State of Louisiana

Coastal Protection and Restoration Authority (CPRA)

2014 Operations, Maintenance, and Monitoring Report

for

Freshwater Bayou Canal Wetland Protection

State Project Number ME-04
Priority Project List 2

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Vermilion Parish

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For
Freshwater Bayou Wetland Protection (ME-04)

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Preface

The 2014 OM&M Report format combines the Operations and Maintenance annual project inspection information with the Monitoring data and analyses for the project. This report includes monitoring data collected through December 2013 and annual Maintenance Inspections through May 2012.

The 2014 report is the 4th in a series of OM&M reports. For additional information on lessons learned, recommendations and project effectiveness please refer to previous OM&M reports (2007 and 2011), annual O&M inspection reports (2005-2013), progress reports (five early monitoring reports, 1995-1999), and comprehensive monitoring reports (2000 and 2005) on the CPRA web site (http://lacoast.gov/new/Projects/Info.aspx?num=ME-04).

I. Introduction

The Freshwater Bayou wetlands project area encompasses 36,928 ac (14,945 ha) of fresh, intermediate, and brackish marsh located between Intracoastal City and Pecan Island in Vermilion Parish, Louisiana (Figure 1). Centered approximately at Lat. 29E 40' 00" N and Long. 92E 18' 00" W, the area is bounded on the north by the old Intracoastal Waterway (Schooner Bayou), on the west by LA Hwy 82 and the Acadiana Marina Canal, on the south by Humble Canal (Acadiana Marina Canal), and on the east by Freshwater Bayou Canal.

The project plan (USDA/SCS 1994) divides the project area into three Conservation Treatment Units (CTU's), with CTU 1 and 3 benefiting directly from the shoreline protection work implemented under Phase 1 of the project which was completed in 1995 (Figure 1). Phase 2 of this CWPPRA project authorized the installation of eight box-type water control structures with a single flapgate, a variable-crest weir, and two fixed-crest weirs (one with a 4 inch vertical slot) in the project area. Three structures are located in CTU 1, three in CTU 2, and two in CTU 3 and they were completed in June of 1998. A number of water control structures were already in place prior to the project. Additional structures were installed by the landowner at the landowner's expense, to enhance the operation of the eight CWPPRA structures.

The ME-04 project area has undergone many vegetation transitions since data collection in the area began in 1949 when the area was a nearly equal mix of brackish and intermediate vegetation. At the time of construction of the rock dike the project area had shifted to mostly fresh marsh with intermediate areas to the south and east. The southernmost unit, CTU 1, consisted of 13,800 ac (5,585 ha) of predominantly fresh marsh with zones of intermediate and brackish marsh along its eastern and southern boundaries. It was predominantly a *Sagittaria lancifolia* (bull tongue) and *Spartina patens* (wiregrass) marsh. Ponds ranged in depth from 1.7-2.0 ft (0.52 - 0.61 m), and contain over 50% cover with aquatic plants (USDA/SCS 1994). The Phase 1 dike was designed to protect the eastern edge of CTU 1 from wave erosion and possible salt water intrusion from Freshwater Bayou Canal. CTU 2 consisted of 9,300 ac (3,764 ha) of fresh marsh, dominated by *Echinochloa walteri* (Walter's millet) and *S. lancifolia*, located in the west central portion of the project area. Pond depths ranged from 1.7-2.3 ft (0.52 - 0.70 m). The northern section of the project area comprises

CTU 3, which consisted of 13,800 ac (5,585 ha) of predominantly fresh marsh dominated by *S. lancifolia*, *E. walteri*, and *Alternanthera philoxeroides* (alligatorweed), with intermediate and brackish marsh zones dominated by *Spartina patens* and *Schoenoplectus americanus* (Chairmaker's bulrush) along its eastern boundary along Freshwater Bayou Canal. Pond depths ranged from 2.2-3.0 ft (0.67 - 0.91 m) in CTU 3. Subsequently the project area has transitioned slowly to an almost completely intermediate marsh with some brackish locations to the south and east along Freshwater Bayou Canal.

Reference areas R1 and R2 (Figure 1) were established to monitor shoreline erosion along two 0.5 mi (0.8 km) segments of unprotected shoreline located along the east bank of Freshwater Bayou Canal, opposite the south end (R1) and the north end (R2) of the ME-04 rock dike. These two reference areas were used for comparison with erosion rates along the section of canal bank protected by the ME-04 rock dike within CTU 1. The vegetation type is identical to the project area, and like the project area shoreline, the reference area R1 and R2 shorelines include both intact and deteriorated sections of spoil bank. Reference area R3 is representative of what much of the fresh marsh in the northwest section of the project area resembled prior to 2005, in terms of soil type, salinity, water levels, and the frequency and duration of inundation. Reference area R4 is a small tidally influenced area of brackish marsh just outside the boundary of CTU 1. Marsh loss rates were monitored by comparison of all four reference areas with all three CTUs.

Wetlands in the project area are adversely affected by the influence of high water levels from the Mermentau Lakes Sub basin to the west, where elevated water levels are artificially maintained by several locks and water control structures for navigation and agricultural purposes (LWCRTF 1993). Water flowing out of White Lake can enter the project area from the west via oil field canals, the borrow canals and culverts under LA Hwy 82, and from the north via natural openings along the south bank of Schooner Bayou.

Some wetland acreage in the project area was lost through the dredging of oil field access canals and localized erosion. However, most wetland loss in the project area has resulted from hurricane degradation converting fresh and intermediate marsh to open water, mainly between 1956-1978 and 2004-2008. The land loss was not linier but punctuated by several extreme periods of land conversion to open water.

The potential for tidal exchange between Vermilion Bay and the interior marshes in the project area has greatly increased since 1968 when the construction of Freshwater Bayou Canal was completed along with the numerous oil and gas exploration canals, the old GIWW, and the new GIWW. Initially, the fragile organic soils of the interior marshes were protected from saltwater intrusion and tidal scour by spoil banks along these channels. However, much of the spoil banks along Humble Canal and Freshwater Bayou Canal have been destroyed, largely by boat wake-induced shoreline erosion, exposing the interior wetlands to these detrimental forces.

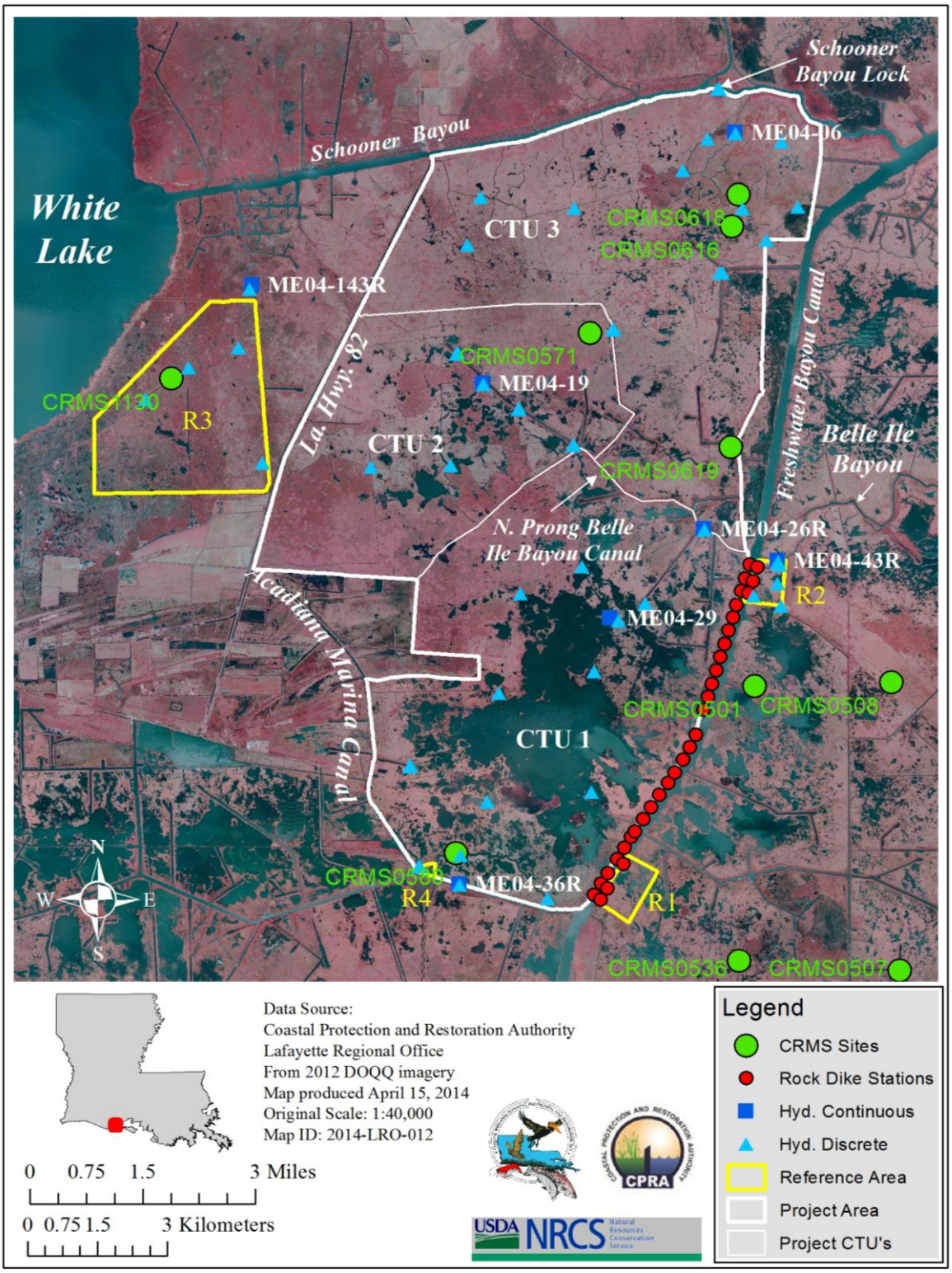


Figure 1. ME-04 project and reference areas with locations of continuous data recorders, discrete sampling stations and CRMS-*Wetlands* monitoring stations.

Based on data provided in a feasibility report by Brown and Root (1992), between 1968-1992, an average of 34,051 large vessels (crew boats, jack-up barges, supply boats, and fishing boats) traveled through the Freshwater Bayou Canal lock and channel each year, contributing to an average shoreline erosion rate of 12.5 ft per year (3.8 m/yr) on each bank for this period.

Hurricane Rita struck the coast of southwestern Louisiana on September 24, 2005 with maximum storm surge of 8-9 ft (2.4 – 2.7 m) in the ME-04 project area (FEMA 2006). USGS calculated the amount of land that changed to water resulting from the storm to be 98 square miles in southwestern Louisiana, 62 square miles in the Mermentau basin (Barras 2006). This loss can be attributed to several patterns. Shearing, which is ripping and removal of marsh vegetation in historically healthy marshes was observed in marshes bordering the east bank of Freshwater Bayou. The removal of remnant marsh from areas with historical land loss from the surge was observed due east of Pecan Island, south of Sweet Lake, and due east of Deep Lake. A large area of open water also formed within CTU 1 (Figure 2) during this storm event.

Hurricane Ike struck near Galveston, Texas on September 13, 2008. A maximum storm surge of 7 - 8 ft (2.1 – 2.4 m) NAVD 88 was reported for the ME-04 project area (East et al. 2008). Hurricane Ike exacerbated the land loss in the ME-04 project area that begun during Hurricane Rita. The four year period from 2004-2008 approximately equaled the land loss experienced over the previous 50 years. However the destructive capacities of the 2005 and 2008 hurricanes were enhanced by the anthropogenic alterations to the landscape and weakened marsh habitat as previously discussed.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Freshwater Bayou Wetlands Project (ME-04) is to evaluate the constructed project features to identify any deficiencies and prepare a report detailing the condition of project features and recommended corrective actions needed. Should it be determined that corrective actions are needed, LDNR shall provide, in the report, a detailed cost estimate for engineering, design, supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs. 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 Freshwater Bayou Wetlands Project are outlined in Section IV.

An inspection of the Freshwater Bayou Wetlands Project (ME-04) was held on May 16, 2012, under sunny skies and mild temperatures. In attendance were Mel Guidry, Stan Aucoin, Jody White, and Garret Broussard from CPRA and Dale Garber representing NRCS. The inspection began at the northern end of the rock dike alignment at 10:50 am.

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 water level and foreshore rock dike elevation. (See Appendix C).

b. Inspection Results

Site 1—Foreshore rock dike

The inspection revealed the 11,420 linear feet of foreshore rock dike repaired in the 2005 maintenance project is in good condition. (Appendix A, Photos 1-3) The inspection noted numerous sections of foreshore rock dike that were below elevation 4.0 NAVD causing evident bank erosion. NRCS personnel previously performed a centerline profile survey of the foreshore rock dike along with cross-sections to determine the deficient reaches of the foreshore rock dike. Based on the surveys, NRCS and CPRA agreed to repair the deficient reaches of the foreshore rock dike to elevation 3.5' NAVD. Based on the survey information, NRCS computed the volume of rock required to cap the deficient reaches of the foreshore rock dike. CPRA utilized the information from NRCS to prepare cost estimates for an O&M Funding Increase Request to the CWPPRA Task Force in the fall of 2012. (Appendix A, Photos 4 - 6)

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

There are several sections of foreshore rock dike along Freshwater Bayou that has settled below the design elevation 4.0 NAVD which is allowing bankline erosion. The rock dike will be capped in an upcoming maintenance event to address the problem areas.

ii. Programmatic/ Routine Repairs

None

II. Maintenance Activity (continued)

d. Maintenance History

General Maintenance: Below is a summary of completed maintenance projects and operation tasks performed since March 1995, the construction completion date of the Freshwater Bayou Wetlands Project (ME-04).

2002 - Freshwater Bayou Wetlands Maintenance Project – LDNR: This maintenance project included the installation of approximately 26,750 tons of 1000 lb gradation stone to repair fifteen thousand, two hundred and sixty-three linear feet of bank. Quantity limitations prevented the repair of all sections required. Construction was completed on 4/22/2002. The cost associated with the engineering, design and construction of the Freshwater Bayou Wetlands Maintenance Project is as follows:

Construction:	$615,900.00
Engineering & Design:	$ 46,882.86
Construction Administration:	$ 36,954.00
Construction Oversight/As builts:	$ 17,311.06
TOTAL CONSTRUCTION COST:	**$717,047.92**

2005 - Freshwater Bayou Wetlands Maintenance Project – LDNR (Luhr Bros. Contractor): This maintenance project included the installation of approximately 21,370 tons of 1,250 lb gradation stone to repair 11,426 linear feet of bank. Quantity limitations prevented the repair of all sections required. Construction was completed on 12/15/2005. The cost associated with the engineering, design and construction of the Freshwater Bayou Wetlands Maintenance Project is as follows:

Construction:	$472,660.50
Engineering & Design:	$ 1,282.84
Construction Administration:	$ 5,625.00
Construction Oversight/As builts:	$ 4,419.68

TOTAL CONSTRUCTION COST: $483,988.02

2014 - Transcontinental Pipeline Breach in Foreshore Rock Dike – Vermilion Parish Police Jury (Luhr Bros. Contractor): During the original construction of ME-04 in 1995, the rock dike in the area of the Transcontinental Pipeline was gapped and tied into the marsh. Marsh loss from Hurricane Rita caused marsh loss and increased the exchange behind the rock dike. The VPPJ obtained $360,000 from the Interim Emergency Board to address a 300 foot section of rock dike which was originally gapped. This project was completed in June 2014.

III. Operation Activity

a. Operation Plan

There are no water control structures associated with this project under the direct responsibility of OCPR, therefore no Structural Operation Plan is required.

b. Actual Operations

There are no water control structures associated with this project under the direct responsibility of OCPR, therefore no required structural operations.

IV. Monitoring Activity

Pursuant to a CWPPRA Task Force decision on August 14, 2003 to adopt the Coastwide Reference Monitoring System-*Wetlands* (CRMS-*Wetlands*) for CWPPRA, updates were made to the ME-04 Monitoring Plan to merge it with CRMS-*Wetlands* and provide more useful information for modeling efforts and future project planning while maintaining the monitoring mandates of the Breaux Act. There are five CRMS sites located in the project area (CRMS0571, CRMS0580, CRMS0616, CRMS0618, and CRMS0619), and five located outside the project area used as reference locations in similar marsh habitat (CRMS0501, CRMS0507, CRMS0508, CRMS0536, and CRMS1130).

a. Monitoring Goals

The objectives of the Freshwater Bayou Wetlands Project are:

1. Protect the existing emergent wetlands along the west bank of Freshwater Bayou Canal and prevent their further deterioration from shoreline erosion and tidal scour.

2. Prevent the widening of the Freshwater Bayou Canal channel into the Freshwater Bayou Wetlands project area.

3. Reduce ponding and marsh loss in the project area wetlands.

4. Maintain target salinity levels in the project area wetlands.

5. Increase vegetation cover in shallow open water areas within the project area wetlands.

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

1. Decrease the rate of spoil bank erosion along the west bank of Freshwater Bayou Canal using a rock breakwater.

2. Reduce water levels to within the target range for fresh to intermediate marsh vegetation, which is 6 in (15 cm) below to 2 in (5 cm) above marsh level.

3. Maintain salinity levels within the target range for fresh to intermediate marsh vegetation, which is 0-5 ppt.

4. Decrease the duration and frequency of flooding over the marsh.

5. Decrease the rate of marsh loss.

6. Increase the coverage of emergent vegetation in shallow open water areas within the project area.

b. Monitoring Elements

Aerial Photography:

For project specific data near-vertical color-infrared aerial photography (1:12,000 scale) was used to document land and water areas, marsh loss rates, and shoreline movement in the ME-04 project area. Photography was obtained in 1997 (pre-construction) and in 2001 (post-construction). The original photography was checked for flight accuracy, color correctness, and clarity and was subsequently archived. Aerial photography was scanned, mosaicked, and geo-rectified by USGS/NWRC personnel according to standard operating procedures (Steyer et al. 1995, revised 2000).

Aerial photography and satellite imagery has been collected for the entire coast through CRMS. The aerial photography will be analyzed for CRMS stations at one meter resolution. The satellite imagery will be analyzed to determine land and water areas for the entire coast. This imagery will be a subset and used to evaluate changes in land and water areas within the ME-04 project area at a coarse (30m) resolution. The CRMS spatial viewer provided historic data for land water quantification in the project area starting in 1956. The years analyzed for land water quantities through the CRMS viewer were 1956, 1978, 1988, 2004, 2006, and 2008. The data provided by this tool is at a large spatial scale and is designed to show trends in land loss, not exact acreages.

Shoreline Change:

To document shoreline movement along Freshwater Bayou Canal, shoreline markers were placed at maximum intervals of 1,000 ft (305 m) on the marsh edge along the west bank of the

canal between its confluence with the Humble Canal and with North Prong Belle Isle Bayou, at 31 points corresponding to the pre-construction survey cross-sections, and at 3 points along each of the two 0.5 mi (0.8 km) long reference areas located along the east side of the channel opposite the north and south ends of the proposed breakwater (Figure 1). Shoreline position relative to shoreline markers was documented in 1998, 2005, 2008, 2011, and 2014.

Water Level:

To evaluate the extent of ponding within the project area, water level relative to marsh level and NGVD was monitored at seven continuous data recorders (Figure 1): one in each of the project area CTUs, one in the reference area R2, one in reference area R3, one in N. Prong Belle Ile Bayou Canal between CTUs 1 and 3, and one in Acadiana Marina Canal south of CTU 1 (removed September 26, 2003). Water level data is used to document the variability in water level, and the frequency, duration, and range of marsh inundation in the project and reference areas. Water level was monitored in 1996-1998 (pre-construction) and in 1999-2006 (post-construction). The recorders were removed in September 2006. Discrete measurements were discontinued prior to 2003. CRMS monitoring in the project and reference area began in 2006 and goes through December 2013 for this report.

Salinity:

Salinities were monitored with continuous data recorders in each CTU and in reference areas (Figure 1). Salinity data is used to characterize the spatial variation in salinity throughout the project area, and to determine if project area salinity is being maintained within the target range. Salinity was monitored in 1996-1998 (pre-construction) and in 1999-2006 (post-construction). The recorders were removed in September 2006 when CRMS monitoring began.

Discrete monthly salinity and water depth were measured at 49 monitoring stations, including the seven recorder stations (Figure 1), 30 located inside the project area and 19 located outside the project area in reference areas R2 and R3, in exterior canals, and inside and outside of the eight CWPPRA structures). Staff gauge water level readings (in ft NAVD88) were also recorded monthly at the seven continuous recorder stations, inside and outside of the eight CWPPRA structures, and at the Vermilion Corporation boat house near the southeast corner of reference area R2. Salinity and water level were recorded by the USACE inside and outside of Schooner Bayou Lock. The discrete monthly salinity data were used to calculate a mean monthly salinity for the early growing season (March-June), the late growing season (July-October), and the dormant season (November-February) at each station, for the pre-construction (March 1996 through September 1998) and post-construction (October 1998 through December 2002) time periods. Discrete measurements were discontinued prior to 2003 and those data are included in previous reports.

Salinity is currently being monitored hourly utilizing 4 CRMS-*Wetlands* stations (571, 580, 616, and 619) within the project area and selected reference sites (501, 507, 1130). Continuous data were used to characterize average annual salinities throughout the project and reference areas.

At each servicing, a measurement of interstitial water salinity (porewater) is collected adjacent to each CRMS-*Wetlands* gauge. Interstitial water salinity is also collected at the vegetation plots when vegetation is surveyed.

Emergent Vegetation:

To document the condition of emergent vegetation in the project area over the life of the project, vegetation was monitored at thirty-seven sampling stations established systematically in the project and reference areas (Figure 2). Six east-west transects were established uniformly across the project area. Sampling stations were established uniformly along each transect line to obtain an even distribution of sampling stations throughout the project area. Similar east-west transects were delineated across reference areas R2 and R3 to establish four sampling stations in each reference area. Percent cover, dominant plant heights, and species composition were documented in 2 m^2 sampling plots marked with 2 corner poles to allow for retreaded sampling over time. Vegetation was evaluated at the sampling sites in the fall of 1996 and 1998 (pre-construction) and in the fall of 2001 (post-construction). A subset of the vegetation stations were sampled after Hurricane Rita in 2005, 2006, 2007 and 2008.

Individual species' cover data from project specific monitoring were summarized according to the Floristic Quality Index (FQI) method utilized by CRMS (Cretini and Steyer 2011) where cover is qualified by scoring species according to whether they are generally associated with habitat disturbance or stability.

Beginning in 2006 vegetation composition and cover was estimated from 10 permanent 2x2 m plots that are randomly distributed along a transect in the emergent marsh within each of the 1 km^2 CRMS-*Wetlands* sites. Data was collected at five CRMS stations located within the ME-04 project area (571, 580, 616, 618, 619), one within reference area 3 (1130) and four selected reference sites (501, 507, 508, 536) near reference area one and three and collection continues presently.

Soil Properties

Soil cores were collected to describe major soil properties such as 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 soil was processed by the Department of Agronomy and Environmental Management at Louisiana State University. Soil cores were only collected at the project and reference CRMS sites during station establishment in 2005-2007 and the second series of samples has not yet been collected.

Soil Surface Elevation Change

Soil surface elevation change utilizing a combination of sediment elevation tables (RSET) and vertical accretion from feldspar horizon markers are being measured twice a year at each of the project and reference CRMS sites. These data will be used to describe general components of elevation change and establish accretion/subsidence rates. The RSET was surveyed to a known elevation datum (ft, NAVD 88) so it could be directly compared to other elevation variables such as water level. Data collected over at least 5 years was used to

calculate rates for the project and reference area; therefore the displayed elevation change rates are an estimation of that temporal trend.

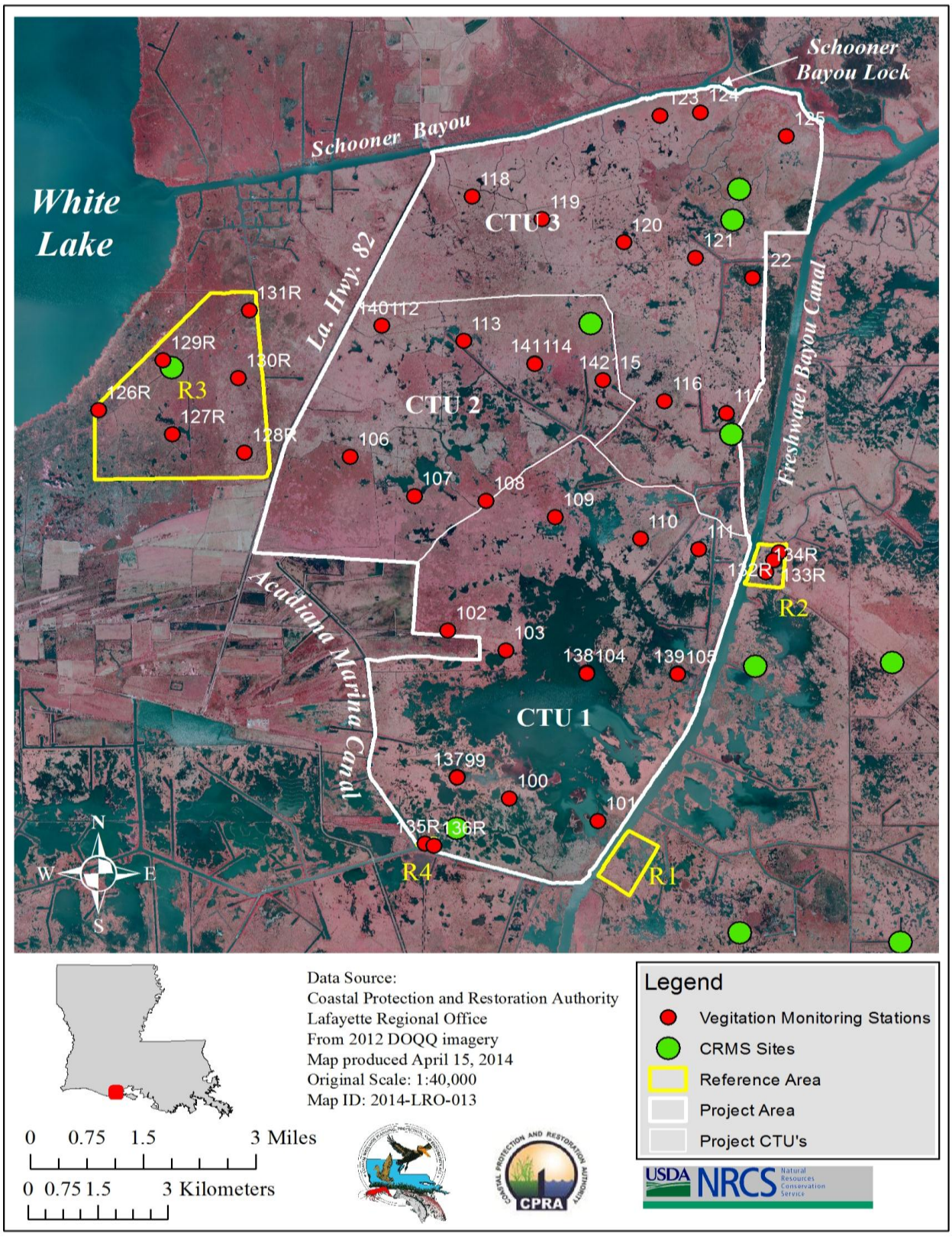


Figure 2. Locations of emergent vegetation sampling plots established in 1996 and 1997 in the ME-04 project and reference areas (R2, R3, and R4) and the associated CRMS stations.

IV. Monitoring Activity (continued)

c. Monitoring Results and Discussion

Aerial photography:

Pre-construction land/water analysis was completed for 1997 aerial photography (Figure 3). Habitat analysis was completed for 1997 pre-construction aerial photography (Figure 4) and for 2001 post-construction aerial photography (Figure 5). Land to water analyses of the pre-construction imagery taken on 11 January 1997 indicate that over 80% of the project area, and reference area units R1, R2, and R3 were classified as land, while less than 45% of reference area R4 was classified as land. The post-construction imagery taken on December 18, 2001 was not formally classified as land and water, however, by adding land and water acreages from the 1997 and 2001 analyses of habitat types, informal comparisons can be made. Between 1997 and 2001, the percentage of land area remained stable within the total project area with 85.4% land area in 1997 and 85.1% land area in 2001. The reference areas also remained stable with land area 94.2% to 93.6% from 1997 to 2001.

The project area experienced a decrease in fresh marsh, especially prevalent in CTU 1 which was marked by a change to intermediate and brackish marsh, and to a lesser extent by conversion to open water. In contrast, CTU 2 and CTU 3 experienced increases of fresh marsh, while CTU 3 also showed a decrease of intermediate marsh. Overall, the reference areas showed an increase of fresh marsh, a complete loss of intermediate marsh, and an increase in brackish marsh. Only R1 and R2 experienced significant changes, both showing conversion of intermediate marsh to brackish marsh with some loss to open water (Table 1).

Table 1. Marsh habitat assessment change in the ME-04 project and reference area.

Year	% Fresh	% Intermediate	% brackish
Project			
1997	58.3	39.0	2.7
2001	48.5	41.5	10.0
Net	-9.8	+2.5	+7.3
Reference			
1997	82.8	15.8	1.4
2001	83.6	0	16.4
Net	+0.8	-15.8	+15.0

The CRMS spatial viewer provided historic data for land water quantification in the project area starting in 1956. In 1956, wetlands accounted for 99.0% of the project area and only 1% of the area was open water. By 1978, wetlands accounted for 91.8% of the project area, with open water areas having increased to 8.2%. As of 2008, wetlands accounted for 80.3% of the project area, while the open water area increased to 19.7% of the project area. Thus, between 1956 and 2008, nearly 20% of the emergent wetlands in the project area were lost (Table 2). Analysis of the project areas interior land loss rate utilizing the CRMS spatial viewer was

possible from 1985 through 2015 (Figure 6). Since this assessment is on a larger scale than that used for the 1997 land-water classification by USGS/NWRC, the results are presented in terms of trends and provide a different perspective of the land to water changes over a period of decades. The percentage of land in the project area has steadily declined from 1980-2015, showing a land change trend for the project area of -0.27%/yr or -28.5 ac/yr. (Figure 6) This assessment excludes the data post Hurricane Rita and Ike causing the slope of -0.27% per year to be more positive than if the hurricane years where included.

Table 2. Land to water percentage changes in the ME-04 project area from 1956 to 2008.

Year	% Land	% Water	Cumulative % Land Loss	Notes
1956	99.0	1.0		
1978	91.8	8.2	-7.2	Post Hurricane Audrey
1988	90.9	9.1	-8.1	
2004	90.5	9.5	-8.5	
2006	82.5	17.5	-16.5	Post Hurricane Rita
2008	80.3	19.7	-18.7	Post Hurricane Ike

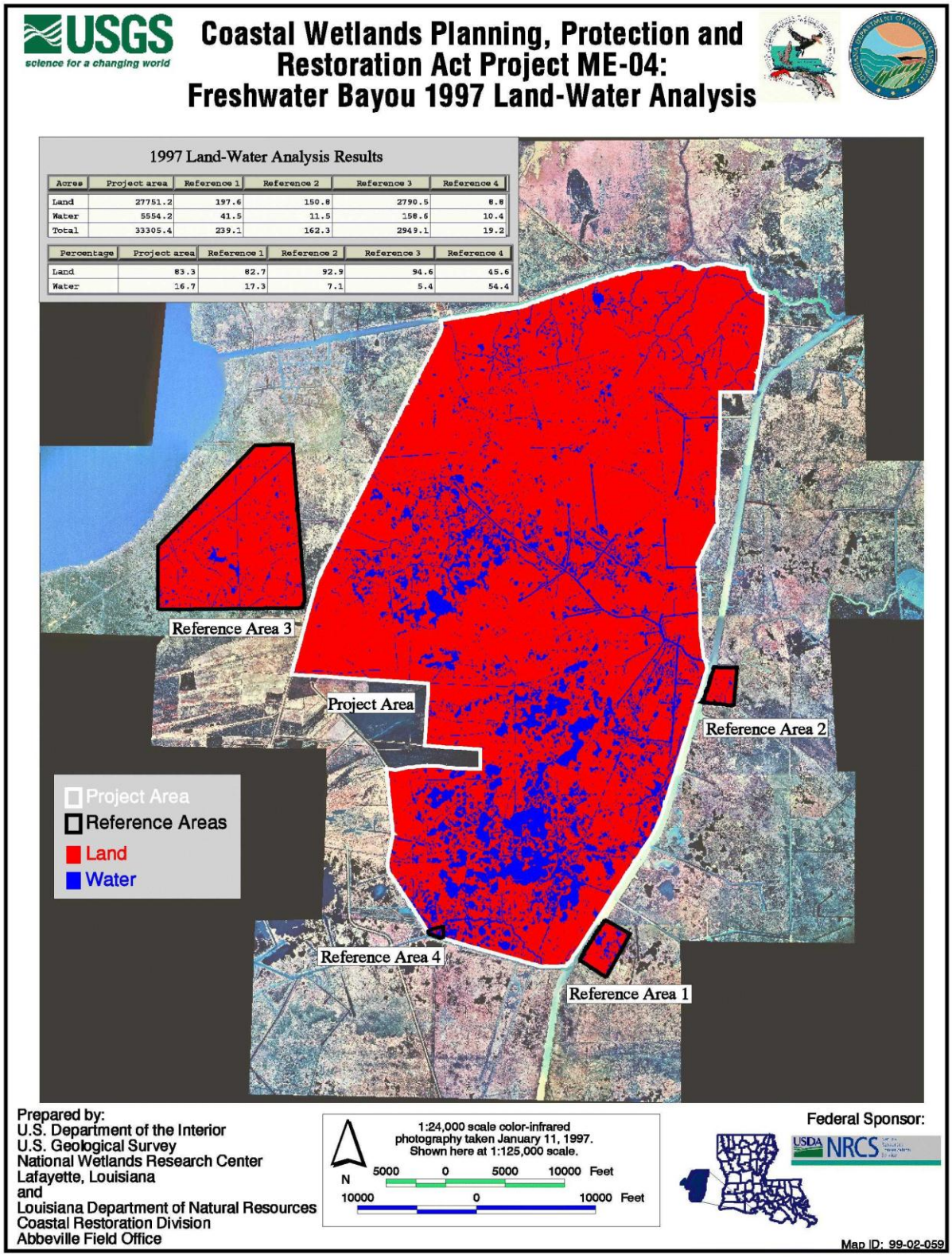


Figure 3. Pre-construction analysis showing the acreage of land and water in the project and reference areas of Freshwater Bayou Canal Wetland Protection in 1997.

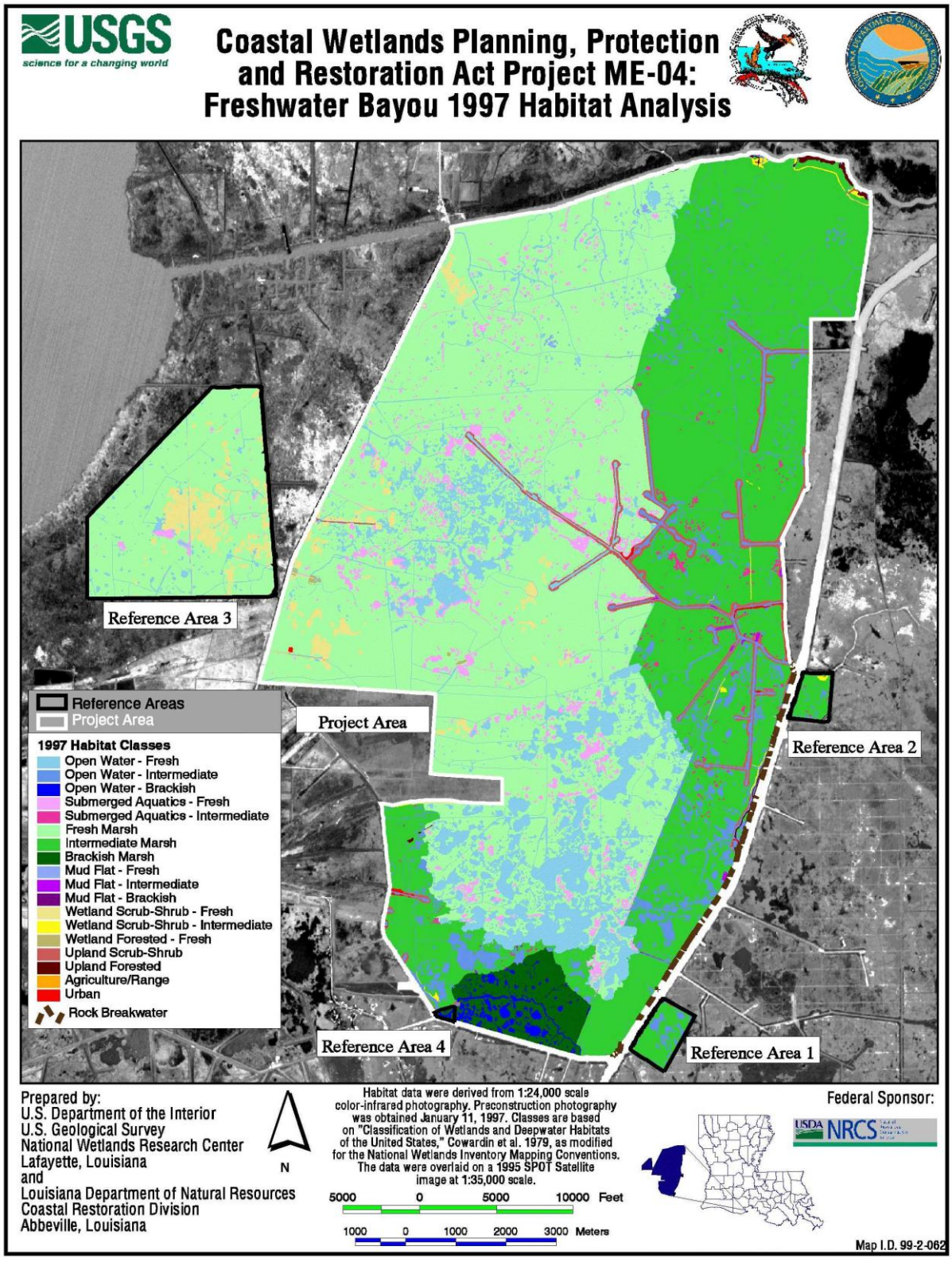


Figure 4. Pre-construction analysis showing acreage of habitats in the project and reference areas in Freshwater Bayous Canal Wetland Protection in 1997.

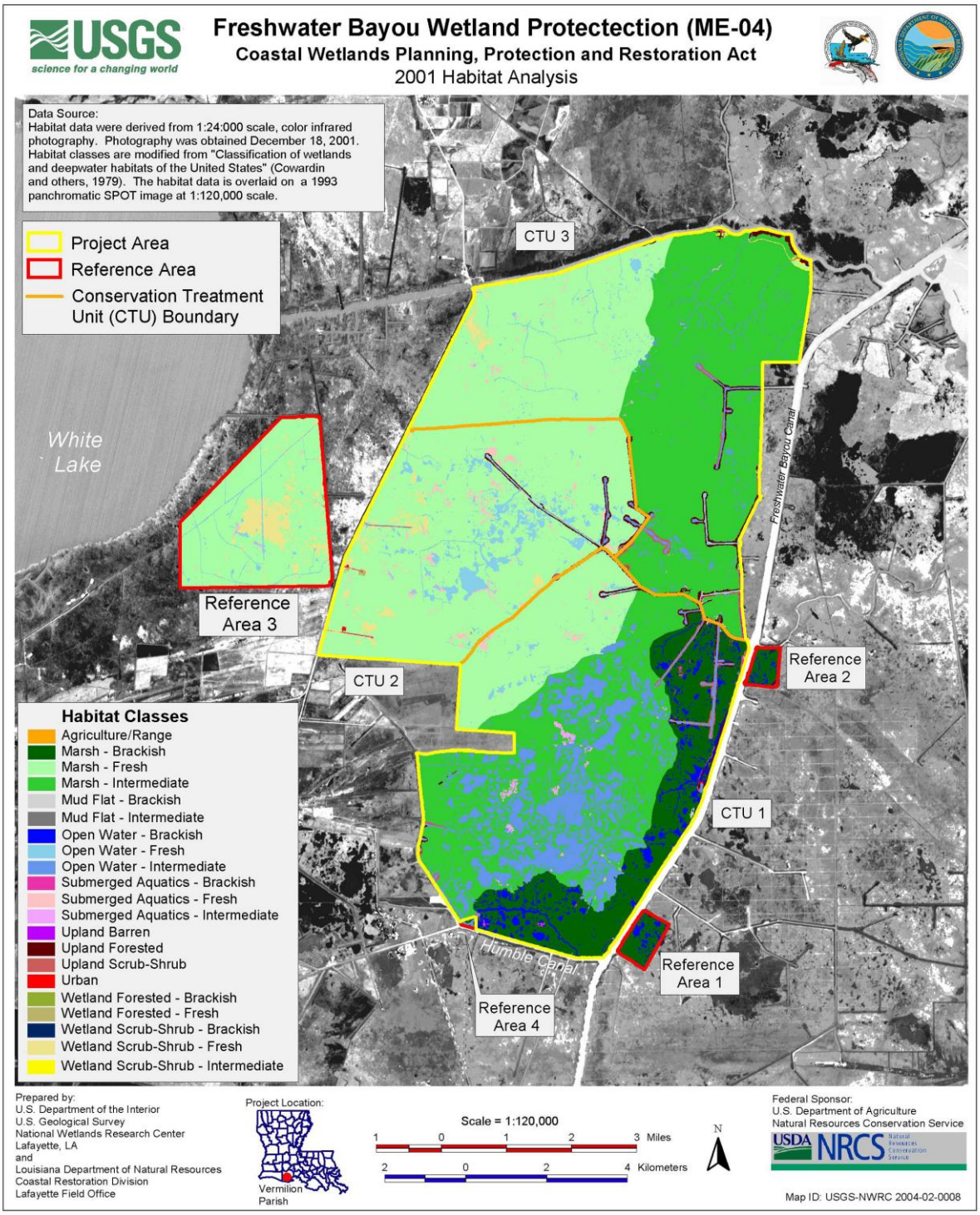


Figure 5. Post-construction analysis showing acreage of habitats in the project and reference areas in Freshwater Bayou Canal Wetland Protection in 2001.

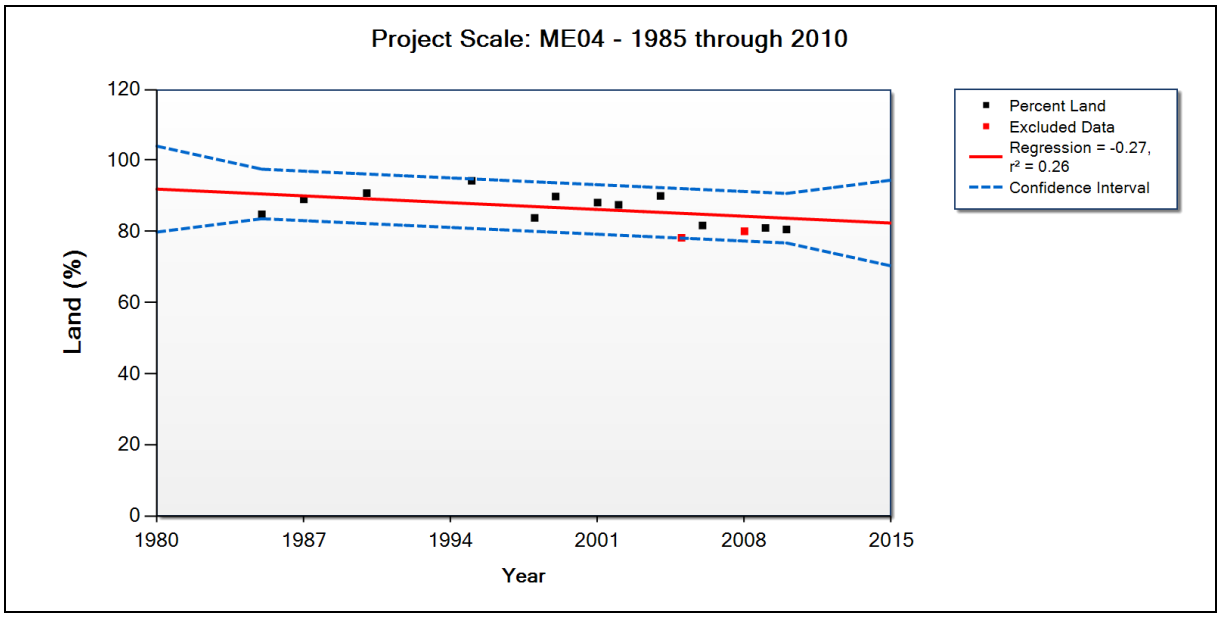


Figure 6. Project scale percent land analysis within the ME-04 project area (n=12) for years 1985 to 2010 with projected percent land through 2015 (CRMS spatial viewer land/water, Barras et al. 2008).

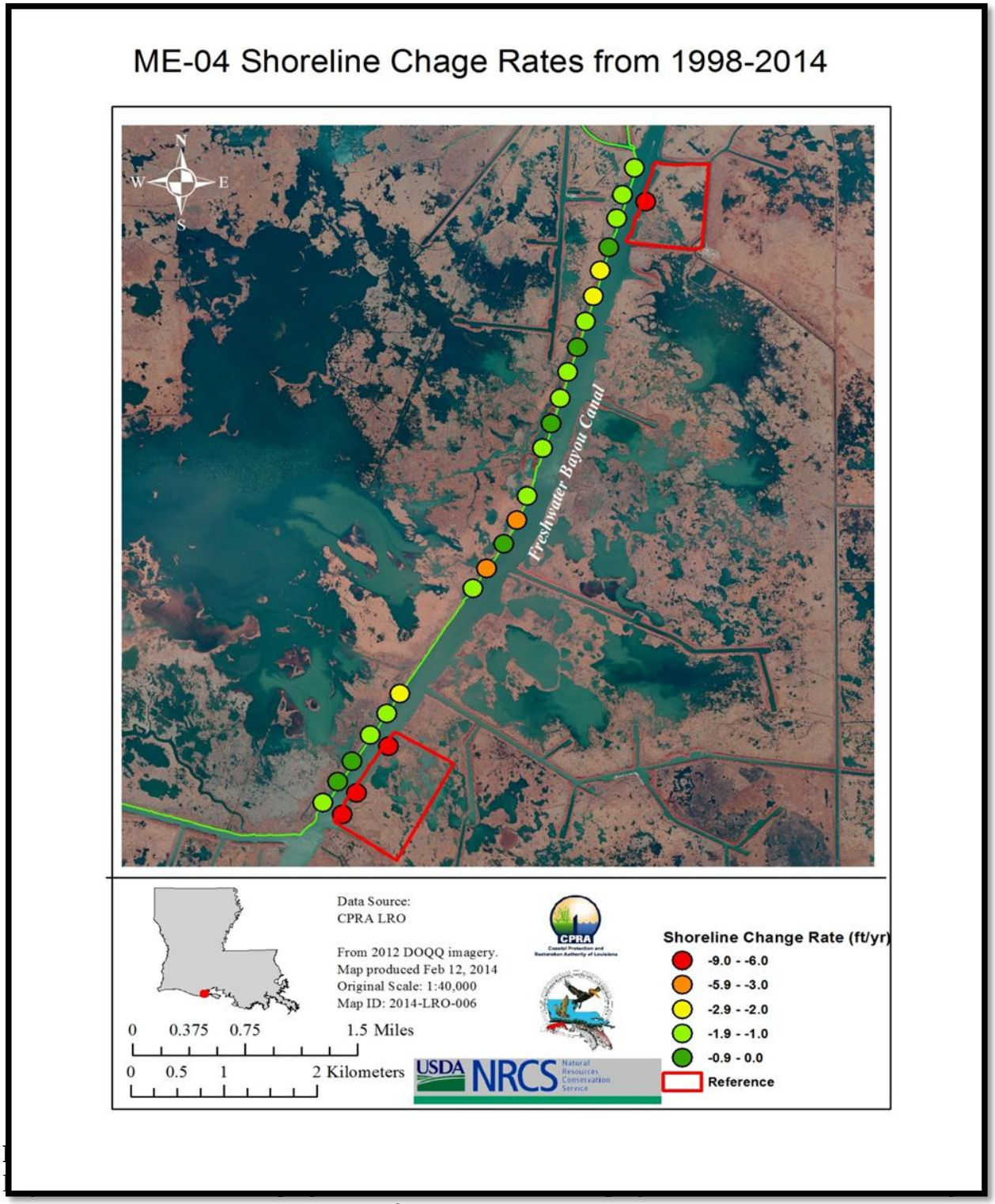
Shoreline change:

The ME-04 project has successfully achieved the shoreline protection component of the project design by substantially reducing the shoreline erosion rate compared to an unarmored reference shoreline (Figure 7). On average the project shoreline has eroded -25.0 ft over the project's life while the reference shoreline has retreated over -117.4 ft and breached into numerous bayous, lakes, and ponds along the east bank of Freshwater Bayou. This has exposed the interior marshes of the reference area to increased wake, wave, and tidal forces. From construction in 1998 through 2014 the erosion rate in the reference area was nearly five times greater than the project area (project -1.6 ft/yr; reference -7.5 ft/yr) (Table 3). The WVA estimated that shoreline losses would increase to -17.4 ft/yr in this area without action and during the 2005 to 2008 time period this rate was approached in the reference area (-15.0 ft/yr) (ME-04 WVA 1992). Several areas within the project rock dike have settled to below the designed elevation, which caused erosion rates to increase along the project shoreline near those locations.

The rocks effectively protected the shoreline in the project area while the reference area continued to erode from 2008 to 2014 even as portions of the rock dike became compromised. As rocks settled and were breached from 2008 to 2011, the erosion rate tripled in the project area overall (-4.0 ft/yr) although the actual change was along the shoreline near the compromised locations (-5.2 ft/yr settled; -1.3 ft/yr stable). The most recent data collection effort in January, 2014 revealed continued erosion in the project area near the breaches (-1.3 ft/yr) although at a slower rate than from 2008 to 2011 and land gain along the rest of the project area (+0.6 ft/yr). The ME-04 rock dike has reduced shoreline erosion and protected interior marshes from wave and tidal forces along Freshwater Bayou even as it has settled in several areas.

Table 3. ME-04 Shoreline change rates and associated events.

	Shoreline Change Rate (ft/yr)				
Time Period	**1998-2005**	**2005-2008**	**2008-2011**	**2011-2014**	**1998-2014**
Project	-1.8	-1.1	-4.0	-0.4	-1.6
Reference	-5.1	-15.0	-6.5	-9.5	-7.5
Project (Settled Rock)			-5.2	-1.3	-1.9
Project (Stable Rock)			-1.3	+0.6	-1.2
Notable Events	Maintenance events 2002 and 2005	Hurricanes Rita and Ike	Second maintenance event planned	Breach expanding	Life of the project rates



reduced shoreline erosion while the reference shoreline has expanded as it connects to interior waterways increasing tidal exchange and scouring.

Water level:

The goal to reduce water levels to within the target range of 6 in (15 cm) below to 2 in (5 cm) above marsh level was not met. Water levels in the project area were within the target range less than 50% of the year during 10 years of project-specific data collection. However, project area water levels were within the target range a greater percentage of time than the reference area (Figure 8). In general, when reference area water levels were out of the target range, they tended to be greater than 2" above the marsh surface. Project area water levels were less than 6" below marsh surface more often than reference stations. This would be expected since the reference area stations are located along major waterways and are subject to higher tidal amplitude, while the three project area stations were located in interior marsh areas influenced by water control structures. Water levels were lower during all years in the project area compared to the reference area (Vincent 2003). But there were no distinct differences between the project and reference areas as differences between CTU's were as notable as project reference variations.

This trend of no substantial differences between the project area and reference areas continued through 2013 as the project and reference CRMS sites were within the target range 45.5% and 50.1% respectively (Figure 9). The CRMS sites chosen as references had nearly identical in-target water levels to project area sites. Site 571 (in the northeastern part of CTU 2) had very high water levels compared to all other stations. It did appear that the reference water levels were general below target more often that the project area excluding CRMS 1130 which performed more similarly to the project area by being in target or flooded nearly the entire period of record (2008-2013). Thus there are no differences in the project or reference area hydrologic regimes as no extensive hydrologic separation is maintained.

Salinity:

The goal to reduce salinity levels to within the target range of less than 5 ppt for fresh to intermediate marsh vegetation was partially met, however since salinity trends in the project and reference areas were similar pre- and post-construction, this cannot be attributed to the project. Prior to construction, salinities within the project area were greater than 5ppt about 13% of the time, compared to around 8% within the reference area (Figure 10). In years 1998, 2001, 2002, 2003, and 2004, salinities were outside of the target range less than 10% of the time in the both the project and reference areas. High salinities were prevalent within both project and reference areas in 1999 and 2000 due to drought conditions. In part of 2005 and all of 2006, the target range was exceeded more than 70% of the time. This is likely due to after effects of Hurricane Rita's storm surge and was reflected in both project and reference areas.

The overall project area CRMS sites and the reference area CRMS sites in-target salinity averages were nearly identical between 2006-2013, 68.0% and 67.5% respectively. Both locations showed an increase in salinities in 2009 following Hurricane Ike, but the effects weren't as extreme as Hurricane Rita. During the 2010-2011 drought the reference sites were out of the salinity target more often that the project sites. The wet years of 2012 and 2013 reduced salinity in both locations but had a larger impact on the project sites and R3. The project sites were in the salinity target more often than the reference sites during this period (Figure 11).

Discrete monthly water salinity readings taken at the eight CWPPRA structure sites do show that water salinity "inside" and "outside" of the structures was higher during the post-construction period than during the pre-construction period at all eight structures (Mouledous 2011).

Mean yearly interstitial porewater salinity at the CRMS project sites were the same as the CRMS reference sites. The project 10 cm salinities were lower than the reference 30 cm interstitial salinities across all years and outside the standard error range suggesting that the reference area soils are storing more salt than the project area annually (Figure 12). Generally interstitial salinities in the project and reference area tracked together and responded to stimuli similarly.

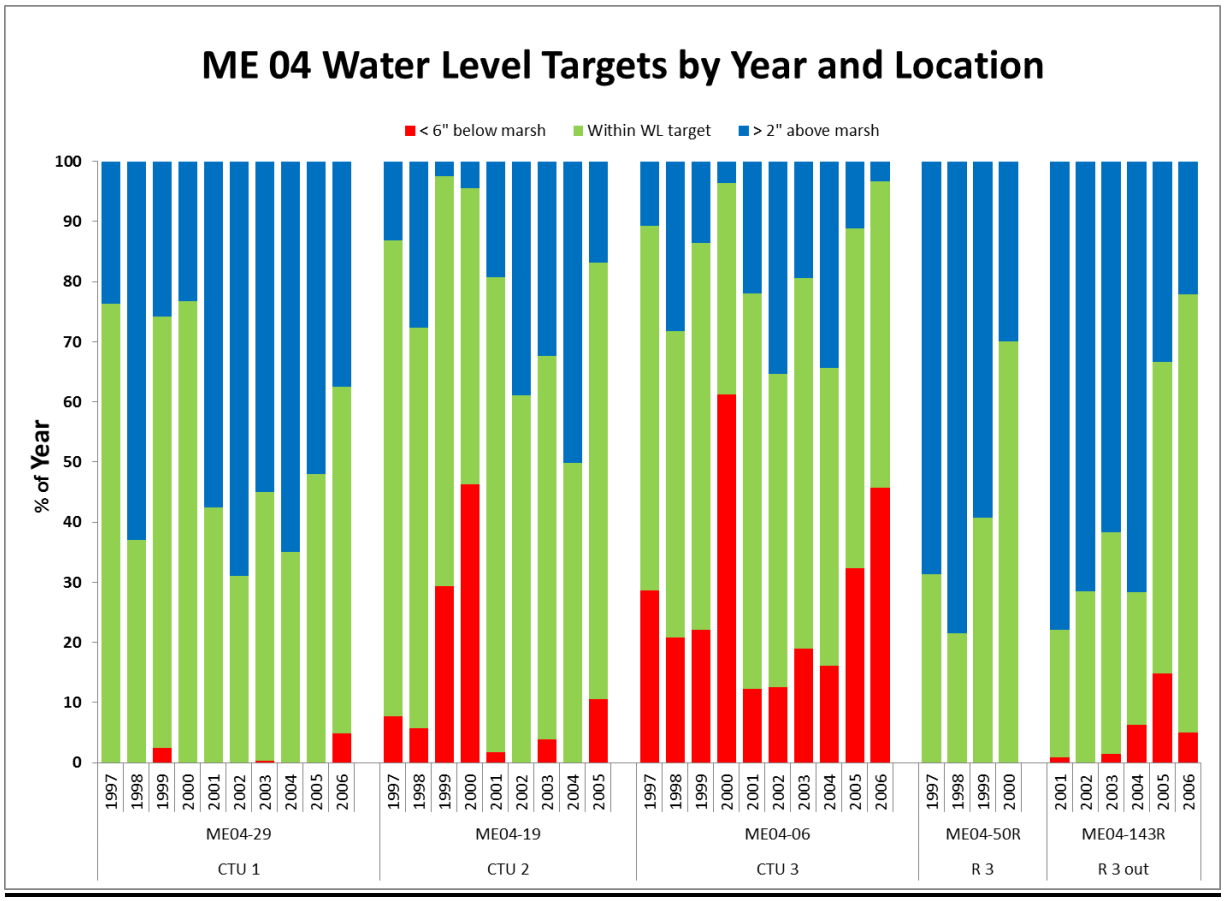


Figure 8. The percentage of the year water level was inside and outside of target range within the project and reference areas at project-specific stations.

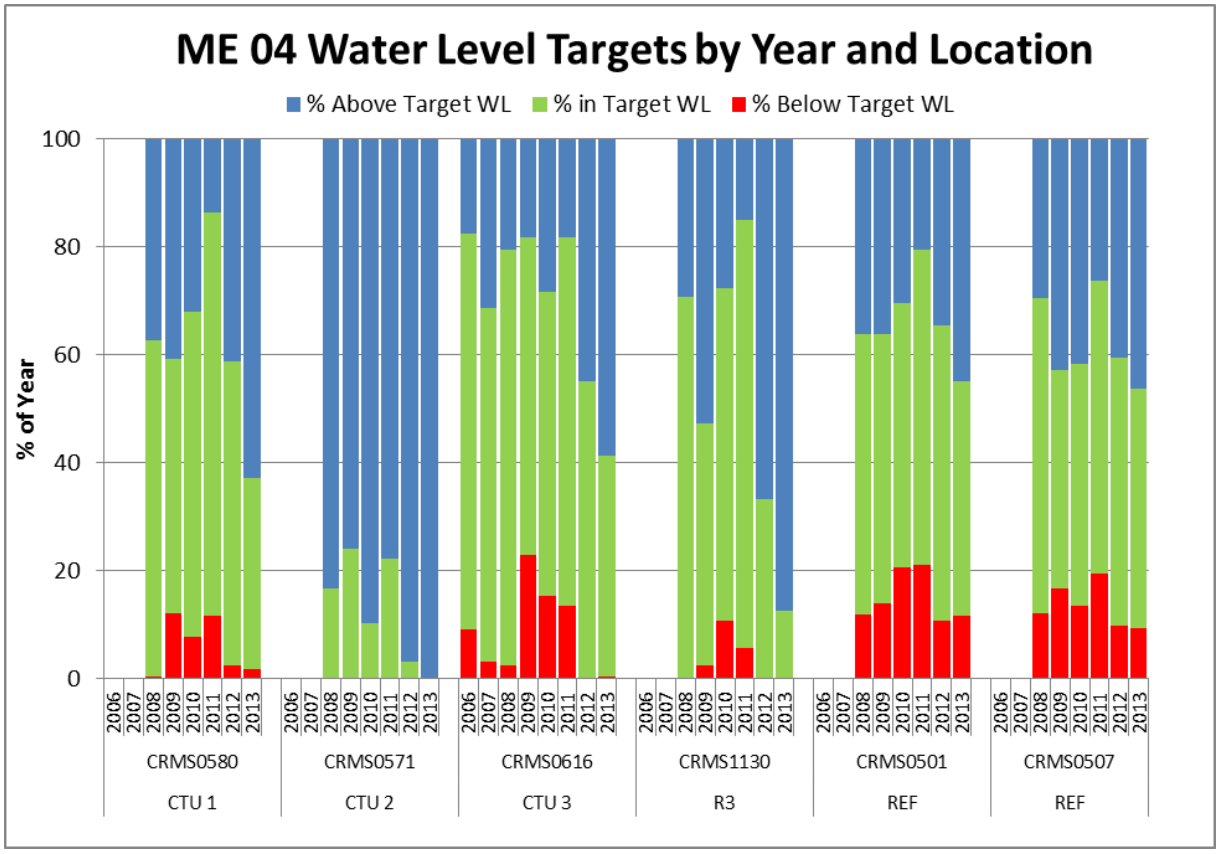


Figure 9. The percentage of the year water levels were above or below the target range within the project and reference areas CRMS stations.

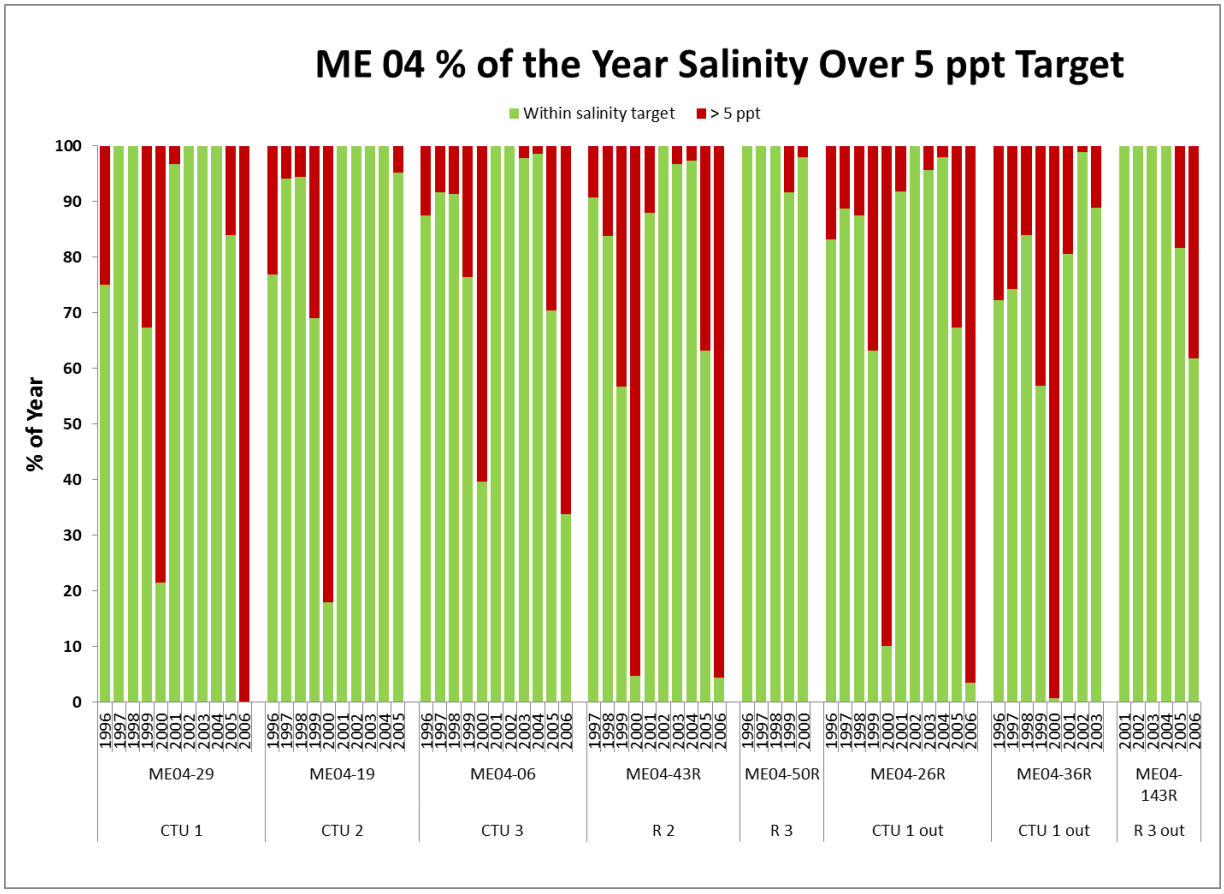


Figure 10. The percentage of the year project and reference area salinities were above the target range of 5 ppt at project-specific stations.

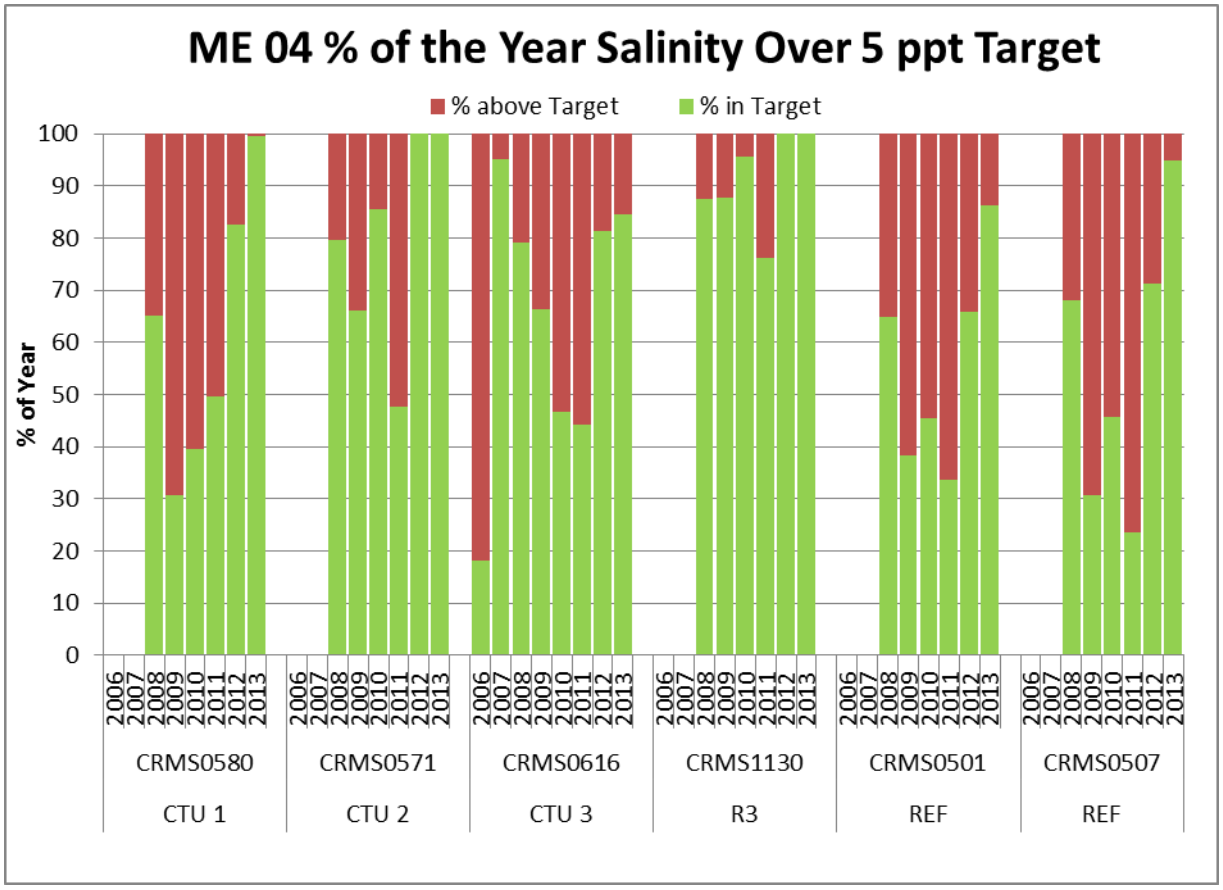


Figure 11. The percentage of the year that project and reference area salinities were above the target range of 5 ppt at project and reference CRMS stations.

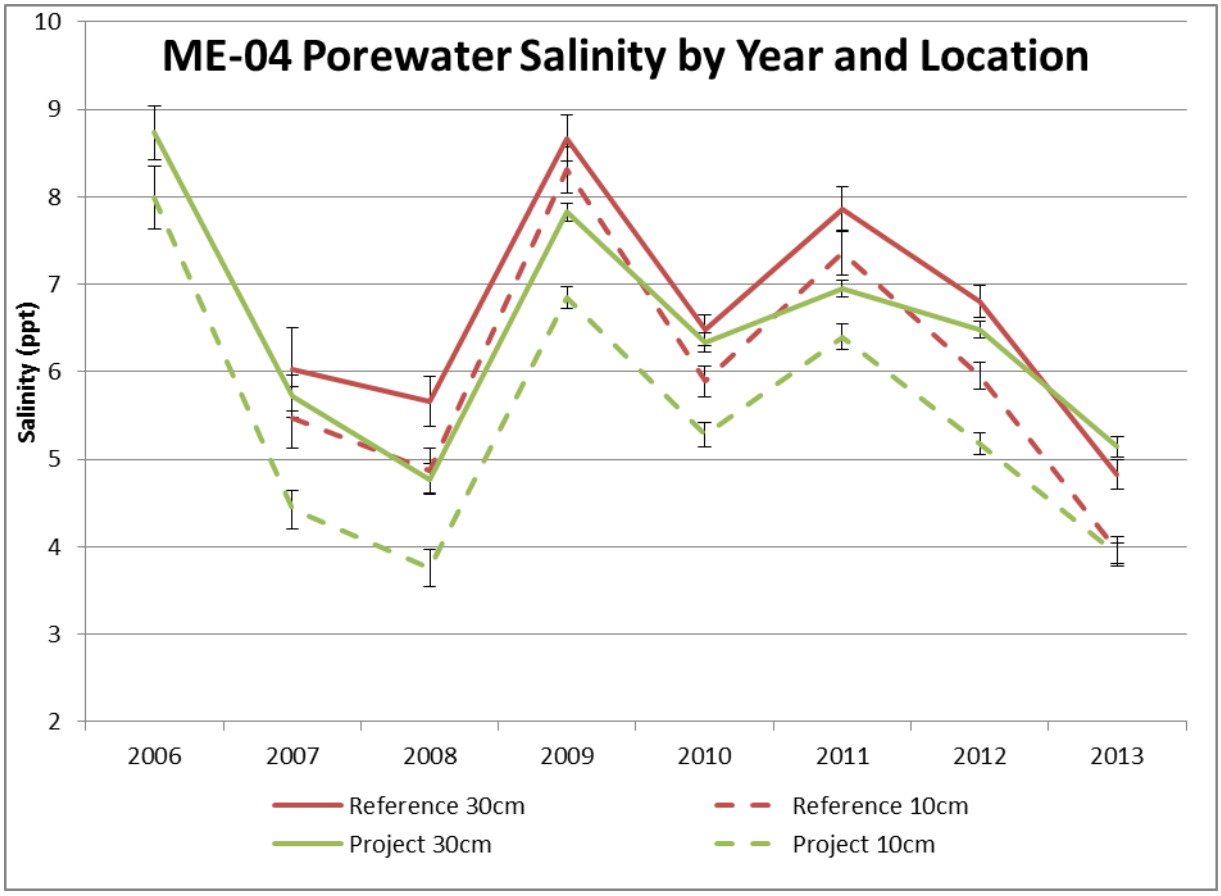


Figure 12. The interstitial water salinity of the project and reference CRMS sites at 10 cm and 30 cm below the soil surface. Overall the project and reference soil salinities where very similar to one another.

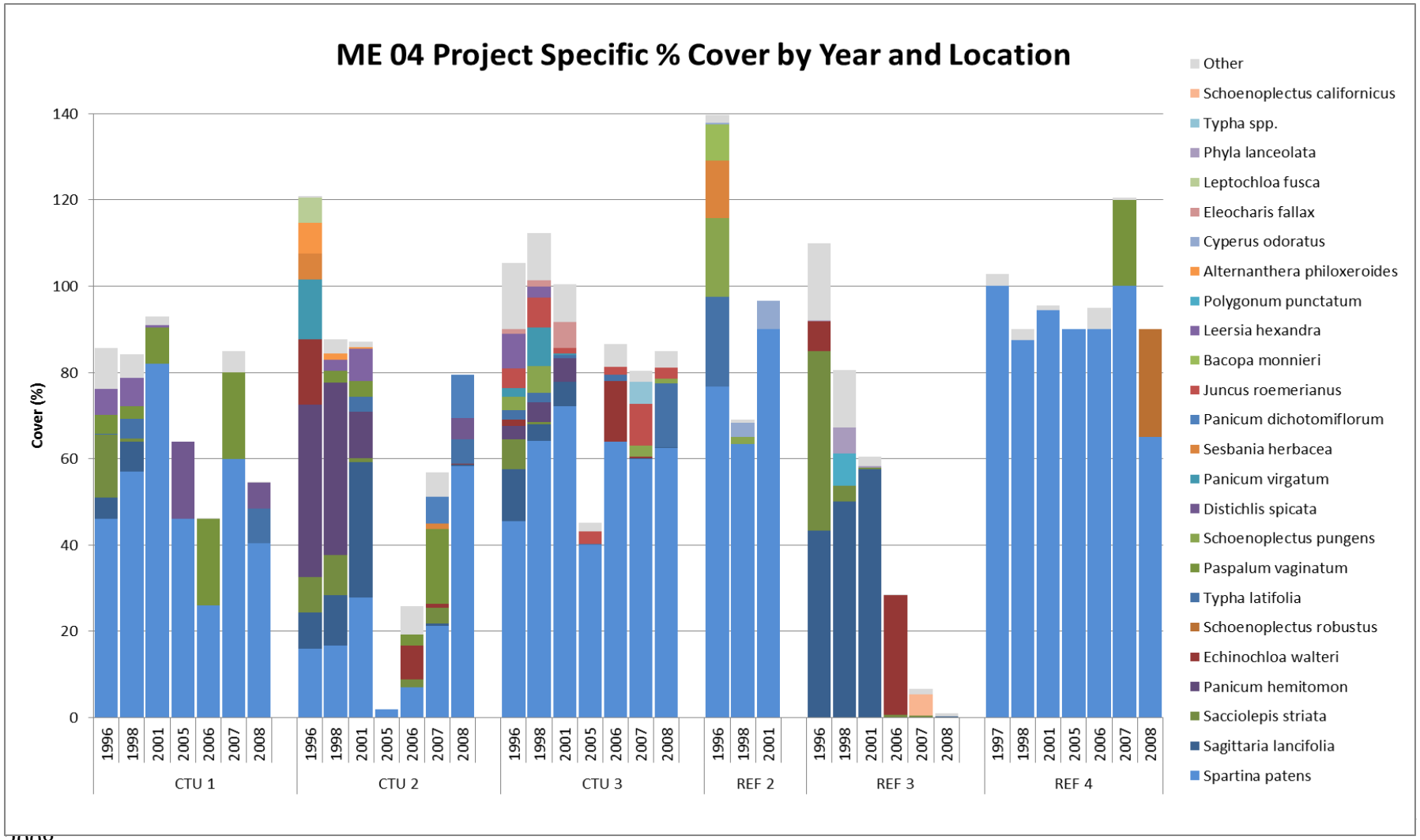
Vegetation:

The ME-04 project area has undergone consistent vegetation transitions since data collection in the area began in 1949 when the area was a nearly equal mix of brackish and intermediate vegetation (Table 4). The project area was dominated by fresh vegetation just prior to construction of the project however the following decade brought drought and hurricane forces to the region. The project was completed in 1998 which coincided with an extended multiyear drought in the region and the vegetative cover dropped slightly in 1998 and 2001 respectively from the pre project levels of 1996 (Figure 13). Following Hurricane Rita in 2005, cover plummeted in all units, though only slightly in R4 (R2 and R3 weren't sampled in 2005). Slowly the marsh vegetation recovered during 2006 and 2007 but again was inhibited following Hurricane Ike in 2008 but to a much less extent than Hurricane Rita. The project specific sampling data ended post Hurricane Ike but the CRMS sites in the area suggested a slow steady improvement in most units until the 2010-2011 time frame. These effects were generally ubiquitous across the area and not related to the project features.

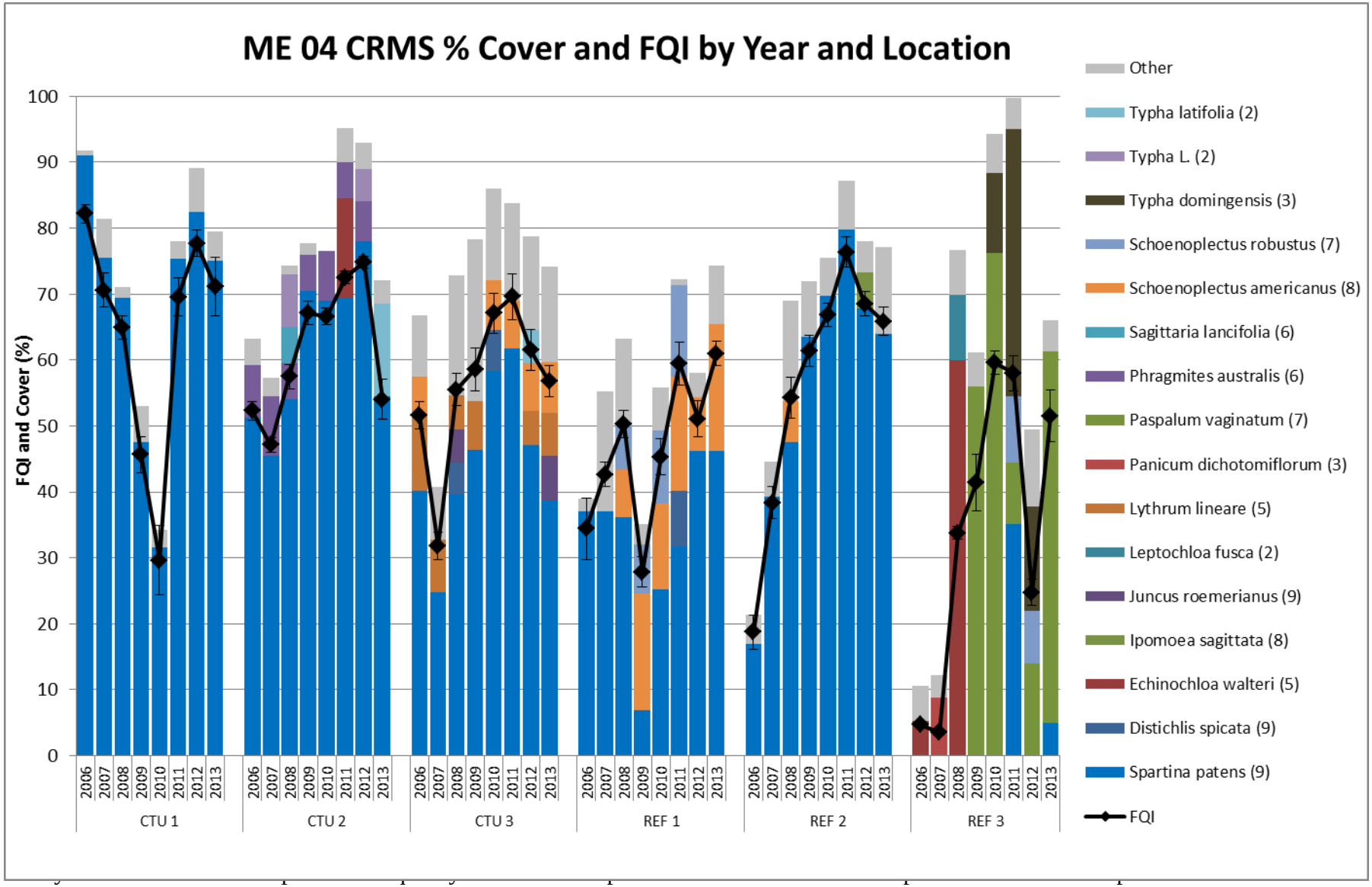
The project and reference area CRMS sites showed a recovery from Hurricane Rita with increases in cover and FQI scores through 2008 at all locations except for CTU 1, which had a negative trend (Figure 14). Through 2010, all units showed a recovery to near pre-Hurricane Rita levels except for CTU 1 which continued to decrease in cover and FQI score over this time. CTU 1 did make a rapid recovery in 2011 possibly due to the large drought as most of the project and reference locations initially responded favorably to the lower water levels. In general the CRMS project sites vegetation reached a peak in 2011-2012 and dropped off in percent cover and FQI value in 2013. The reference area CRMS sites trended differently except for R2 which was very similar to the project. Reference areas one and three both showed percent cover and FQI loss in the wetter 2012 but recovery in 2013. Overall the project and reference area's vegetation is very similar, dominated by Spartina patens and responding to stimuli accordingly. However R3 is distinct in the vegetation species present and marsh salinity type, it is a substantially less saline environment rarely exceeding the project target of 5 ppt and this is reflected in the herbaceous community composition (Figure 15). After 2008 some of the project and reference areas started to trend toward a more brackish and saline vegetation cohort but most of the locations stabilized or reverted back to pre-2008 vegetation salinity patterns during the heavy rain falls of 2012.

Table 4. Percent of vegetated surface by marsh habitat type with in the ME-04 project area.

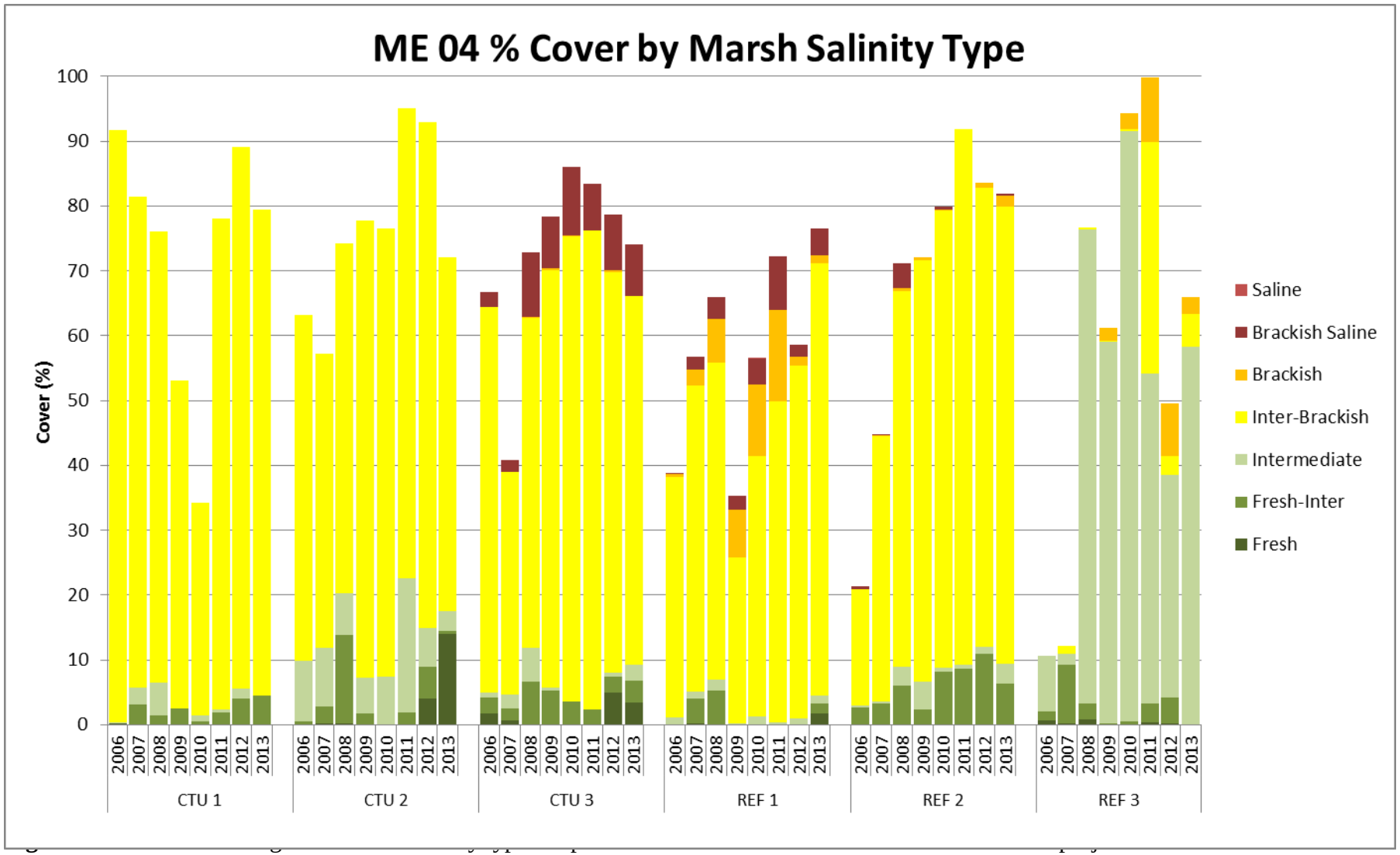
Marsh Type	1949	1968	1978	1988	1997	2001	2007	2013(est.)
Fresh	0	35.17	55.18	38.40	68.79	14.93	0	0
Intermediate	51.09	64.83	42.87	59.72	31.21	85.07	94.68	90.0
Brackish	44.93	0	1.95	1.77	0	0	5.3	10.0
Saline	3.99	0	0	0	0	0	0	0


ME 04 Project Specific % Cover by Year and Location
Cover (%)
0
20
40
60
80
100
120
140
1996 1998 2001 2005 2006 2007 2008
CTU 1
1996 1998 2001 2005 2006 2007 2008
CTU 2
1996 1998 2001 2005 2006 2007 2008
CTU 3
1996 1998 2001
REF 2
1996 1998 2001 2006 2007 2008
REF 3
1997 1998 2001 2005 2006 2007 2008
REF 4
Other
Schoenoplectus californicus
Typha spp.
Phyla lanceolata
Leptochloa fusca
Eleocharis fallax
Cyperus odoratus
Alternanthera philoxeroides
Polygonum punctatum
Leersia hexandra
Bacopa monnieri
Juncus roemerianus
Panicum dichotomiflorum
Sesbania herbacea
Panicum virgatum
Distichlis spicata
Schoenoplectus pungens
Paspalum vaginatum
Typha latifolia
Schoenoplectus robustus
Echinochloa walteri
Panicum hemitomon
Sacciolepis striata
Sagittaria lancifolia
Spartina patens

2008.


ME 04 CRMS % Cover and FQI by Year and Location
FQI and Cover (%)
100
90
80
70
60
50
40
30
20
10
0
2006 2007 2008 2009 2010 2011 2012 2013
CTU 1
CTU 2
CTU 3
REF 1
REF 2
REF 3
Other
Typha latifolia (2)
Typha L. (2)
Typha domingensis (3)
Schoenoplectus robustus (7)
Schoenoplectus americanus (8)
Sagittaria lancifolia (6)
Phragmites australis (6)
Paspalum vaginatum (7)
Panicum dichotomiflorum (3)
Lythrum lineare (5)
Leptochloa fusca (2)
Juncus roemerianus (9)
Ipomoea sagittata (8)
Echinochloa walteri (5)
Distichlis spicata (9)
Spartina patens (9)
FQI

stability.



year. The marsh salinity type represent the salinity cohort of individual species from fresh to saline indicating if a location is stable or undergoing habitat transition annually.

Soils:

Soil cores were collected one time (within a year of site establishment) to describe soil properties (bulk density and percent organic matter). All cores were sampled after Hurricane Rita. Mean bulk density and percent organic matter (OM%) for project and reference CRMS station differed little except for 507 and 571 which represented the largest difference among the project and reference CRMS sites (Figures 16 and 17). The bulk density profile of 507 had a substantially higher bulk density and lower percent organic matter below 16 cm than any other location suggesting it could be located near a ridge or cheniere. While CRMS 571 possessed the lowest bulk density and highest percent organic matter signifying a very peaty soil.

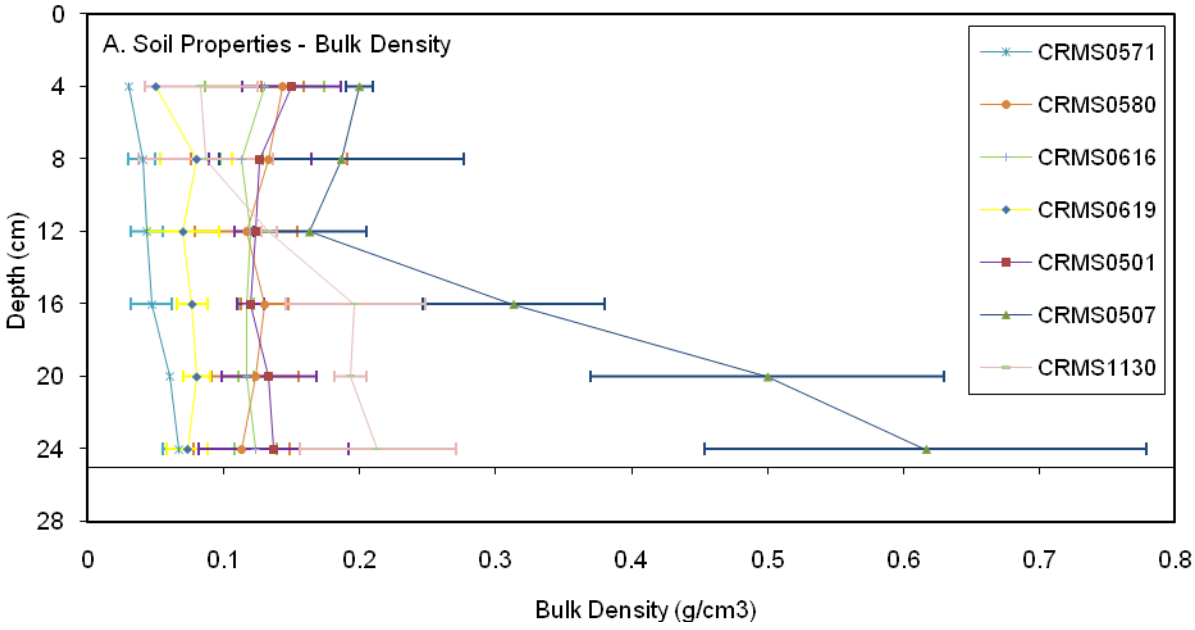


Figure 16. Mean soil bulk density collected at project and reference CRMS stations. Error bars represent standard deviation.

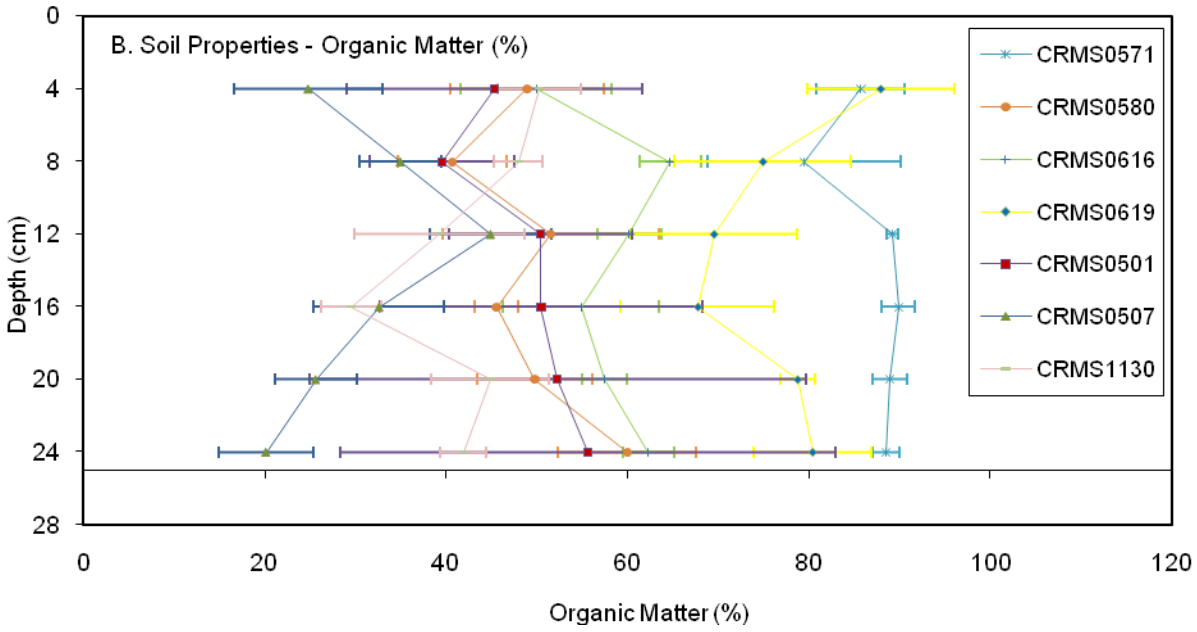


Figure 17. Mean soil organic matter content collected at project and reference CRMS stations. Error bars represent standard deviation.

Elevation Change:

Subsidence and accretion data collected at the ME-04 project CRMS sites 571, 580, 616, 618, and 619 along with the reference CRMS sites 501, 507, 508, 536, and 1130 generally show the project area keeping up with sea level rise (SLR) while the reference area loses elevation (Figure 18). The project locations are mostly maintaining elevation compared to the Sabine Pass NOAA tide gauge sea level rise estimate of 0.6 centimeters per year except CRMS 616 (Zervas 2009). Overall this is probably not a direct result from the project features though the rock dike along Freshwater Bayou Canal reduces the tidal export of sediments and organic materials from CTU one. This indicates that land loss in the project area would likely to be dominated by wave erosion which the project rock dike effectively reduces. The elevation change rates of the project area ranged from 1.32 cm/yr to 0.05 cm/yr relative to SLR, but generally were closer to 0.6 cm/yr on average. The elevation change rates of the reference CRMS sites ranged from 0.43cm/yr to -1.28 cm/yr compared to SLR, but averaged approximately -0.2 cm/yr. These values indicate elevation change rates along Freshwater Bayou are generally stable. CRMS site 1130 had the largest negative elevation change rate (-1.28 cm/yr). This is likely due to its isolation from any sediment source, herbivory and high subsidence.

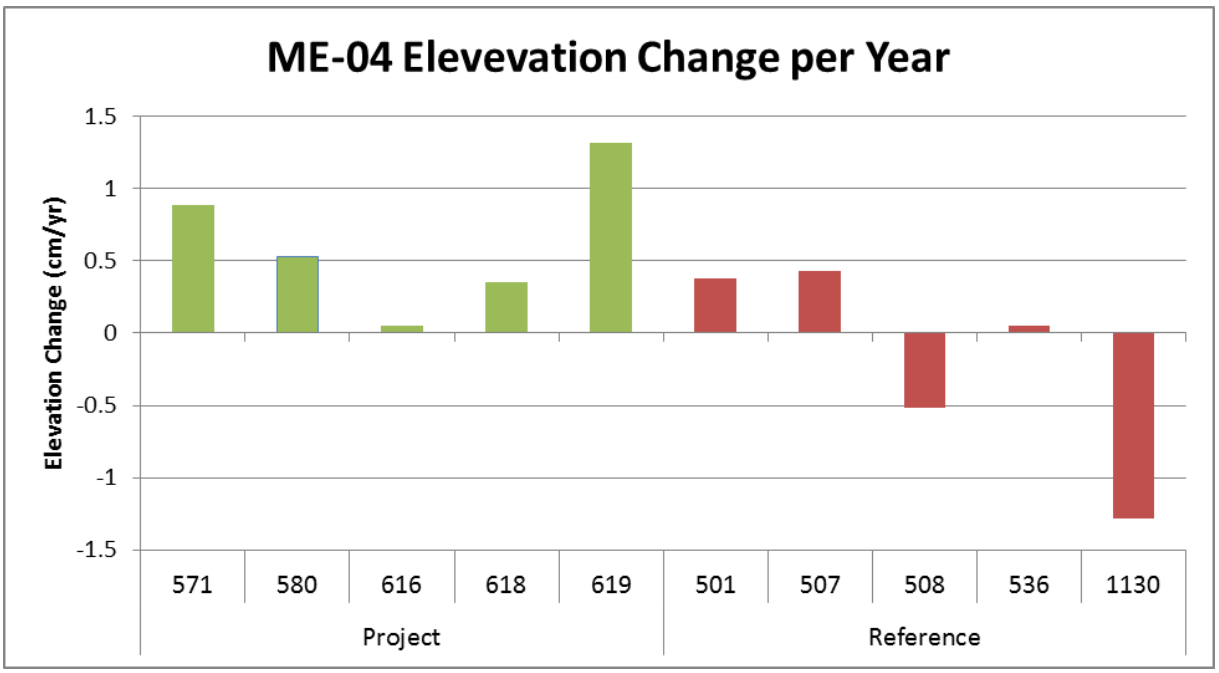


Figure 18. Elevation change per year comparative to sea level rise as experienced in the project CRMS sites and reference CRMS sites. The overall trend is that the project sites are keeping up with SLR while the reference sites are varied in nature.

V. Conclusions

a. Project Effectiveness

The shoreline along the west bank of Freshwater Bayou Canal and associated wetlands in the project area have benefited from the construction of the project rock dike, as indicated by the significantly reduced erosion rates relative to the reference areas. However, the rate of erosion increases when the elevation of the rock dike falls below the original construction elevation, as noted between the 2008-2011 and 2011-2014 time intervals. Maintenance events in 2002 and 2005 lifted the rock dike back to the prescribed elevations; however a large breach had occurred at the Transco Pipeline exposing the interior marsh of CTU 1 to the tidal effects of Vermilion Bay. CTU 1 was already severely impacted by Hurricanes Rita and Ike and is the most vulnerable area of the project to tidal scour and sediment export. A maintenance event by the Vermilion Parish Police Jury has been completed to plug the 300 foot breach at the Transco Pipeline. In addition, a CWPPRA O&M maintenance event to address the deficient reaches of foreshore rock dike is expected to begin in 2014/2015. In an effort to reduce costs, the Engineering, Design and Construction Contract for ME-04 Freshwater Bayou Wetland Protection Project will be combined with the maintenance proposed for ME-13 Freshwater Bayou Canal Bank Stabilization Project.

The ME-04 project is not effectively keeping water levels within the desired range since the project and reference areas are in target nearly an identical percentage of the year (45-50%). Salinity stayed within the target range in the project area and reference area over 62% of the year since 2007, but this cannot be attributed to project features because there is no significant hydrologic separation between the project and reference areas. The observed salinity spikes have been associated with periods of droughts and tropical storm or hurricane activity in the project and reference locations. Reference area 10cm and 30cm porewater salinities were higher than their project area counterparts consistently across all years surveyed, suggesting that the rock dike may prevent higher saline waters penetrate the project area.

Marsh loss in the project area and specifically CTU 1 continues to be a major issue but is typically associated with episodic hurricane damage in the interior marshes. Without the project rock dike it is likely that Freshwater Bayou Canal would have breached into multiple areas of the ME-04 project wetlands and created deep water interior connections between the Freshwater Bayou Canal and CTU 1. This separation of Freshwater Bayou Canal and the interior wetlands prevents strong tidal scouring that would remove fragile organic soils from the project area.

Vegetation in the project area was severely impacted by Hurricane Rita and to a lesser extent by Hurricane Ike. Species assemblages have generally rebounded to pre disturbance percent cover and FQI values. The vegetation showed a small but consistent increase in brackish and saline species from 2008 to 2011 when high rainfall in 2012 and 2013 reversed that trend. A

large blowout in CTU 1, caused by Hurricane Rita, in combination with the tidal exchange through the breach in the spoil bank levee is causing stress to the vegetation and erosion of that unit. Overall there is very little distinct separation between the vegetation in the project and reference areas except for R 3 which is hydrologically isolated from the salinity pulses present to the east.

b. Recommended Improvements

Overall the Freshwater Bayou Wetlands Project rock dike is in operational condition; however the portions of the foreshore dike that have settled below the designed elevation need to be capped to prevent further bankline erosion. A funding request was approved by the CWPPRA taskforce in 2012 and construction is likely to begin in the 2014-2015 timeframe.

c. Lessons Learned

The water control structures that were constructed, operated and maintained by the land owner are not included in the CPRA Operation and Maintenance Plan. Implementation of CWPPRA projects where the landowner has total control over the operation of existing water control structures, and over the installation and operation of additional structures as part of the features of a CWPPRA project, as was the case for ME-04, has been discontinued.

In order to prevent further wetland degradation along Freshwater Bayou, especially in the ME-04 project and reference areas and adjacent marshes, and to prevent increased saltwater intrusion into this part of the Chicot Aquifer, any deepening and widening of the Freshwater Bayou Canal to Port of Iberia Canal shipping lane must be mitigated by the installation and maintenance of canal embankments, preferably armored with rock or protected by rock dikes. The proposed deepening and widening of Freshwater Bayou, Gulf Intracoastal Waterway, and Port of Iberia Canal on the ME-04 project and reference areas and adjacent marsh areas would introduce additional saltwater into fresh and intermediate marshes. This cross sectional increase would also exacerbate the tidal forces ability to remove organic materials and soils from the interior wetlands. Most of the marshes in the ME-04 project and reference areas have converted from mainly fresh marshes to intermediate to brackish dominated by *Spartina patens*. These intermediate and brackish marshes are inundated a considerable proportion of the year and if this is exacerbated due to increasing the size of Freshwater Bayou or due to rapid sea level rise the current dominant species *Spartina patens* could undergo rapid die back. It is more likely that these marshes will convert to a less productive shallow pond habitat than to an emergent or floating vegetation type (LCWCRTF, 2002). The Cameron-Creole Wetlands and Sabine National Wildlife Refuge Freshwater Impoundment (Unit 5) are historically similar in soils and marsh types to those in the Freshwater Bayou project and reference areas. Navigation channel-induced saltwater intrusion due to widening and deepening of the Calcasieu Ship Channel in the 1950's caused major land loss by killing vegetation in the fresh sawgrass marsh and converting it to shallow open water ponds (LCWCRTF, 2002).

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Appendix A
(Inspection Photographs)

Photo No. 1, Typical Rock Dike

Photo No. 2, Vegetation Behind Rock Dike

Photo No. 3, Typical Rock Dike

Photo No. 4, Low Areas in Rock Dike, Erosion of Bank

Photo No. 5, Low Areas in Rock Dike

Photo No. 6, Low Areas in Rock Dike

Appendix B
(Three Year Budget Projection)

FRESHWATER BAYOU / ME04 / PPL2

Three-Year Operations & Maintenance Budgets 07/01/2014 - 06/30/2017

Project Manager	O & M Manager	Federal Sponsor	Prepared By
Pat Landry	*Mel Guidry*	*NRCS*	*Mel Guidry*

	2014/2015 (-20)	2015/2016 (-21)	2016/2017 (-22)
Maintenance Inspection	$ 6,651.00	$ 6,851.00	$ 7,057.00
Structure Operation	$ -	$ -	$ -
State Administration	$ 13,000.00	$ -	$ -
Federal Administration	$ 8,000.00	$ -	$ -
Maintenance/Rehabilitation			

14/15 Description: Capping of rock dike.

E&D	$ -	
Construction	$ 2,244,550.00	(Incl. 25% Contingency)
Construction Oversight	$ 75,000.00	
Sub Total - Maint. And Rehab.	$ 2,319,550.00	

15/16 Description:

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

16/17 Description:

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

	2014/2015 (-20)	2015/2016 (-21)	2016/2017 (-22)
Total O&M Budgets	**$ 2,347,201.00**	**$ 6,851.00**	**$ 7,057.00**

O &M Budget (3 yr Total)	**$ 2,361,109.00**
Unexpended O & M Budget	**$ 2,532,274.00**
Remaining O & M Budget (Projected)	**$ 171,165.00**

Note: Additional funding of $2,450,664 approved at Jan. 2013 TF Mtg.

OPERATION AND MAINTENANCE BUDGET WORKSHEET

FRESHWATER BAYOU / PROJECT NO. ME-04 / PPL NO. 2 / 2014/2015

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,457.00	**$6,457.00**
General Structure Maintenance	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	$75,000.00	**$75,000.00**

ADMINISTRATION

OCPR / CRD Admin.	LUMP	1	$13,000.00	$13,000.00
FEDERAL SPONSOR Admin.	LUMP	1	$8,000.00	$8,000.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$21,000.00**

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: E & D for Pipeline Gap Closure and Capping of Rock Dike

Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Rip Rap	0	0.0	21,942	$75.00	$1,645,650.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00

Filter Cloth / Geogrid Fabric	SQ YD	0	$0.00	$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	CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)		0	$0.00	$0.00
Timber Piles (each or lump sum)		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	$150,000.00	$150,000.00
Contingency (25%) (1,795,650 x 0.25)	LUMP	1	$448,900.00	$448,900.00
General Structure Maintenance	LUMP	0	$0.00	$0.00
		0	$0.00	$0.00
		0	$0.00	$0.00
		0	$0.00	$0.00
			TOTAL CONSTRUCTION COSTS:	**$2,244,550.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$2,347,007.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET

FRESHWATER BAYOU / PROJECT NO. ME-04 / PPL NO. 2 / 2015/2016

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,851.00	**$6,851.00**
General Structure Maintenance	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

OCPR / CRD 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	
Rip Rap	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$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		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			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%) (1,795,650 x 0.25)		LUMP	0	$0.00	$0.00
General Structure Maintenance		LUMP	0	$0.00	$0.00
			0	$0.00	$0.00
			0	$0.00	$0.00
			0	$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,851.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET

FRESHWATER BAYOU / PROJECT NO. ME-04 / PPL NO. 2 / 2016/2017

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$7,057.00	**$7,057.00**
General Structure Maintenance	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

OCPR / CRD 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	
Rip Rap	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$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		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			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%) (1,795,650 x 0.25)		LUMP	0	$0.00	$0.00
General Structure Maintenance		LUMP	0	$0.00	$0.00
			0	$0.00	$0.00
			0	$0.00	$0.00
			0	$0.00	$0.00
			TOTAL CONSTRUCTION COSTS:		**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$7,057.00**

APPENDIX C
(Field Inspection Notes)

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: ME-04 Freshwater Bayou Wetland Protection

Date of Inspection: May 16, 2012 Time: 10:50 am

Structure No. N/A

Inspector(s): Mel Guidry, Stan Aucoin, Jody White, and Garret Broussard (CPRA)
Dale Garber (NRCS)

Structure Description: Foreshore Rock Dike

Water Level : 0.4 at 10:04am at Maxie Pierce Staff Gage

Type of Inspection: Annual

Weather Conditions: sunny and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill) (foreshore dike)	Good			1,2,3	Recent maintenance work to restore dike to constructed elevation still in good condition.
				4,5,6	Approx. 2,000 LF still below +4.0 NAVD88 and will be addressed through a proposed maintenance event.
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?