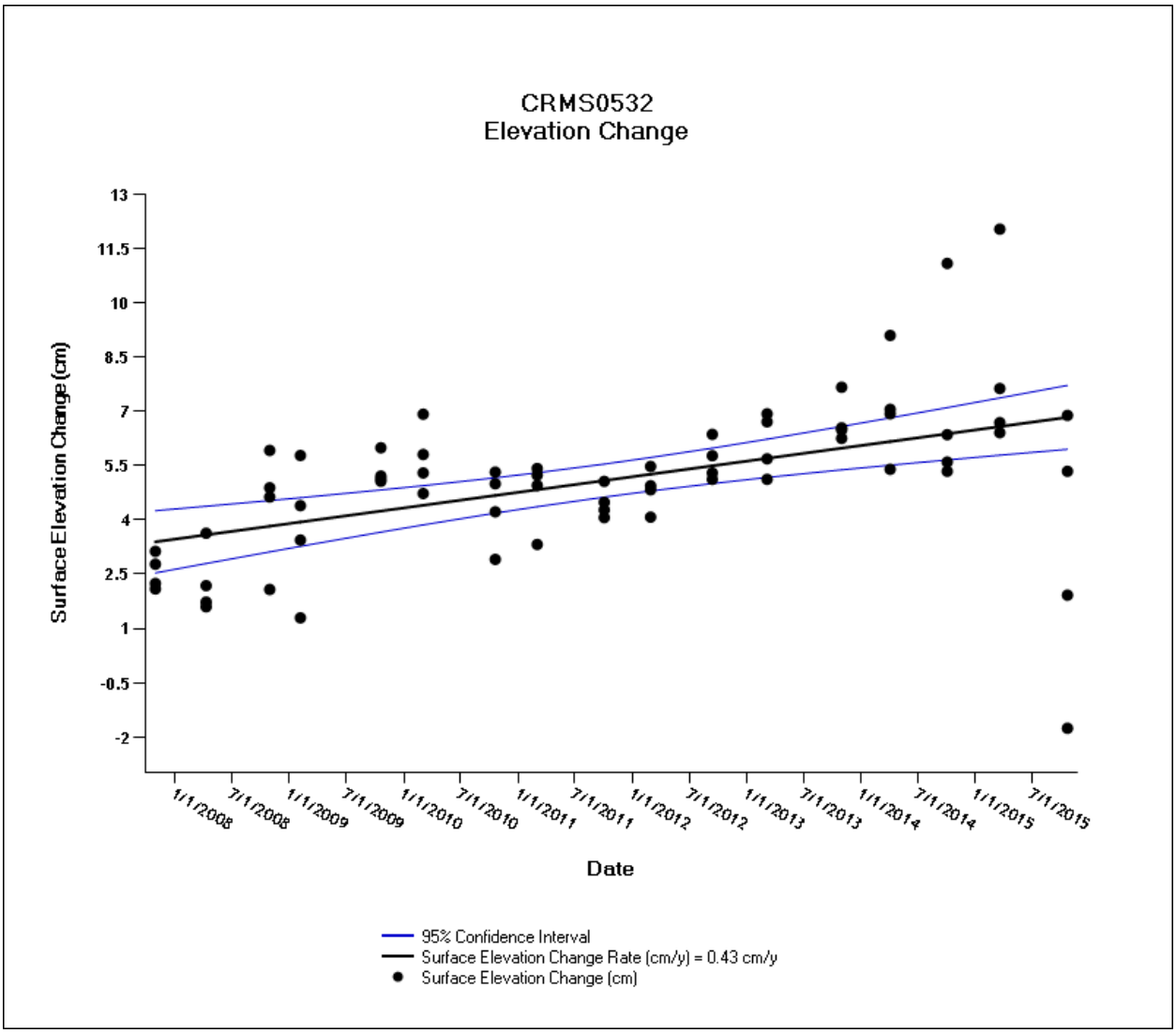


Figure 19. Elevation change per year at CRMS0532 (Project).

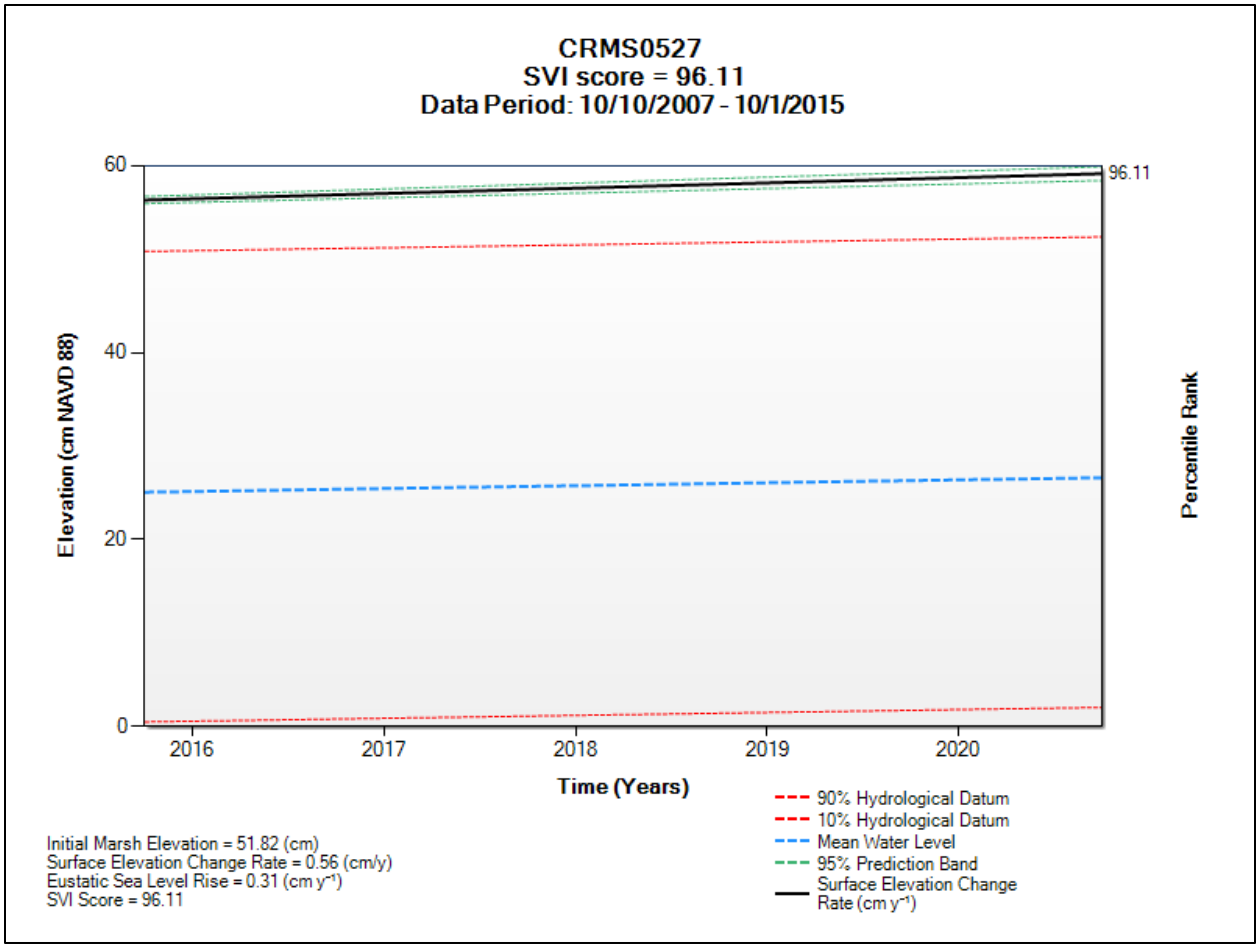


Figure 20. Submerged Vulnerability Index (SVI) of CRMS0527 (Reference).

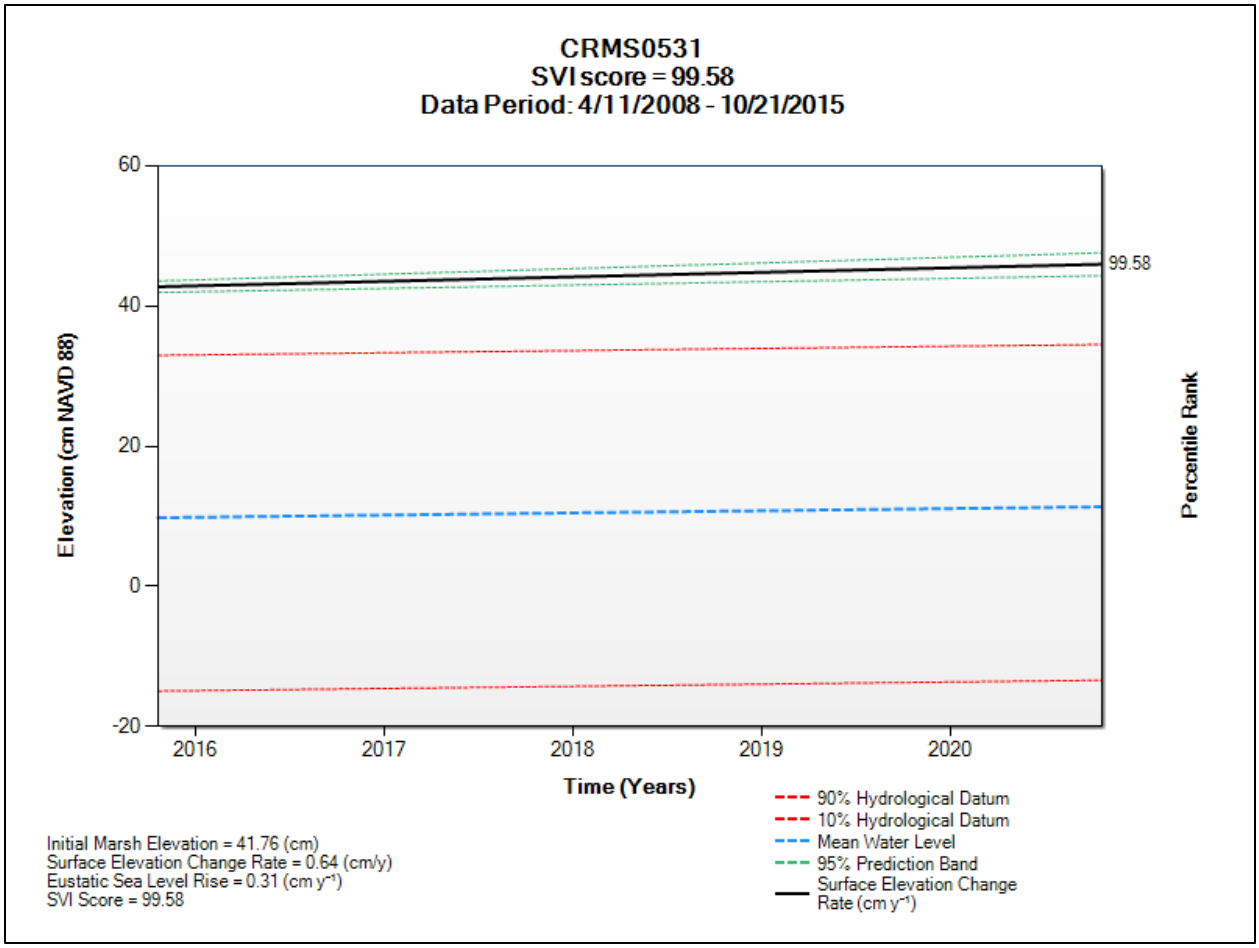


Figure 21. Submerged Vulnerability Index (SVI) of CRMS0531 (Reference).

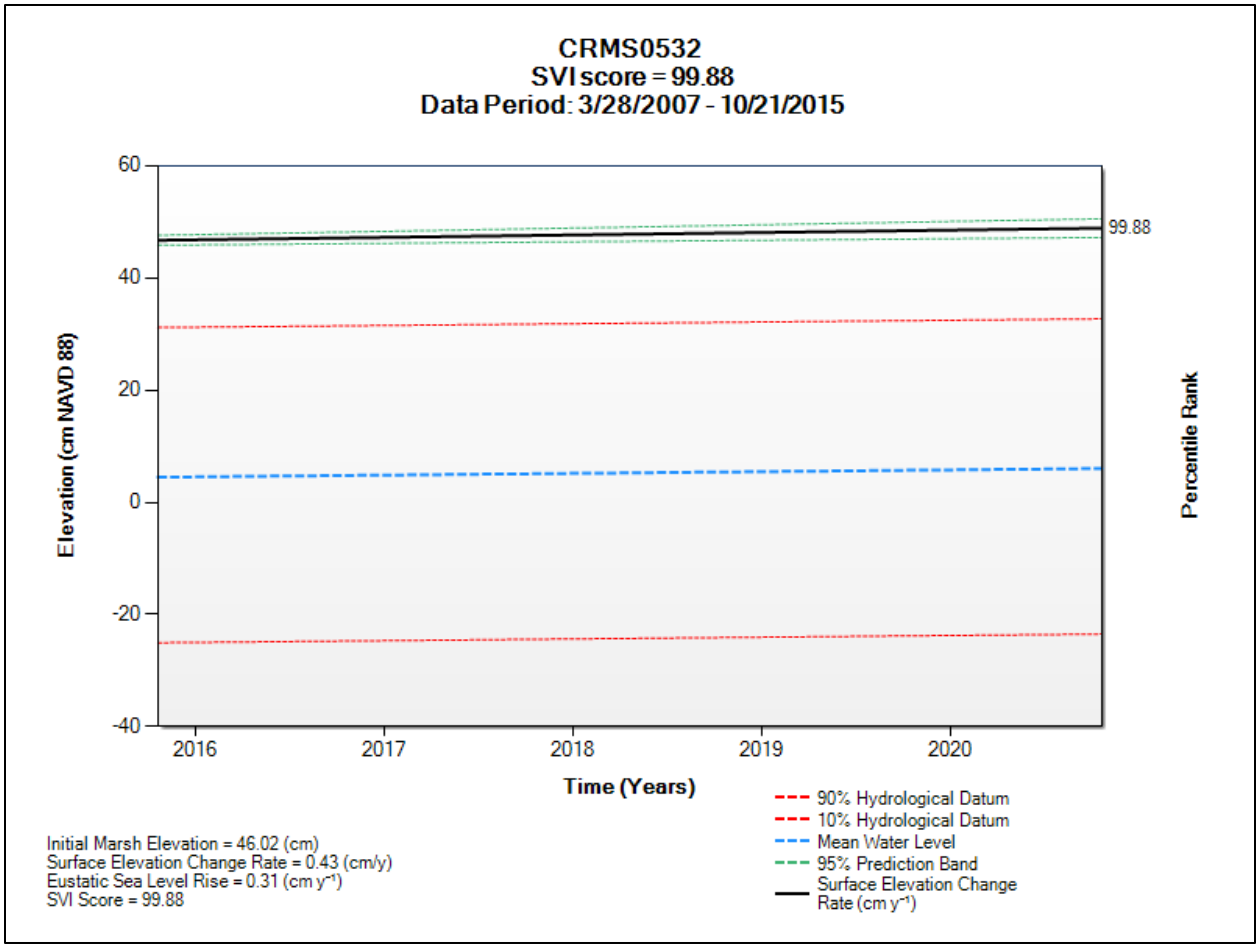


Figure 22. Submerged Vulnerability Index (SVI) of CRMS0532 (Project).

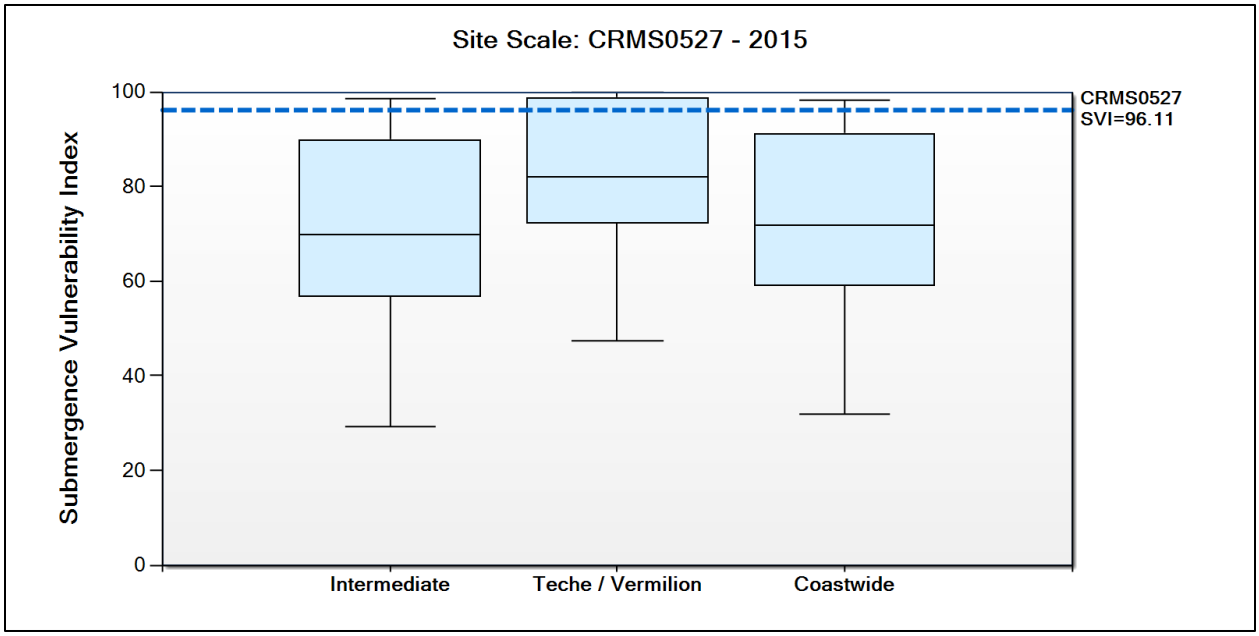


Figure 23. Submerged Vulnerability Index (SVI) of CRMS0527 (Reference) compared to multiple spatial scales to provide a reference for site performance.

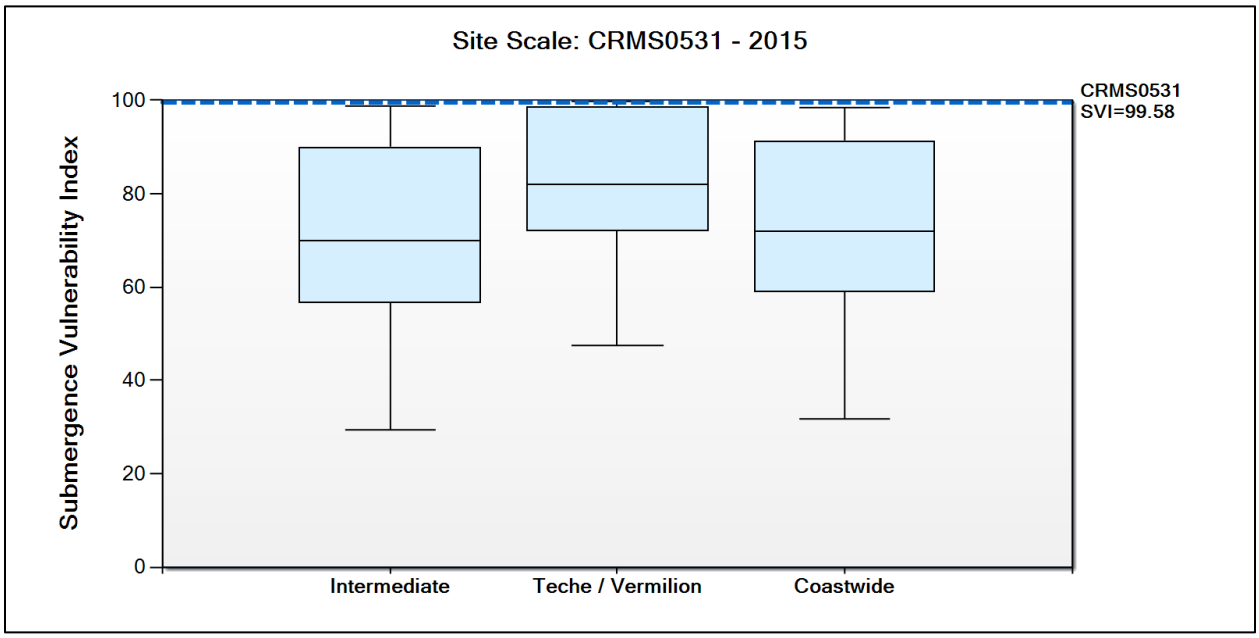


Figure 24. Submerged Vulnerability Index (SVI) of CRMS0531 (Reference) compared to multiple spatial scales to provide a reference for site performance.

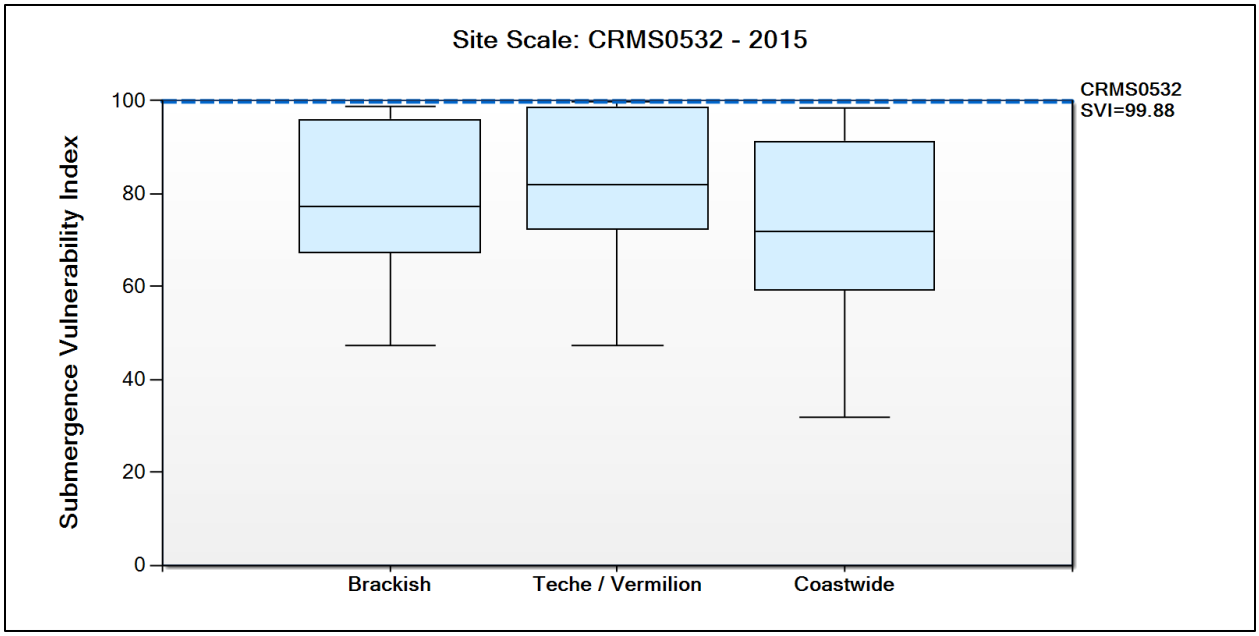


Figure 25. Submerged Vulnerability Index (SVI) of CRMS0532 (Project) compared to multiple spatial scales to provide a reference for site performance.

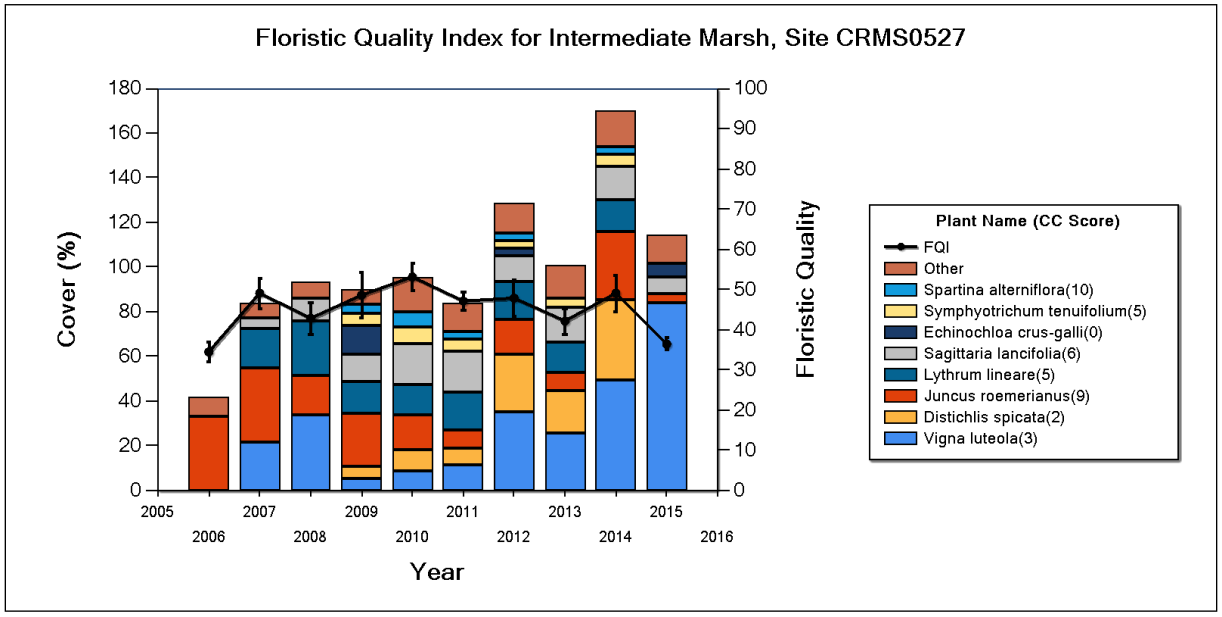


Figure 26. Vegetative composition and Floristic Quality Index for CRMS site 527 (reference site) since sampling began. Values are means of 10 stations within the site; therefore, the sum of percent coverage of individual species can be greater than 100 %.

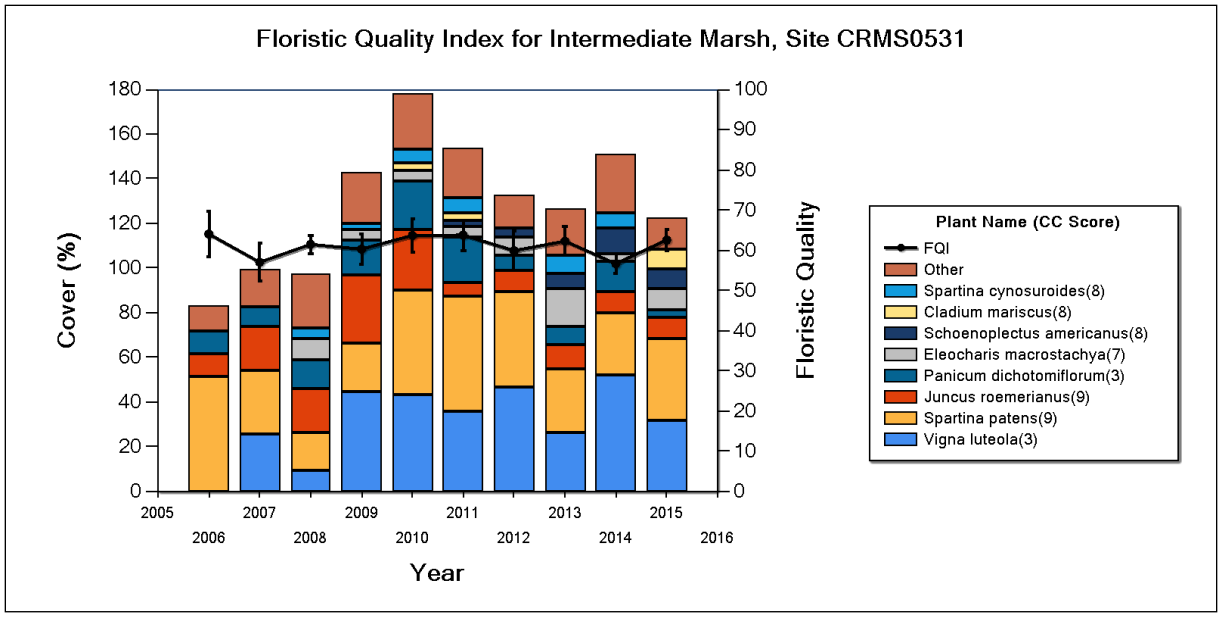


Figure 27. Vegetative composition and Floristic Quality Index for CRMS site 531 (reference site) since sampling began. Values are means of 10 stations within the site; therefore, the sum of percent coverage of individual species can be greater than 100 %.

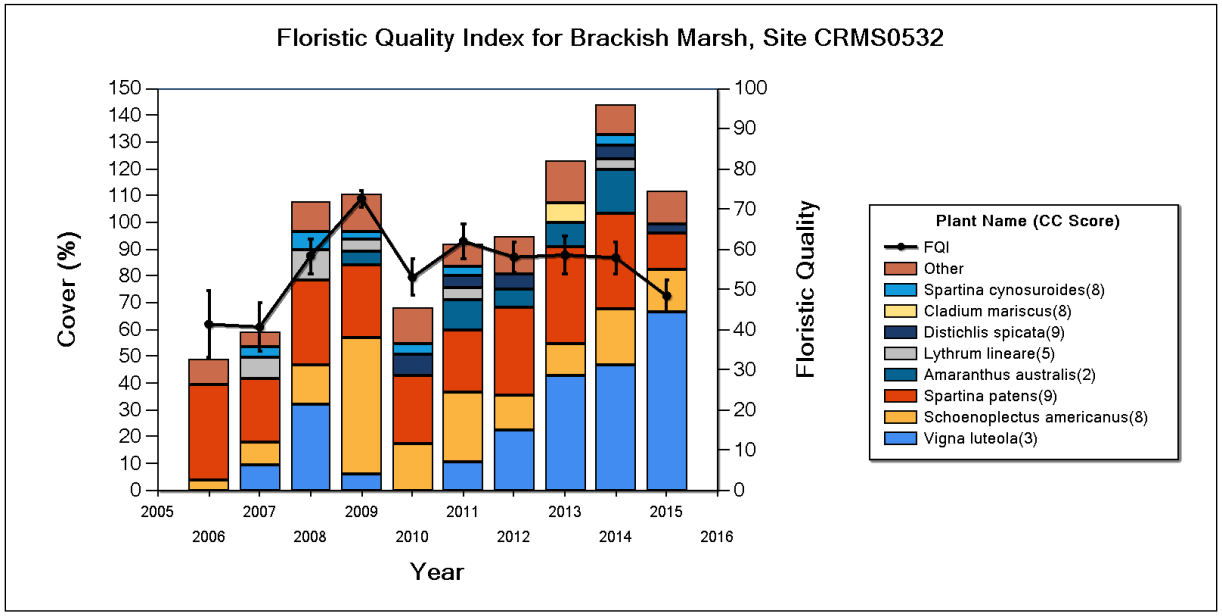


Figure 28. Vegetative composition and Floristic Quality Index for CRMS site 532 (project) since sampling began. Values are means of 10 stations within the site; therefore, the sum of percent coverage of individual species can be greater than 100 %.

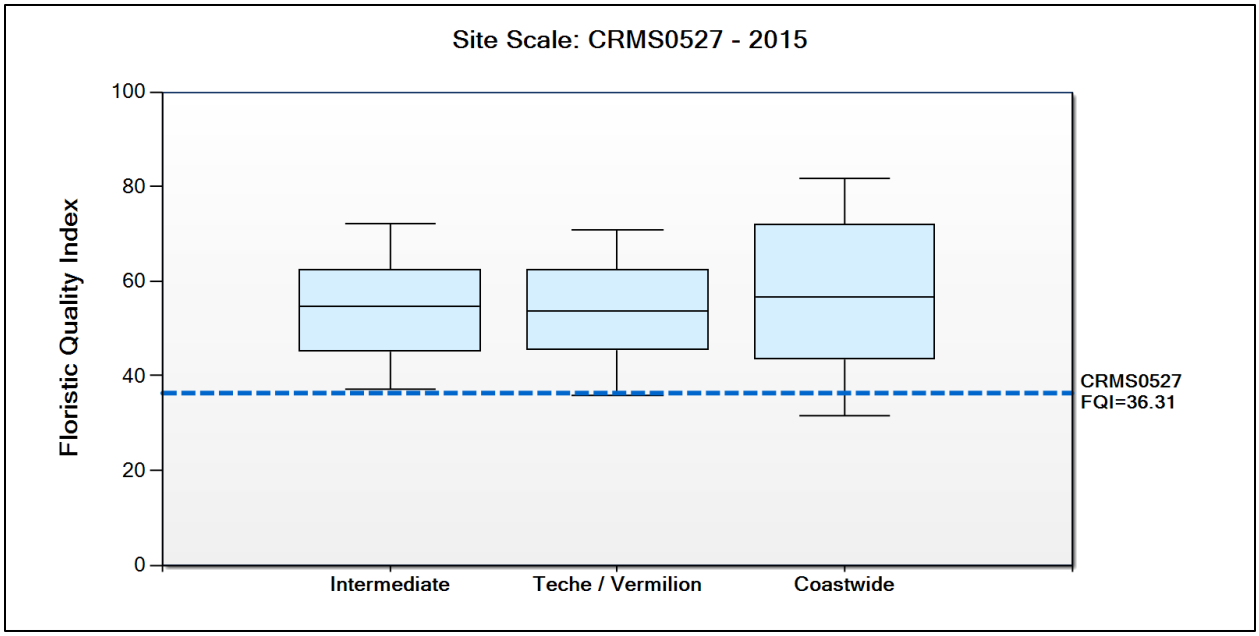


Figure 29. Floristic Quality Index (FQI) for CRMS0527 (Reference) in 2015 compared to the distribution of scores for all coastwide sites within the intermediate marsh type, within the Teche/Vermilion basin, and across the entire Louisiana coastal zone.

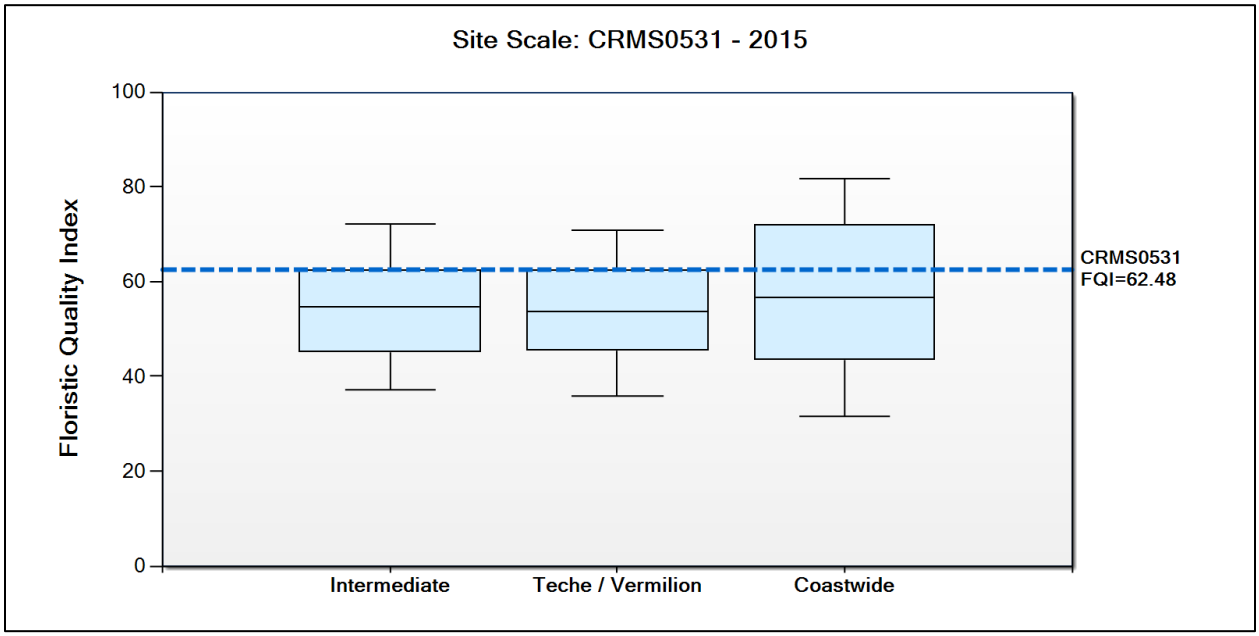


Figure 30. Floristic Quality Index (FQI) for CRMS0531 (Reference) in 2015 compared to the distribution of scores for all coastwide sites within the intermediate marsh type, within the Teche/Vermilion basin, and across the entire Louisiana coastal zone.

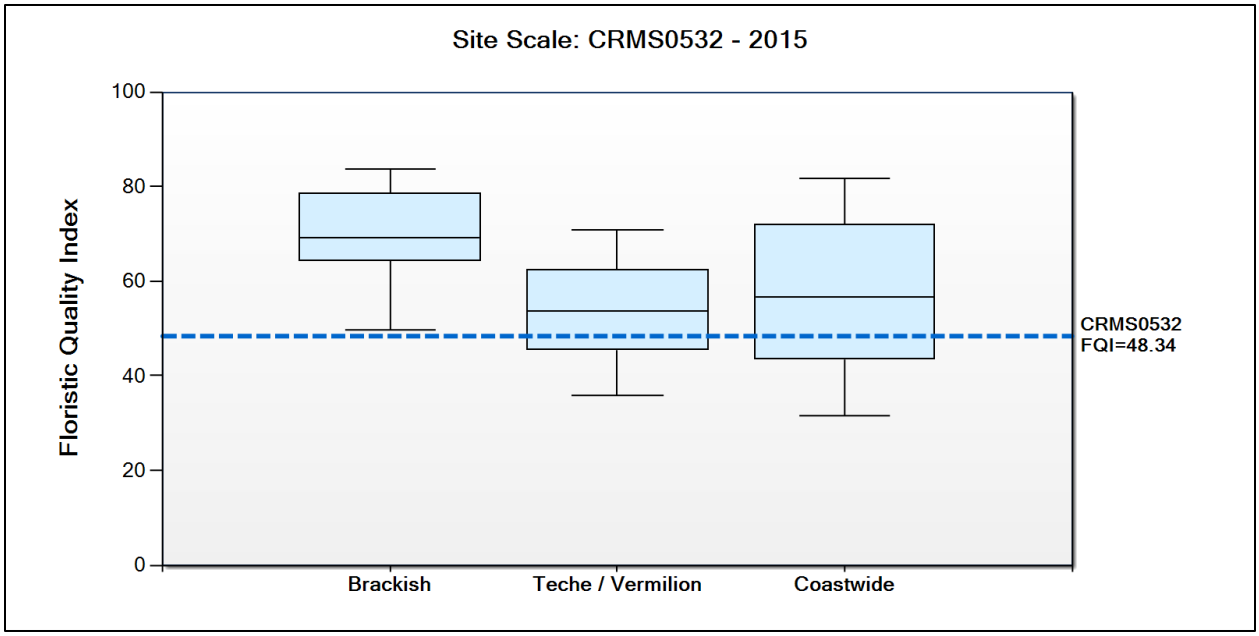
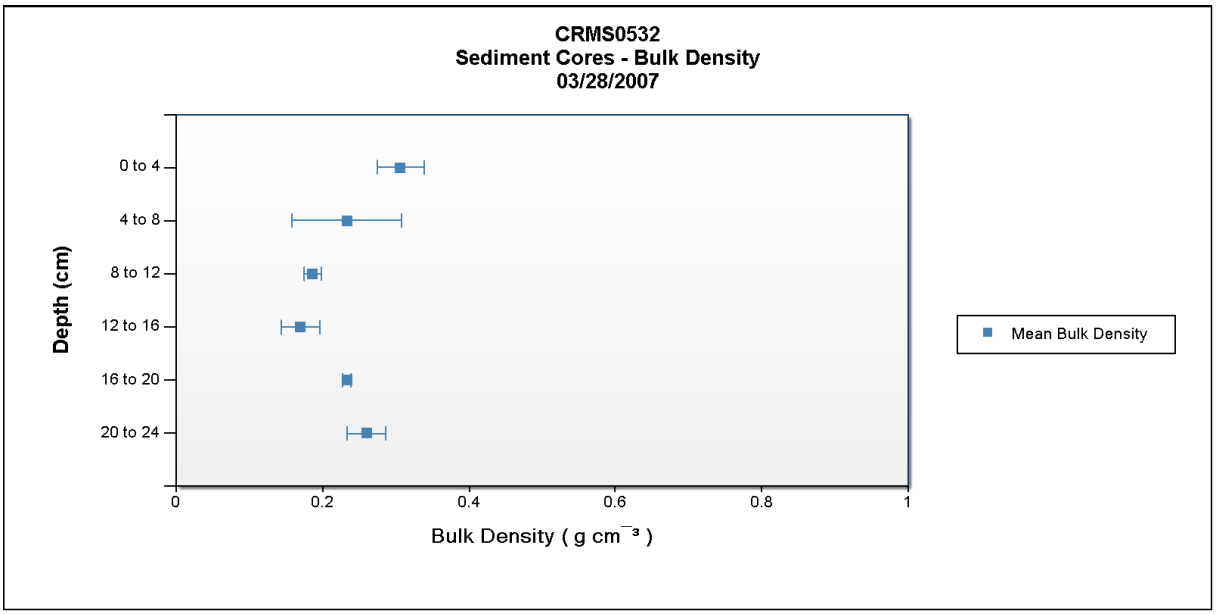
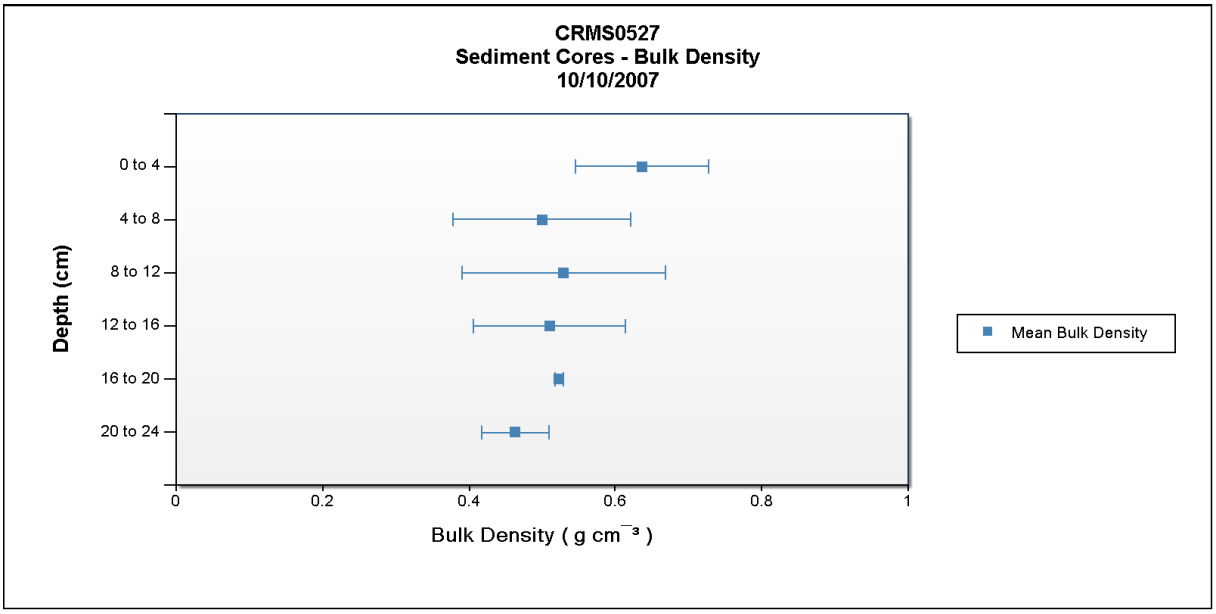
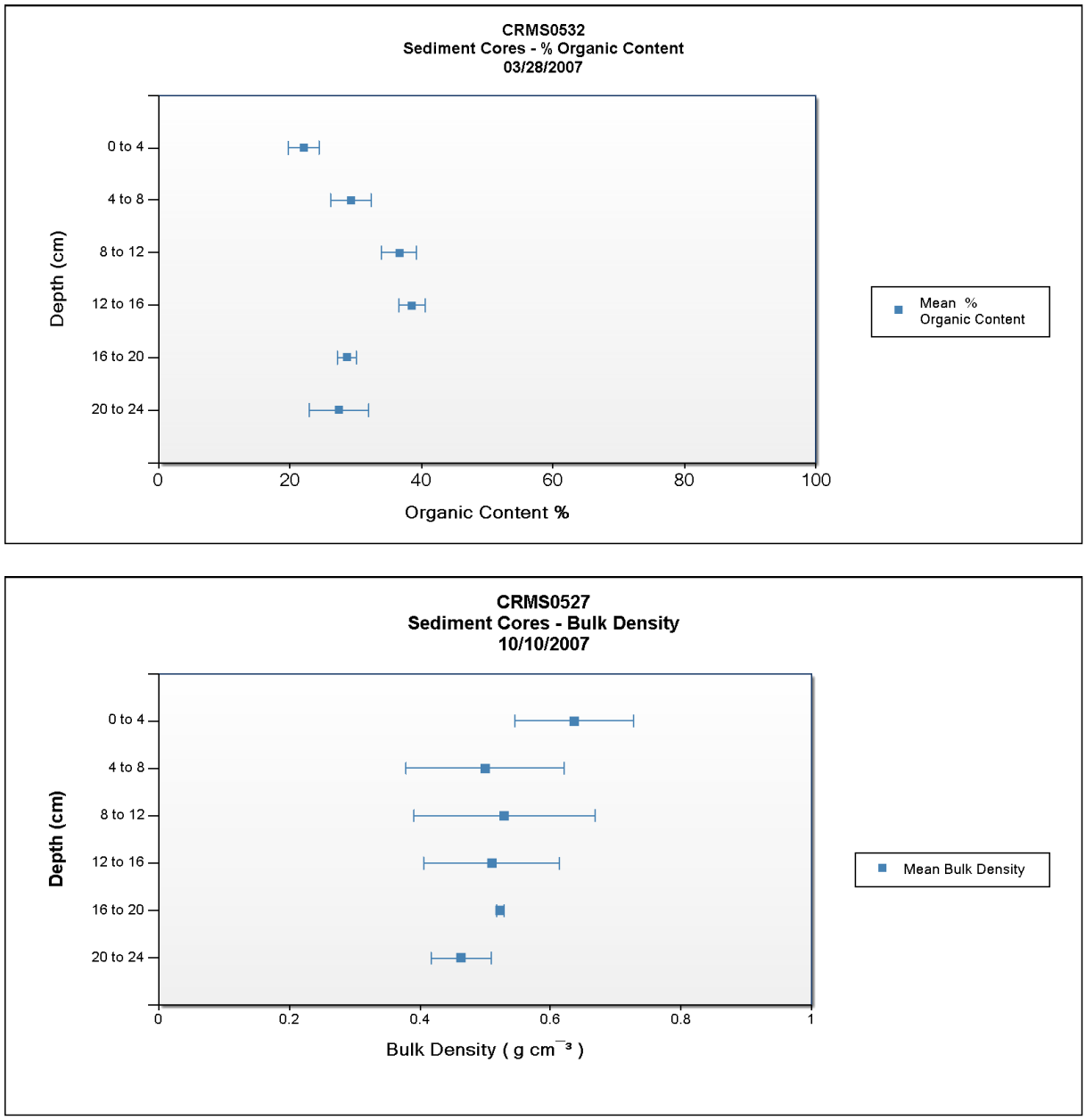


Figure 31. Floristic Quality Index (FQI) for CRMS0532 (Project) in 2015 compared to the distribution of scores for all coastwide sites within the intermediate marsh type, within the Teche/Vermilion basin, and across the entire Louisiana coastal zone.





Figures 32a and 32b. Soil bulk density comparison of CRMS0532 (project) and CRMS0527 (reference).



Figures 33a and 33b. Soil organic matter content comparison of CRMS0532 (project) and CRMS0527 (reference).

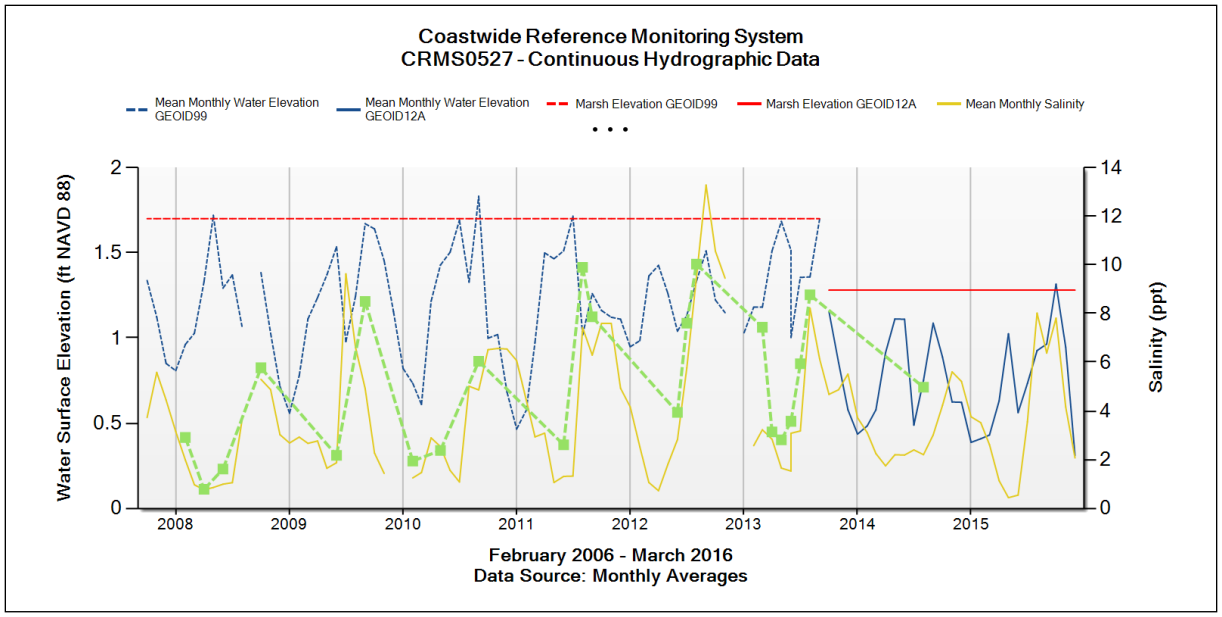


Figure 34. Surface water and soil porewater salinities for CRMS0527 (Reference).

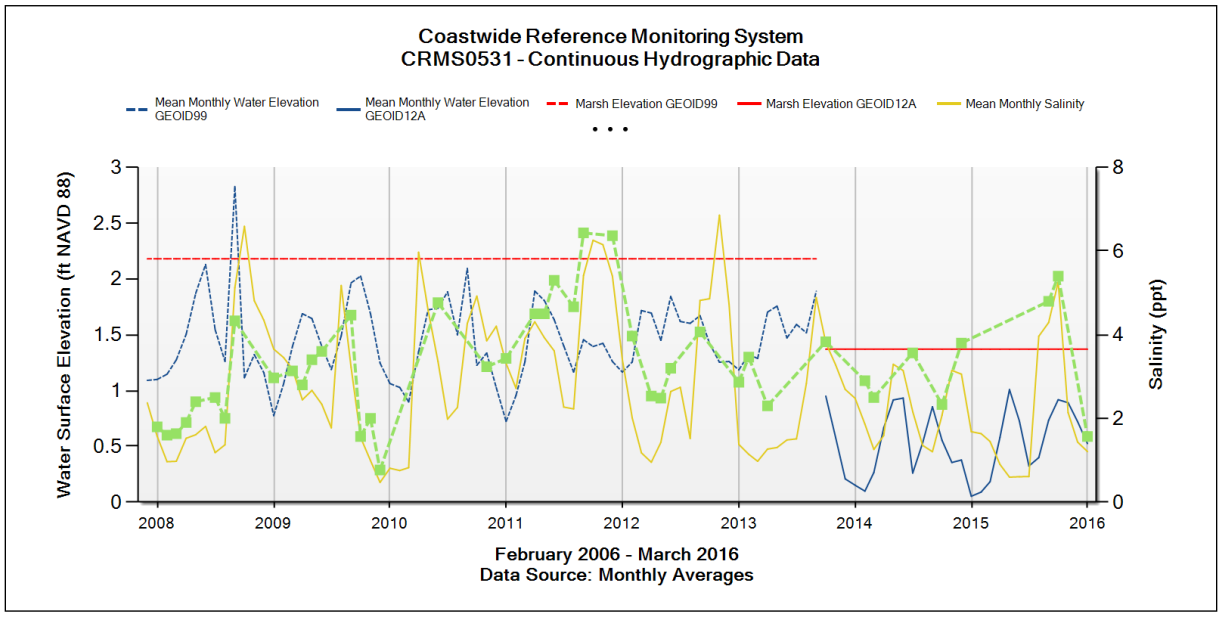


Figure 35. Surface water and soil porewater salinities for CRMS0531 (Reference).

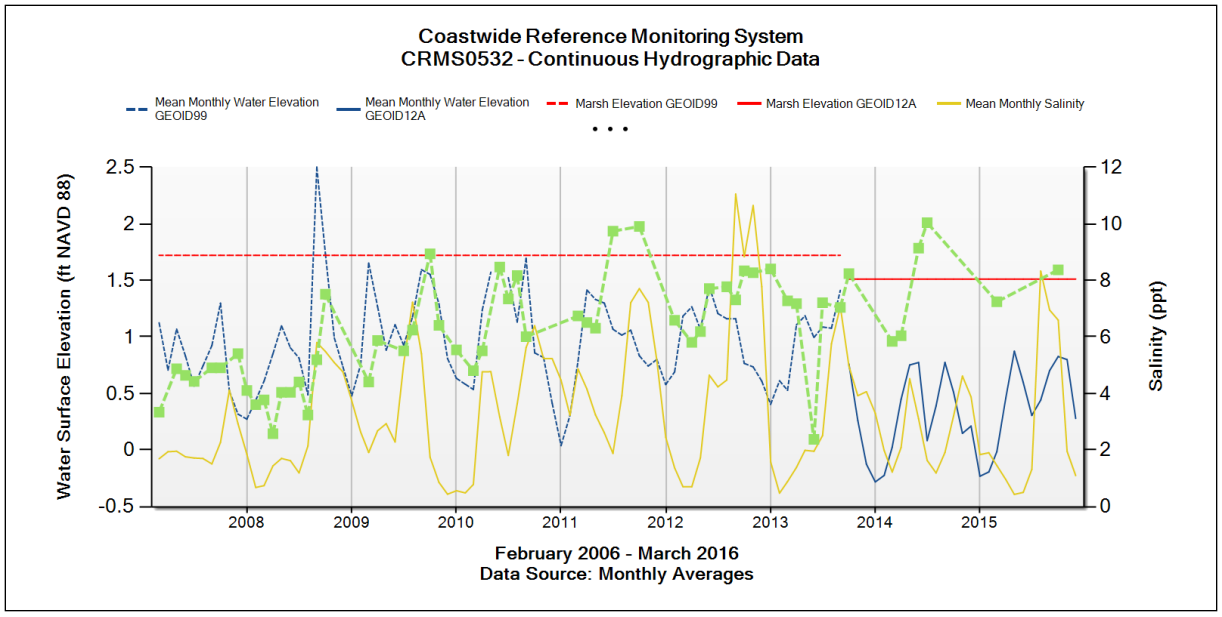


Figure 36. Surface water and soil porewater salinities for CRMS0532 (Project).

V. Conclusions

a. Project Effectiveness

Overall, the project appears to be maintaining its goals of protecting the shorelines of Vermilion Bay and the GIWW in the project area and reducing rapid water level variability. Percent land change in both the project area and reference areas have increased since 2006 (post-storms). In addition, shoreline erosion has also decreased along the Vermilion Bay shoreline since 2010.

The CRMS supplemental data indicates that the area is stable. CRMS0532 which is located within the project boundary has a hydrologic index similar to other brackish marshes in the area and has shown a rise in surface elevation. Percent vegetative cover has decreased since 2014 at CRMS0532, but is comparable to other brackish sites within the Teche/Vermilion basin.

From an engineering standpoint, the Oaks/Avery Canals Hydrologic Restoration Project features are in good condition and functioning as designed. The earthen plug on the Union Canal is doing well and does not require any maintenance at this time.

b. Recommended Improvements

Shoreline protection measures are recommended for those portions of the Vermilion Bay shoreline exhibiting the highest erosion rates in excess. In addition, it is imperative to have a better understanding of the factors causing the observed shoreline loss in this area of the project.

Operations staffs are exploring the possibility of extending the rock revetment to the west of the mouth of the Oaks Canal to protect the embankment created by the Vermilion Parish Drainage District. Additionally, rock would be added to the low area of the dike on the northern bank of the GIWW.

c. Lessons Learned

VI. Literature Cited

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APPENDIX A
(Inspection Photographs)

Photo No. 1, Rock along north bank of GIWW showing low area

Photo No. 2, Rock dike at Oaks Canal, west side

Photo No. 3, Rock dike at Oaks Canal, west side

Photo No. 4, Rock dike at Oaks Canal, East side

Photo No. 5, Rock dike at Oaks Canal, East side

Photo No. 6, Cow Path Structure

Photo No. 7, Rock plug gapped as part of maintenance event. (photo taken 07/02/2012)

Photo No. 8, Rock dike along south bank of GIWW

Photo No. 9, Spoilbank Maintenance along Oaks Canal

Photo No. 10, Earthen Canal Plug on Oaks Canal

Photo No. 11, Damage to levee on Oaks Canal

Photo No. 12, Earthen Canal plug on Union Canal

Photo No. 13, Earthen Canal plug on Union Canal

APPENDIX B
(Three Year Budget Projection)

OAKS-AVERY HYDROLOGIC RESTORATION/ TV13a / PPL 6

Three-Year Operations & Maintenance Budgets 07/01/2016 - 06/30/2019

Project Manager	O & M Manager	Federal Sponsor	Prepared By
Pat Landry	*Dion Broussard*	*NRCS*	*Dion Broussard*

	2016/2017 (-14)	2017/2018 (-15)	2018/2019 (-16)
Maintenance Inspection	$ 7,057.00	$ 7,269.00	$ 7,487.00
Structure Operation		$ -	$ -
State Administration		$ 5,000.00	$ -
Federal Administration		$ 5,000.00	$ -
Maintenance/Rehabilitation			

16/17 Description: E&D for rock armoring and capping

E&D	$ 44,299.00
Construction	$ -
Construction Oversight	$ -
Sub Total - Maint. And Rehab.	$ 44,299.00

17/18 Description: Rock armor at bay shore and cap rock dike at GIWW.

E&D	$ -	
Construction	$ 279,000.00	(Incl. 25% Cont.)
Construction Oversight	$ 32,257.00	
Sub Total - Maint. And Rehab.	$ 311,257.00	

18/19 Description:

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

	2016/2017 (-14)	2017/2018 (-15)	2018/2019 (-16)
Total O&M Budgets	**$ 51,356.00**	**$ 328,526.00**	**$ 7,487.00**

O &M Budget (3 yr Total)	**$ 387,369.00**
Unexpended O & M Budget	**$ 264,447.00**
Remaining O & M Budget (Projected)	**$ (122,922.00)**

OAKS-AVERY HYDROLOGIC RESTORATION/ TV13a / PPL 6

Three-Year Operations & Maintenance Budgets 07/01/2011 - 06/30/2014

Project Manager	O & M Manager	Federal Sponsor	Prepared By
Darrell Pontiff	*Darrell Pontiff*	*NRCS*	*Darrell Pontiff*

	2011/2012 (-9)	2012/2013 (-10)	2013/2014 (-11)
Maintenance Inspection	$ 6,086.00	$ 6,269.00	$ 6,457.00
Structure Operation		$ -	$ -
Administration	$5,000.00	$ -	$ -
Maintenance/Rehabilitation			

11/12 Description: Add staff gage at Cow Path Structure, Oaks Canal repairs, Earthen Plug Construction

Note: E&D includes $5,000 for staff gage installation

E&D	$10,000.00
Construction	$130,625.00
Construction Oversight	$10,000
Sub Total - Maint. And Rehab.	$ 150,625.00

09/10 Description

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

10/11 Description:

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

	2011/2012 (-9)	2012/2013 (-10)	2013/2014 (-11)
Total O&M Budgets	**$ 161,711.00**	**$ 6,269.00**	**$ 6,457.00**

O &M Budget (3 yr Total)	**$ 174,437.00**
Unexpended O & M Budget	**$ 196,641.00**
Remaining O & M Budget (Projected)	**$ 22,204.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET

OAKS/AVERY HR / PROJECT NO. TV-13A / PPL NO. 6 / 2016-2017

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$7,057.00	**$7,057.00**
Nav Aid Inspection	LUMP	0	$0.00	**$0.00**
Engineering and Design	LUMP	1	$44,299.00	**$44,299.00**
Operations Contract	LUMP	0	$0.00	**$0.00**
Construction Oversight	LUMP	0	$0.00	**$0.00**

ADMINISTRATION

STATE Admin.	LUMP	0	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	0	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:					
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Rock Dike	0	0.0	0	$0.00	$0.00
Bank Paving	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$8.00	$0.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		LUMP	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)		LF	0	$0.00	$0.00
Timber Piles (each or lump sum)		EACH	0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	0	$0.00	$0.00
Materials		LUMP	0	$0.00	$0.00
Mob / Demob		LUMP	0	$0.00	$0.00
Contingency (25%)		LUMP	0	$0.00	$0.00
General Structure Maintenance		LUMP	0	$0.00	$0.00
Vegetative Plantings		LUMP	0	$0.00	$0.00
Whalers		LF	0	$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$51,356.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET

OAKS/AVERY HR / PROJECT NO. TV-13A / PPL NO. 6 / 2017-2018

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$7,269.00	**$7,269.00**
Nav Aid Inspection	LUMP	0	$0.00	**$0.00**
Engineering and Design	LUMP	0	$0.00	**$0.00**
Operations Contract	LUMP	0	$0.00	**$0.00**
Construction Oversight	LUMP	1	$32,257.00	**$32,257.00**

ADMINISTRATION

STATE Admin.	LUMP	1	$5,000.00	$5,000.00
FEDERAL SPONSOR Admin.	LUMP	1	$5,000.00	$5,000.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$10,000.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION: Rock armoring at bay shore and cap rock dike at GIWW

Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Rock Dike	350	4.0	1,400	$85.00	$119,000.00
Bank Paving	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	525	$8.00	$4,200.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		LUMP	1	$50,000.00	$50,000.00
Sheet Piles (Lin Ft or Sq Yds)		LF	0	$0.00	$0.00
Timber Piles (each or lump sum)		EACH	0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	0	$0.00	$0.00
Materials		LUMP	0	$0.00	$0.00
Mob / Demob		LUMP	1	$50,000.00	$50,000.00
Contingency (25%)		LUMP	1	$55,800.00	$55,800.00
General Structure Maintenance		LUMP	0	$0.00	$0.00
Vegetative Plantings		LUMP	0	$0.00	$0.00
Whalers		LF	0	$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$279,000.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$328,526.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET

OAKS/AVERY HR / PROJECT NO. TV-13A / PPL NO. 6 / 2018-2019

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$7,487.00	**$7,487.00**
Nav Aid Inspection	LUMP	0	$0.00	**$0.00**
Engineering and Design	LUMP	0	$0.00	**$0.00**
Operations Contract	LUMP	0	$0.00	**$0.00**
Construction Oversight	LUMP	0	$0.00	**$0.00**

ADMINISTRATION

STATE Admin.	LUMP	0	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	0	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION: Construct 756 LF of rock dike extension either side of Boston Canal.

Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Rock Dike	0	0.0	0	$0.00	$0.00
Bank Paving	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$8.00	$0.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		LUMP	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)		LF	0	$0.00	$0.00
Timber Piles (each or lump sum)		EACH	0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	0	$0.00	$0.00
Materials		LUMP	0	$0.00	$0.00
Mob / Demob		LUMP	0	$0.00	$0.00
Contingency (25%)		LUMP	0	$0.00	$0.00
General Structure Maintenance		LUMP	0	$0.00	$0.00
Vegetative Plantings		LUMP	0	$0.00	$0.00
Whalers		LF	0	$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$7,487.00**

APPENDIX C
(Field Inspection Notes)

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: TV-13a Oaks/Avery Canal Hydrologic Restoration — Date of Inspection: June 18, 2014 Time: 10:30 am

Structure No. N/A — Inspector(s): Dion Broussard, Stan Aucoin, Bernard Wood (CPRA)
Loland Broussard, Dale Garber, Brandon Samson, Cody Lafleur (NRCS

Structure Description: Earthen canal plug (Union Canal)

Water Level

Type of Inspection: Annual — Weater Conditions: sunny and warm

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Vegetation	Good			12-13	Vegetation Flourishing.
Signage /Supports	N/A				
Rip Rap/dike	N/A				
Eathern Embankment	Good			12-13	The earthen canal plug had experienced settlement intially, but is in good condition and does not require maintenance at this time.

What are the conditions of the existing levees?
Are there any noticable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: TV-13a Oaks/Avery Canal Hydrologic Restoration

Date of Inspection: June 18, 2014 Time: 10:30 am

Structure No. N/A

Inspector(s): Dion Broussard, Stan Aucoin, Bernard Wood (CPRA)
Loland Broussard, Dale Garber, Brandon Samson, Cody Lafleur (NRCS)

Structure Description: Spoilbank Maintenance (Oaks Canal)

Water Level

Type of Inspection: Annual

Weater Conditions: sunny and warm

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Vegetation	Good			9-11	Vegetation Flourishing.
Signage /Supports	N/A				
Rip Rap (fill)	N/A				
Earthen Embankment	Good			9-11	Spoilbank is built up to +5' elevation or greater. Earthen canal plug has received additional dredge material from maintenance work done by the Vermilion Parish Gravity Drainage District. Earthen canal plug is stable.

What are the conditions of the existing levees?
Are there any noticeable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: TV-13a Oaks/Avery Canal Hydrologic Restoration

Date of Inspection: June 18, 2014 Time: 10:30 am

Structure No. N/A

Inspector(s): Dion Broussard, Stan Aucoin, Bernard Wood (CPRA)
Loland Broussard, Dale Garber, Brandon Samson, Cody Lafleur (NRCS)

Structure Description: Shoreline vegetation

Water Level

Type of Inspection: Annual

Weater Conditions: sunny and warm

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Vegetation	Good				Only vegetation inspected was along either side of the mouth of the Oaks Canal.
Signage /Supports	N/A				
Rip Rap (fill)	N/A				
Earthen Embankment	N/A				

What are the conditions of the existing levees?
Are there any noticeable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: TV-13a Oaks/Avery Canal Hydrologic Restoration

Date of Inspection: June 18, 2014 Time: 10:30 am

Structure No. N/A

Inspector(s): Dion Broussard, Stan Aucoin, Bernard Wood (CPRA)
Loland Broussard, Dale Garber, Brandon Samson, Cody Lafleur (NRCS)

Structure Description: Rock dike along southern bank of GIWW

Water Level

Type of Inspection: Annual

Weater Conditions: sunny and warm

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Vegetation	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Excellent			8	Rock dike is in good condition.
Eathern Embankment	N/A				

What are the conditions of the existing levees?
Are there any noticable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: TV-13a Oaks/Avery Canal Hydrologic Restoration

Date of Inspection: June 18, 2014 Time: 10:30 am

Structure No. N/A

Inspector(s): Dion Broussard, Stan Aucoin, Bernard Wood (CPRA)
Loland Broussard, Dale Garber, Brandon Samson, Cody Lafleur (NRCS)

Structure Description: Rock plug

Water Level

Type of Inspection: Annual

Weater Conditions: sunny and warm

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Vegetation	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Poor				Not inspected on this trip. No access to rock plug. No longer a necessary project feature.
Eathern Embankment	N/A				

What are the conditions of the existing levees?
Are there any noticable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: TV-13a Oaks/Avery Canal Hydrologic Restoration

Date of Inspection: June 18, 2014 Time: 10:30 am

Structure No. N/A

Inspector(s): Dion Broussard, Stan Aucoin, Bernard Wood (CPRA)
Loland Broussard, Dale Garber, Brandon Samson, Cody Lafleur (NRCS)

Structure Description: Spoilbank Maintenance Union Canal

Water Level

Type of Inspection: Annual

Weater Conditions: sunny and warm

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Vegetation	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	N/A				
Eathern Embankment	Excellent				Spoilbank looks great. Difficult to differentiate repaired section from established sections.

What are the conditions of the existing levees?
Are there any noticable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: TV-13a Oaks/Avery Canal Hydrologic Restoration

Date of Inspection: June 18, 2014 Time: 10:30 am

Structure No. Cowpath Structure

Inspector(s): Dion Broussard, Stan Aucoin, Bernard Wood (CPRA)
Loland Broussard, Dale Garber, Brandon Samson, Cody Lafleur (NRCS)

Structure Description: Fixed crest weir

Water Level

Type of Inspection: Annual

Weater Conditions: sunny and warm

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	Excellent			6	
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	Good			6	
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	Excellent				
Vegetation	N/A				
Signage /Supports	Excellent			6	
Rip Rap (fill)	N/A				
Eathern Embankment	Excellent				

What are the conditions of the existing levees?
Are there any noticable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: TV-13a Oaks/Avery Canal Hydrologic Restoration

Date of Inspection: June 18, 2014 Time: 10:30 am

Structure No. N/A

Inspector(s): Dion Broussard, Stan Aucoin, Bernard Wood (CPRA)
Loland Broussard, Dale Garber, Brandon Samson, Cody Lafleur (NRCS)

Structure Description: rock paving at Oaks Canal

Water Level

Type of Inspection: Annual

Weater Conditions: sunny and warm

Item	Condition	Pysical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Vegetation	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Excellent			2-5	Rock in excellent condition.
Eathern Embankment	N/A				

What are the conditions of the existing levees?
Are there any noticable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?