State of Louisiana

Coastal Protection and Restoration Authority (CPRA)

2025 Operations, Maintenance, and Monitoring Report

for

Freshwater Introduction South of Highway 82

State Project Number ME-16
Priority Project List 9

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Calcasieu Parish

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For
Freshwater Introduction South of Highway 82 (ME-16)

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Preface

This report includes monitoring data collected through December 2024, and the annual maintenance inspections through May 2017. A damage assessment inspection was conducted following Hurricane Laura in September 2020. The Freshwater Introduction South of LA Hwy 82 (ME-16) project is a 20-year Coastal Wetlands, Planning, Protection, and Restoration Act (CWPPRA, Public Law 101-646, Title III, Priority List 9) project administered by the United States Fish and Wildlife Service (USFWS) and the Coastal Protection and Restoration Authority of Louisiana (CPRA).

The 2025 report is the 6th and final in a series of reports. For additional information on lessons learned, recommendations and project effectiveness please refer to the 2004, 2007, 2011, 2015, and 2020 Operations, Maintenance, and Monitoring Reports on the CPRA web site at http://coastal.Louisiana.gov/. These reports will be made available for download at the following website: http://cims.coastal.la.gov/.

I. Introduction

The Freshwater Introduction South of LA Hwy 82 project area is located in the central and eastern portions of Rockefeller State Wildlife Refuge, and Miami Corporation on the eastern end of the Grand Chenier ridge, approximately 10 miles (16.09 km) east of the community of Grand Chenier in Cameron and Vermilion Parishes, La (Figure 1). It is bounded to the west by a canal west of Little Constance Bayou south of Deep Lake, to the south by the Gulf shoreline of the unmanaged marsh south of Unit 6, to the east by Rollover Bayou to a line from Flat Lake to the western boundary of Unit 15 and to the north by Louisiana LA Hwy 82. The project will benefit some 19,988 acres (8,088.87 ha) of which 15,835 acres (6,408.21 ha) are marsh and the remaining 4,153 acres (1,680.66 ha) are open water (USGS 1999).

The “Lakes” subbasin of the Mermentau Basin is experiencing high water levels (>2 ft MLG) due to the existence of locks and gates that control water levels and prevent saltwater intrusion into Grand and White Lakes. The “Chenier” subbasin of the Mermentau Basin is experiencing saltwater intrusion due to lack of freshwater flow caused by the presence of the hydrologic barriers consisting of LA Hwy 82 and the Lakes subbasin gates and locks. Marsh loss is occurring in the Chenier subbasin due to saltwater intrusion and in the Lakes subbasin due to high freshwater water levels which stress *Spartina patens* (marshhay cordgrass) and certain fresh marsh species and cause increased shoreline erosion along White Lake and Grand Lake (Clark 1999).

Most of the soils in the project area are classified as either Clovelly muck, Scatlake mucky clay or Bancker muck, which are level, poorly drained fluid soils (U.S. Department of Agriculture [USDA] 1995). Clovelly muck and Bancker muck are organic and mineral soils respectively, found in brackish marsh, whereas Scatlake mucky clay, prevalent at the southern end of the project area, is a mineral soil found in saline marshes.

The habitats in the project and adjacent areas are brackish and intermediate emergent marsh with saline marsh along the edge of the Gulf of Mexico (Chabreck et al., 1968, Chabreck and Linscombe, 1978, 1988). Dominant emergent vegetation species present in and adjacent to the

project include *Spartina patens* (marshhay cordgrass), *Schoenoplectus americanus* (chairmaker's bullrush), *Distichlis spicata* (inland saltgrass), *Phragmites australis* (Roseau cane) and *Bulboschoenus robustus* (leafy three-square) (USDA-NRCS 2002).

The project is designed to move water from Grand and White Lakes (when adequate head differential exists) to marsh areas south of LA Hwy 82, in order to moderate elevated salinities in Areas A, B and C. In addition 14 acres (5.67 ha) of marsh were created through the construction of terraces in Area B (Figure 1).

A model was prepared by Fenstermaker and Associates and a report was submitted to evaluate the effects of the project (C.H. Fenstermaker and Associates [CHFA] 2003). The modeling software used was MIKE 11, a one-dimensional model used for simulating flows, sediment transport, and water quality in estuaries, rivers, irrigation systems, and similar water bodies. The model showed that, overall, the project would reduce salinities in Area A. The magnitude of salinity reduction varied from each location with variances from 1-2 ppt to 3-4 ppt. The flap gates of the proposed structures at Little Constance Bayou, Dyson Bayou, Cop Cop Bayou, and structures No. 10 and 12 in the Boundary Line Levee should protect Unit 6 and Areas B and C from salinity spikes.

The construction phase of the project consisted of the following components:

1. The borrow canal along Hwy 82 and the trenasse connecting Superior Canal to the borrow canal were widened and deepened.
2. The Grand Volle Ditch was widened and deepened on both sides of Hwy 82 and a conveyance channel was constructed into Grand Volle Lake from Grand Volle Ditch. A barricade was also placed at the intersection of Grand Volle Ditch and Grand Volle Lake.
3. Approximately 26,000 linear ft of vegetated "duck-wing" terraces were constructed in the shallow open water between Units 6 and 14.
4. The plug in the Superior Canal branch that forms the eastern boundary of Rockefeller Refuge Unit 13 at the NE portion of Unit 13/Unit 6 Boundary line canal was removed.
5. The existing Little Constance Bayou water control structure was replaced with 4 – 4'-8" X 6'-8" flap gates on the south side and stop logs on the north side.
6. A new structure with four 48 in diameter culverts with flapgates and stoplogs was installed north of the existing Dyson Bayou structure near the NW portion of a small lake in the Unit 6 Boundary Line levee.
7. A new structure with four 48 in diameter culverts with flapgates and stoplogs was installed near the plugged Cop Cop Bayou adjacent to the existing Cop Cop Bayou structure.
8. Two new structures (10 and 12) with three 48 in diameter culverts with flapgates and stoplogs were installed in the Boundary Line Levee south of Unit 14.
9. The existing boundary line channel near the Cameron-Vermilion Parish line was widened and deepened.

Construction of the project features was completed in October 2006.

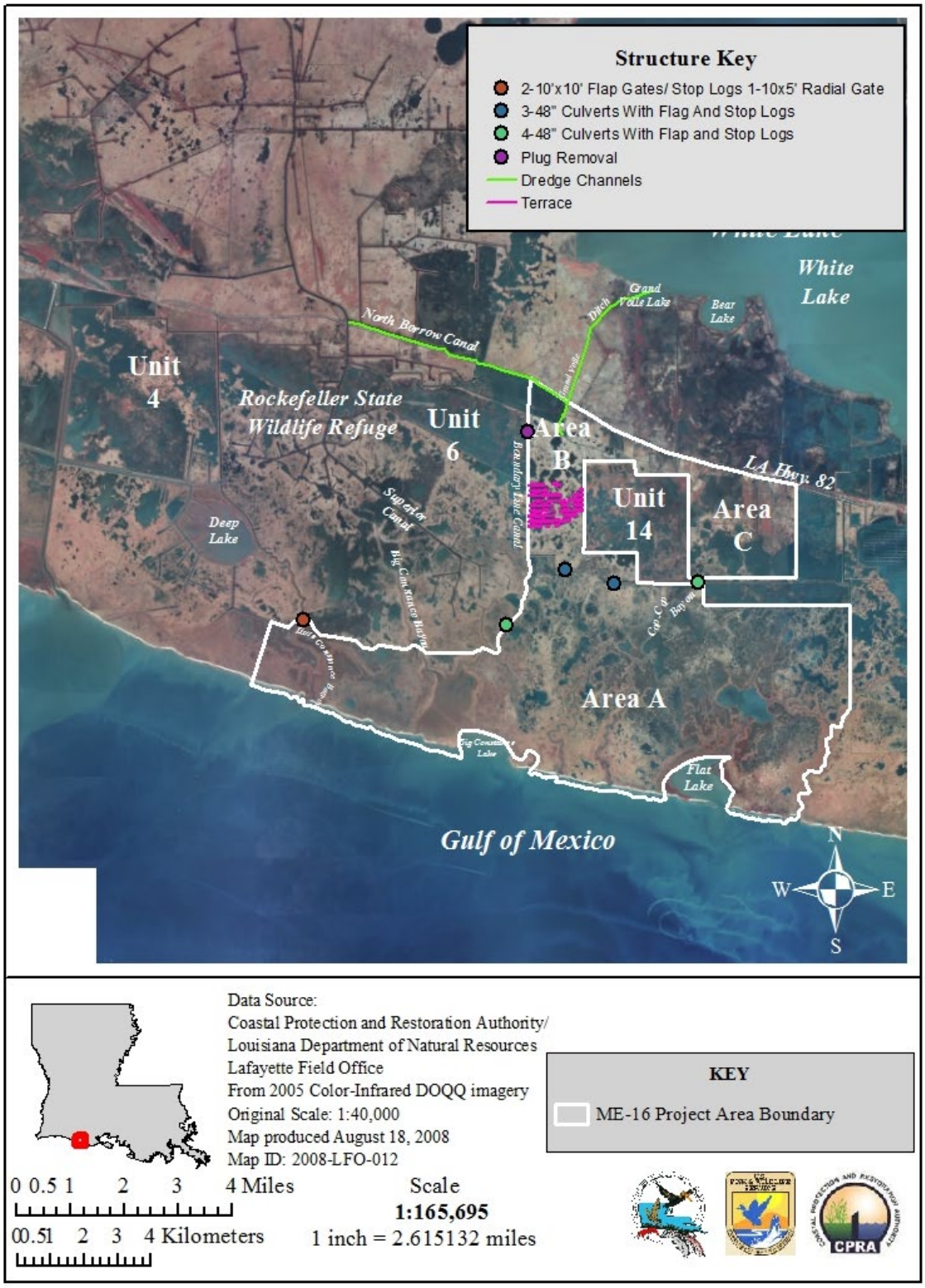


Figure 1. Freshwater Introduction South of Hwy 82 (ME-16) project area and construction features.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Freshwater Introduction South of Highway 82 Project (ME-16) 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. An inspection of the Freshwater Introduction South of Hwy 82 Project (ME-16) was held on September 09, 2020, following Hurricane Laura, which made landfall on the Louisiana coast August 29, 2020. A second site visit was made on April 07, 2021. CPRA was hoping water levels would have receded since the initial post-storm site visit. Water levels had in fact receded, but this did not afford a better visual inspection of the damages, as the culverts were still below the water line.

b. Inspection Results

New Cop-Cop Structure

The inlet side of the structure received considerable damage. The corrugated aluminum wing walls and all four (4) half-round aluminum risers, along with the variable crest weir inlet and framing hardware were damaged beyond repair. Approximately 20 percent of the soil and rock armoring between the structure inlet and outlet sides has been washed away.

With water levels elevated, it was not possible to assess damage below the water line.

The outlet side of the structure (aluminum backflow gates and timber bulkhead) appeared to be in working order as water could be seen flowing out. The backflow gates were not manually operated to determine condition or operability. (Photos: Appendix A, Photo 1)

Perry Bayou Structure (Formerly Structure No. 12)

The inlet side of the structure received considerable damage. The corrugated aluminum wing walls and all three (3) half-round aluminum risers, along with the variable crest weir inlet were damaged beyond repair. Approximately 80 percent of the soil and rock armament above the structure has been washed away.

With water levels elevated, it was not possible to assess damage below the water line.

The outlet side of the structure (aluminum backflow gates and timber bulkhead) appeared to be in working order as water could be seen flowing out. The backflow gates were not manually operated to determine condition or operability. (Photos: Appendix A, Photo 2)

McNeese Bayou Structure (Formerly Structure No. 10)

The inlet side of the structure received considerable damage. The corrugated aluminum wing walls and all three (3) half-round aluminum risers, along with the variable crest weir inlet and

framing hardware were damaged beyond repair. Approximately 30 percent of the soil and rock armament above the structure has been washed away. There was further erosion of the levee directly adjacent to the structure.

With water levels elevated, it was not possible to assess damage below the water line. The first set of timber piles back from inlet were visible above the water line and appear to be sound and plumb.

The outlet side of the structure (aluminum backflow gates and timber bulkhead) appeared to be in working order as water could be seen flowing out. The backflow gates were not manually operated to determine condition or operability. (Photos: Appendix A, Photo 3)

Hess Structure (Formerly New Dyson Structure)

The inlet side of the structure received considerable damage. The corrugated aluminum wing walls and all four (4) half-round aluminum risers, along with the variable crest weir inlet and framing hardware were damaged beyond repair. Approximately 30 percent of the soil and rock armament above the structure has been washed away.

With water levels elevated, it was not possible to assess damage below the water line. The first set of timber piles back from inlet were visible just below the water line and appear to be sound and plumb.

The outlet side of the structure received some minor damage. Three (3) aluminum grating platforms are detached from the outlets and are lifted. One (1) aluminum grating platform has broken free of the bulkhead. Water could be seen flowing out of the backflow gates. The backflow gates were not manually operated to determine condition or operability. (Photos: Appendix A, Photo 4)

Little Constance Structure

Some minor damage to structure and erosion of embankment adjacent to the structure. Minor damage to the structure included detached ladders and spalling of concrete. Spalling of the concrete is most likely a long term aging of the structure and not due to the storm. Some concrete appeared to be broken off due to force and could be storm related. Some rock armament and soil have been washed away on embankment around the structure.

Weir inlets are below water line and were unable to be assessed. Backflow gates appeared to be in the fully closed position below the water line. Therefore, backflow gates could not be assessed. The backflow gate lifting mechanism was not operated, therefore it is unknown if there are any damages to the lifting system. (Photos: Appendix A, Photo 5 & 6)

Earthen Terraces

One segment of terrace in the southernmost area of the terrace field experienced some erosion. Generally, the terrace field is in good condition. (Photos: Appendix A, Photo 7)

Grand Volle South Channel Enlargement

This area was not inspected during this field trip.

Louisiana Highway 82 Channel Enlargement

This area was not inspected during this field trip.

Grand Volle North Channel Enlargement and Marine Barrier

This area was not inspected during this field trip.

Boundary Line Channel Enlargement and Earthen Plug Removal

This area was not inspected during this field trip.

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

All flashboard risers have been damaged beyond repair. All 48 inch corrugated aluminum culverts, timber piles and outlet side of structure are believed to be partially intact and functional.

A request for FEMA claims was made, and FEMA obligated $2,424,419.00 on February 03, 2022 with the issuance of PW 984. This award was based on replacing the structures in-kind. HDR was tasked by CPRA with E&D for the repairs on September 19, 2022. CPRA asked HDR to prepare a design report with a cost for in-kind structure replacement, along with an alternative structure, referred to as the Ducks Unlimited (DU) structure. The DU structure is a structure designed and funded by DU and was constructed on the Rockefeller Refuge at a location known as Unit 4. The structure utilizes concrete T Panels as the base foundational structure form, with aluminum weir box inlets, and an aluminum flapped outlet. This structure withstood the storm surge of Hurricanes Laura and Delta, and was proposed as a preferred structure type for replacement of the ME-0016 structures, by LDWF personnel. HDR's opinion of probable construction cost for in-kind replacement was $4,869,176.54 and $6,891,773.54 for the alternate DU structure type (mitigated structure).

Further discussions were had with ICF, the state's FEMA liason, and CPRA decided to pursue funding for mitigation. A mitigated structure would be more robust and resilient to storm damage vs. the all-aluminum culvert and flashboard riser structure that existed pre-storm. ICF prepared and submitted a claim for mitigation to FEMA, and this claim was approved with the new FEMA PW 984 obligation for $6,892,000.00, on November 27, 2024.

On June 02, 2025, ICF made CPRA aware that the FEMA deadline for storm repairs for Hurricane Laura claims was August 28, 2024. An extension request has been

submitted, however ICF has relayed that, in their experience, extensions are not often granted.

CPRA has instructed HDR to continue working toward design and putting together plans and specifications for construction. After much discussion, the project team has decided to move away from the T Panel based structure, as there is a patent on the system design. In order for CPRA not to sole source the product design for construction, as well as, not to infringe on the patent, the project team is steering the design to an alternative structure that would be more resilient to storm damage.

Below is the overall estimated cost for the recommended repairs outlined above:

Estimated Repair Costs:

Repair of water control structures (Mitigated Structure), replacement of fill and rock armament

HDR Task - Engineering, Design, Construction Admin & Insp.	$350,000.00
CPRA Admin.	$75,000.00
Construction (with 35% Contingency)	$6,892,000.00
Total Estimated Construction Costs:	**$7,317,000.00**

TOTAL COST TO GET PROJECT IN WORKING ORDER $7,317,000.00

ii. Programmatic/ Routine Repairs

No maintenance work required at this time.

d. Maintenance History

General Maintenance: Below is a summary of completed maintenance projects and operation tasks performed since December 2006, the construction completion date of the Freshwater Introduction South of Hwy 82 Project (ME-16).

2011 – Hurricane Ike Repairs to New Cop Cop, Structure 12, Structure 10, New Dyson, and Little Constance water control structures – B & J Marine Services – This maintenance project included placing rock revetment at all five water control structures within the project boundary.

- New Cop Cop – approximately 94 tons of rip rap placed
- Structure 12 – approximately 377 tons of rip rap placed
- Structure 10 – approximately 159 tons of rip rap placed
- New Dyson – approximately 198 tons of rip rap placed
- Little Constance – approximately 467 tons of rip rap placed

At the time of construction, the contractor uncovered sinkholes above pipes at the New Cop Cop and New Dyson structures. The sinkholes were created by water infiltrating through breeches in the seal between the pipe and headwall. A change order was issued and the

contractor repaired the breeches by excavating soil around the pipe, sealing the pipe and headwall with Wet Dry 700 and redi-mix concrete, and then backfilling.

This maintenance project was a result of damages sustained from Hurricane Ike's storm surge in September 2008. The state was reimbursed for this maintenance project by FEMA in 2011.

Construction Costs	$300,484.44
Engineering and Design, Construction Oversight	$79,202.27
Total Cost	**$379,686.71**

III. Operation Activity

a. Operation Plan

Operation Plan Control Structure	Structure Type	Area Controlled	Salinity Target Level	Water Target Level	Operation
Little Constance Control Structure Note: no change to Big Constance Structure	Existing structure modified from 3 - 10 ft wide X 8 ft deep radial arm gates to flapgates on the south side and stoplogs on the north side.	Unit 6 and Area A Unmanaged-ed unit	5/10 ppt @ Superior Canal-Hwy 82 Bridge	3" below marsh level (0.75 feet NAVD88)	Maintenance – All flapgates open and stop logs removed when target levels not exceeded. Salinity Target – 2 bays closed (i.e., flapgates lowered) when 5 ppt salinity target level reached, stoplogs removed; all bays closed (all 3 flapgates lowered) when 10 ppt salinity reached, stoplogs removed. Water Level Target – Stoplogs set at marsh level to 0.5 feet below marsh level when water levels reach target levels (3 inches BML or 0.75 ft NAVD88) or less.
Existing Dyson Bayou and Bayou Josephine WCSs	4 – 48 inch diameter culverts with flapgates on south and stop logs on north (Unit 6) side.	Unit 6 and Area A	5/10 ppt @ Superior Canal-Hwy 82 Bridge	3" below marsh level (0.75 feet NAVD88)	Maintenance – All gates flapping, stop logs at 2 ft below marsh level Water Level Target – Stop logs set at marsh level to 0.5 ft below marsh level when water levels approach target levels (0.75 ft NAVD88) @ Superior Canal.
New Dyson Bayou WCS	4 – 48 inch diameter culverts with flapgates on south and stop logs on north (Unit 6) side.	Unit 6 and Area A	5/10 ppt @ Superior Canal-Hwy 82 Bridge	3" below marsh level (0.75 feet NAVD88)	Maintenance – All gates flapping, stop logs at 2 ft below marsh level Water Level Target – Stop logs set at marsh level to 0.5 ft below marsh level (1.0 ft to 0.5 ft) when water levels approach target levels (0.75 ft NAVD88) @ Superior Canal.
Existing Cop-Cop Bayou WCS	4 – 48 inch diameter culverts with flapgates on south and stop logs on north side.	Area A and Areas B and C	6 ppt @ Area A at Unit 14 station	3" below marsh level (0.75 feet NAVD88)	Maintenance – All gates flapping, stop logs at 2 ft below marsh level Ingress Period (May-June) – Flapgates raised; Stop logs at 2 ft below marsh level or lower Water Level Target – Stop logs set at marsh level to 0.5 ft below marsh level (1.0 ft to 0.5 ft) when water levels approach target levels (0.75 ft NAVD88) @ Superior Canal.
New Cop-Cop Bayou, New Structures 10 and No. 12 WCS	4 – 48 inch diameter culverts with flapgates on south and stop logs on north side.	Area A and Areas B and C	6 ppt @ Area A at Unit 14 station	3" below marsh level (0.75 feet NAVD88)	Maintenance (Always) – All gates flapping, stop logs at 2 ft or greater below marsh level Water Level Target – Stop logs set at marsh level to 0.5 ft below marsh level (1.0 ft to 0.5 ft) when water levels approach target levels (0.75 ft NAVD88) @ Superior Canal.

Note: The above operational plan submitted by Darryl Clark with USFWS.

a. Actual Operations

- No operations were conducted after damages from Hurricane Laura in 2020.

IV. Monitoring Activity

CWPPRA projects authorized for construction after August 14, 2003 will be monitored only with Coastwide Reference Monitoring System-*Wetlands* (CRMS) stations and other existing data collection. At the request of the federal sponsor (USFWS) one additional continuous recorder was specifically added to the project and will be funded through project-specific monitoring funds. There are 4 CRMS-*Wetlands* sites in the project area (Figure 2).

a. Monitoring Goals

The objective of the Freshwater Introduction South of Hwy 82 project is to protect and restore intermediate and brackish marshes within the project area over the 20-year project life.

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

1. Reduce the rate of marsh loss in Area A saline marshes from 0.16%/yr to 0.11%/yr, in Area A brackish marshes from 0.16%/yr to 0.10%yr, in Area B marshes from 0.24%/yr to 0%/yr and Area C marshes from 0.56%/yr to 0.39%/yr.
2. Reduce mean salinity levels in Area A saline marshes from 20 ppt to 17 ppt, in Area A brackish marshes from 15 ppt to 11 ppt, and in Areas B and C, from 5 to 4 ppt.
3. Increase the coverage of emergent wetland vegetation within Areas A, B and C.
4. Increase the coverage of submerged aquatic vegetation (SAV) in the shallow open water areas within Areas A, B and C.

b. Monitoring Elements

Aerial Photography

For project specific data, near-vertical color-infrared aerial photography (1:12,000 scale) was used to measure vegetated and non-vegetated areas for the project area. The photography was obtained in post-construction years 2008 and 2018. Aerial photography planned for 2024 was canceled due to budgetary constraints. 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 is collected for the entire coast through CRMS-*Wetlands* and was used to evaluate ME-16 along with project-specific photography. Land:Water analysis of the 1 km CRMS sites was done using an automated classification methodology using only manual delineation. Photography for the CRMS sites was collected and analyzed in 2005, 2008, 2012, 2015, 2018, and 2021.

In addition, land change of the project area as a whole was assessed from land/water data interpreted from TM satellite imagery (30 m^2 resolution) which is stored on the CRMS viewer website (http://www.lacoast.gov/crms_viewer/); pre- and post-construction comparisons were made. Linear regressions were calculated for the period of record. The variability in percent land data points around the slope illustrate the influence of various sources of environmental variance or classification error. Positive slopes indicate increasing percent land or historical land gain and negative slopes indicate decreasing percent land or historical land loss (Couvillion, 2021).

Salinity

Salinity is monitored hourly utilizing three CRMS-*Wetlands* sites (599, 609, 610) within the project area and selected reference site CRMS0600. A project-specific continuous recorder (ME16-06) was installed within Muskrat Bayou southeast of Cop-Cop Bayou to further measure project effects on salinity levels (Figure 2). Salinity is measured every hour with a salinity gauge that is attached to the water-level gauge. The gauges are serviced at the same time. Continuous data will be used to characterize average annual salinities throughout the project and reference areas. At each servicing, a measurement of interstitial water salinity is collected adjacent to each gauge. Interstitial water salinity is also determined at the 10 vegetation plots, when vegetation is surveyed. Salinity data will be 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. For this report, data were available pre-construction at stations ME16-01, ME16-02, ME16-03, ME16-04R, ME16-05R, and pre- and post-construction at station ME16-06 and CRMS sites inside (599, 609, 610) and outside (600) the project area (Table 1). Though the boardwalk for CRMS0600 is located within the project area, the recorder is located outside of the project area at the mouth of Rollover Bayou where the reference station ME16-04R was previously located.

Station	Location	Data Collection Period
ME16-01	No. of Cop Cop WCS	5/21/01 – 2/19/04
ME16-02	So. of Cop Cop WCS	5/21/01 – 2/19/04
ME16-03	Area A south of Boundary Line Canal	6/21/01 – 2/19/04
ME16-04R	Rollover Bayou mouth	1/9/02 – 2/19/04
ME16-05R	SW White Lake	2/7/02 – 2/19/04
ME16-06	Area A SE of Cop Cop	3/3/05 – 6/1/2022
CRMS0599	SW Area A	11/14/06 – present
CRMS0609	NE Area A	12/11/07 – present
CRMS0610	SW Area A	1/15/18 – present
CRMS0600	SE Area A	7/7/11 – present

Table 1. Project hydro station location and data collection period.

Vegetation

Vegetation composition and cover is 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 were collected in early fall of 2006 - 2024 using the Braun Blanquet method.

Individual species' cover data are summarized according to the Floristic Quality Index (FQI) method (Cretini and Steyer 2011). A list of plants occurring in Louisiana's coastal wetlands (~500 species) was provided to all known Louisiana coastal vegetation experts and their input on scoring was requested. The panel then provided an agreed upon group score (Coefficient of Conservatism or CC score) for each species. CC scores are weighed based on cover in the FQI for Louisiana coastal wetlands. All species known to occur in the coastal zone were given a floristic quality score on a scale of 0 to 10. Species that scored the lowest were considered by the panel to indicate disturbance or unstable marsh environments. CRMS sites inside (599, 600, 609, 610) the project were used for this report.

Water Level

Water level within the marsh is measured at every salinity station every hour with a water-level gauge installed within an area that is hydrologically connected to the surrounding water body. The gauge is surveyed relative to the top of the RSET (NAVD 88). The water-level gauge is serviced on approximately a monthly basis. Water level data is used to document the variability in water level in the project and reference areas.

Submerged Aquatic Vegetation (SAV)

SAV coverage was not measured as SAV monitoring was outside the scope of the monitoring plan. Visual observations were made during routine O&M inspections.

Soil Properties

Soil cores were collected one time (within a year of site establishment) 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 the site. The soil was processed by the Department of Agronomy and Environmental Management at Louisiana State University.

Elevation Change

Soil surface elevation change utilizing a combination of sediment elevation tables (RSET) and vertical accretion from feldspar horizon markers are measured twice per year at each CRMS site. This data was used to describe general components of elevation change and establish accretion/subsidence rates. The RSET was surveyed to a known elevation datum (ft, NAVD88) to 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 areas; therefore the displayed elevation change rates are an estimation of that temporal trend.

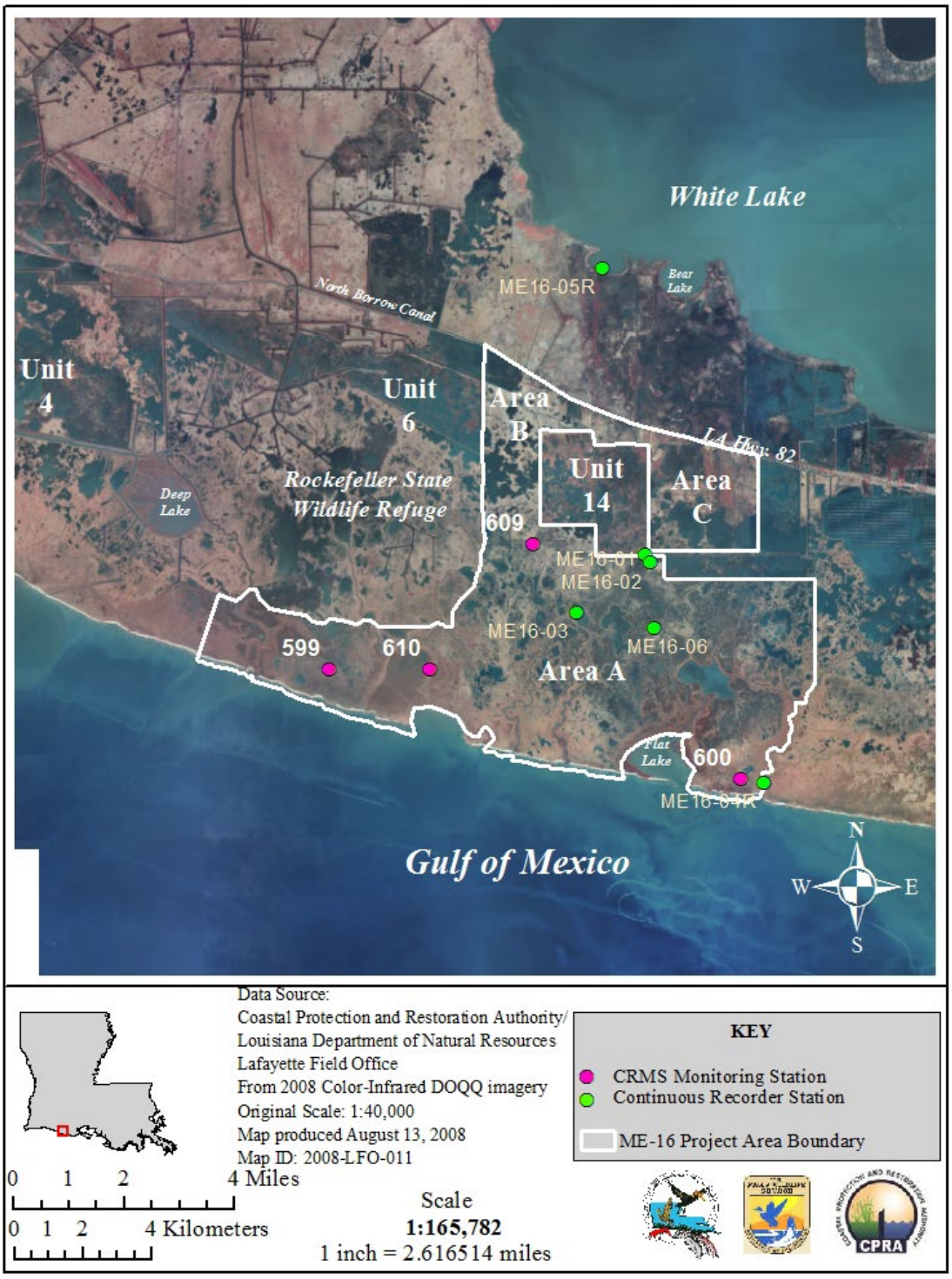


Figure 2. Location of project-specific monitoring stations and CRMS-*Wetlands* sites within Freshwater Introduction South of Hwy 82 (ME-16) project area and surrounding marsh.

c. Monitoring Results and Discussion

Aerial Photography

Post-construction land:water analysis was completed for the 2008 and 2018 aerial photography (Figures 4a and 4b). Results from the 2008 photography indicated 74.15% land and 25.84% water within the project area compared to 73.07% land and 26.92% water in 2018. This results in a loss rate of -0.11%/yr for the project over that time frame, which accomplishes the project's goal to reduce the historical rate of marsh loss, which ranged from 0.16%/yr in Area A to 0.56%/yr in Area C prior to construction.

For the four CRMS-*Wetlands* sites within the project area, the 2005, 2008, 2012, 2015, 2018, and 2021 digital imagery was collected (Figure 3). Land loss is increasing at CRMS0600 (34 acres between 2012 and 2021). This site is located on the Gulf shoreline and is experiencing high rates of shoreline erosion. CRMS0599 and CRMS0609 were gaining land prior to 2015, but have seen consistent losses since. Although CRMS0610 was stable through 2018 with some small gains early in project life, the most recent analysis showed a loss of 33 acres between 2018 and 2021, which coincides with the extreme events of the 2020 hurricane season.

Satellite data was modified from the CRMS land change synthesis report for 1985 – 2021 (Wood *et al*. 2025) for more temporal resolution to assess land change patterns and trends in the area (Figure 5). Since 2005, the patterns of land area volatility are punctuated by Hurricanes Rita (2005) and Ike (2008). The general pattern for the three project CRMS sites (0599, 0609, and 0610) is a steep drop in land area after Hurricane Rita with some recovery before Hurricane Ike and generally stable thereafter. The trend for CRMS sites is relatively stable from 1985 to 2000, but the trend line is heavily skewed by land accrual in CRMS 0610 as the historic shoreline in front of Big Constance Lake was eroded and infilled in previous shallow open water and has generally remained stable since. The reference site CRMS 0600 never recovered from land loss occurred following Hurricanes Rita and Ike. This site is exposed to recurring gulf shoreline erosion as well as high water in recent years due to rising sea levels and heavy rainfall, which likely was classified as new water on the more recent imagery analyses.

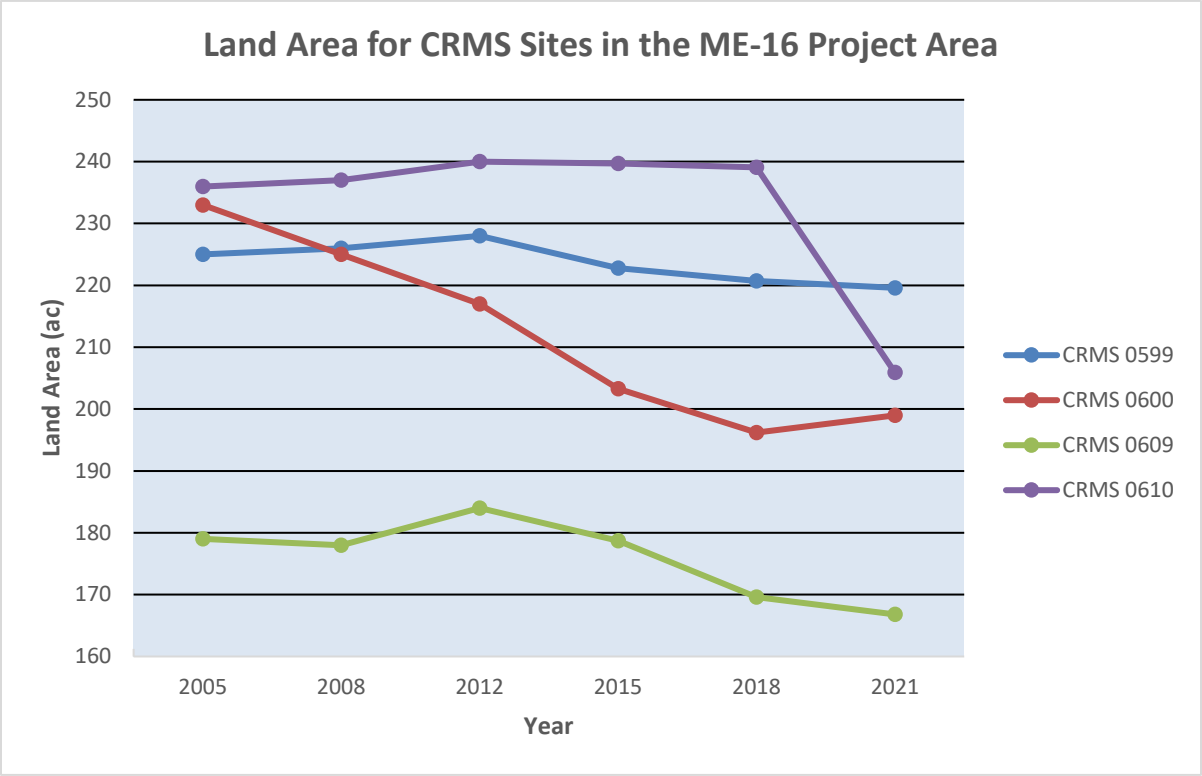


Figure 3. Land Area at CRMS site in the project area for 2005, 2008, 2012, 2015, 2018, and 2021.

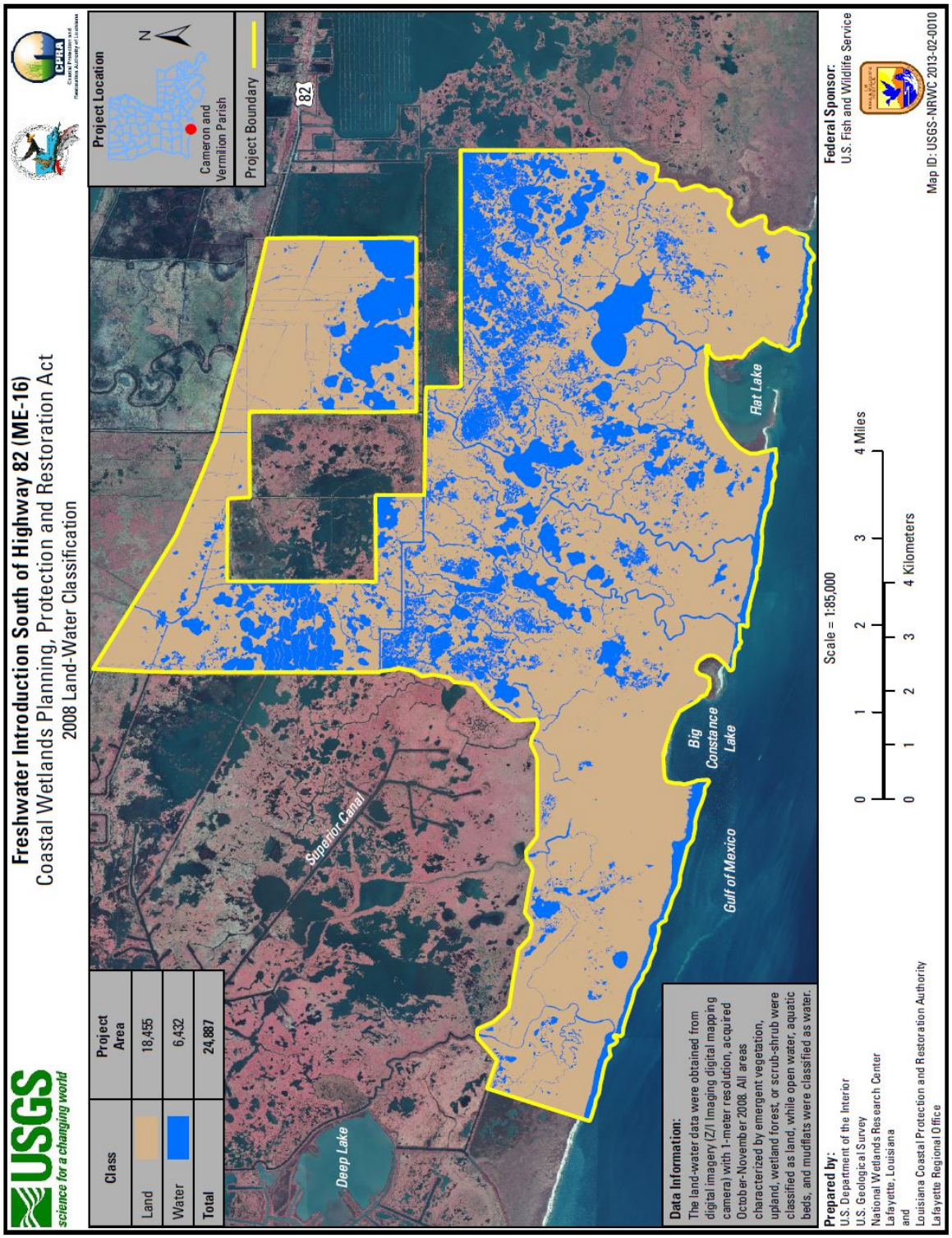


Figure 4a. Freshwater Introduction South of Highway 82 (ME-16) project 2008 land/water analysis.

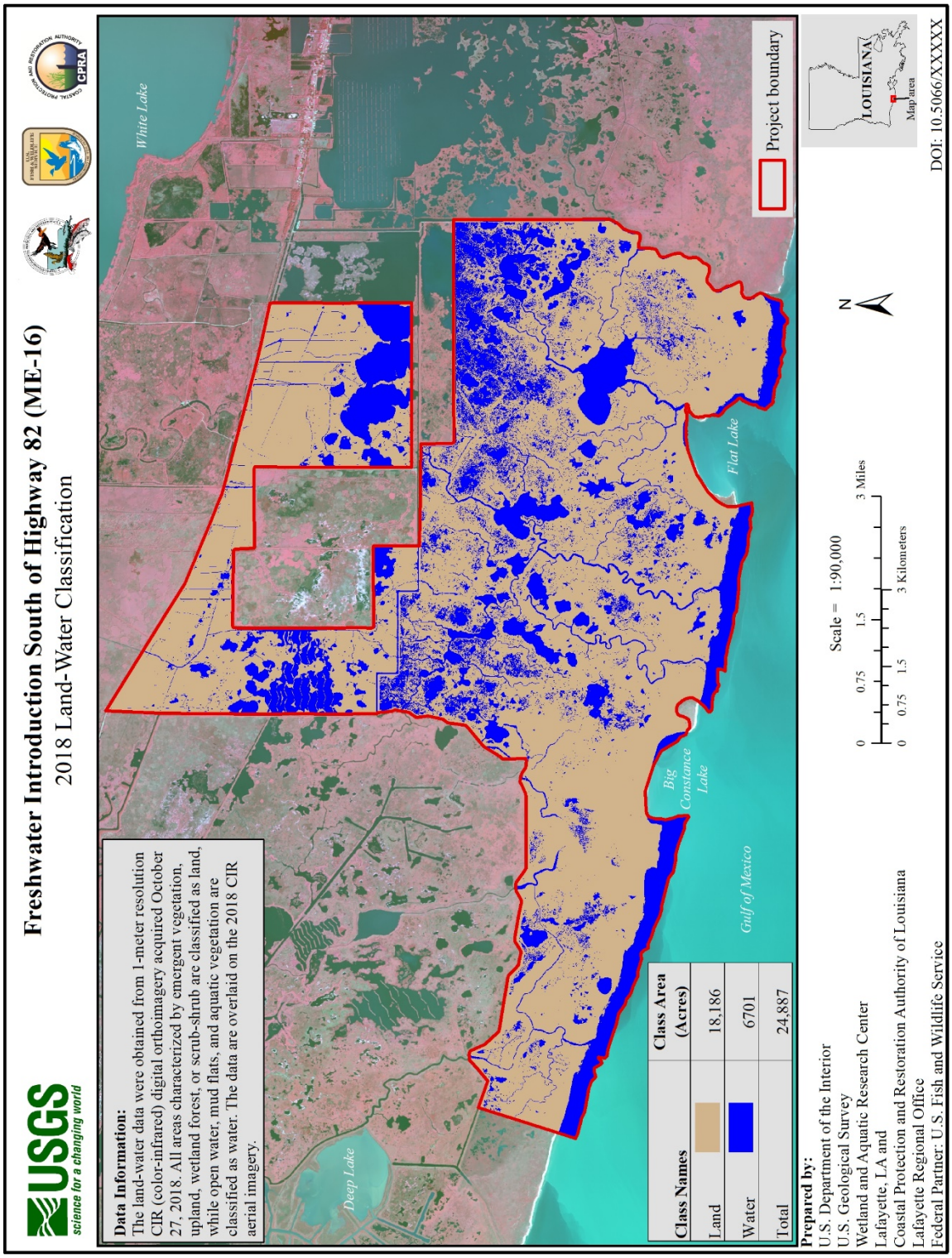


Figure 4b. Freshwater Introduction South of Highway 82 (ME-16) project 2018 land/water analysis.

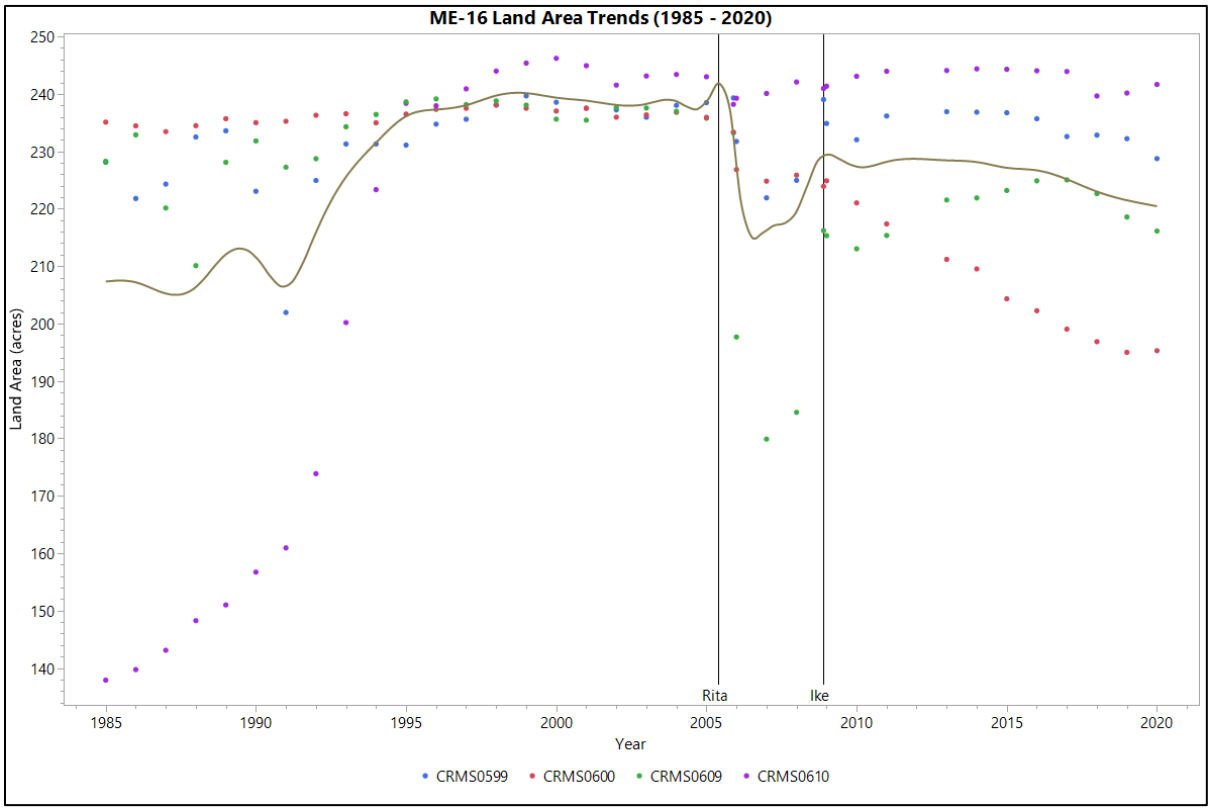


Figure 5. CRMS satellite land change trends for ME-16. Land area values are displayed for available satellite imagery from 1985-2020.

Salinity

The project's goal for salinity is to reduce mean salinity levels in Area A saline marshes from 20 ppt to 17 ppt, in Area A brackish marshes from 15 ppt to 11 ppt, and in Areas B and C, from 5 to 4 ppt. Data was collected May 2001 through February 2004 at project and reference sites to document pre-construction conditions in Areas A, B and C (Mouledous and Broussard 2015) and to supply information for the hydrodynamic model (C.H. Fenstermaker and Associates 2003). The model showed that operation of the project structures would enable the project to meet the salinity goals.

The long-term trend for annual salinity data in brackish project sites does not show a distinct effect of project construction (Figure 6a), with environmental drivers including precipitation/drought (Figure 6b), having a universal effect across all project and reference sites (Figure 6c). The highest salinity years across all sites (2011 and 2022) are linked to period of prolonged drought. In fact, in 2022 salinity levels in project brackish sites surpassed both of the saline stations. This is likely due to non/low-functional structures in unmanaged marsh which appears to trap saltwater over wash/inflow without an effective drainage mechanism. Hypersaline conditions have been recorded in this area during extreme drought due to accumulating salinity and saltwater is imported and evaporated.

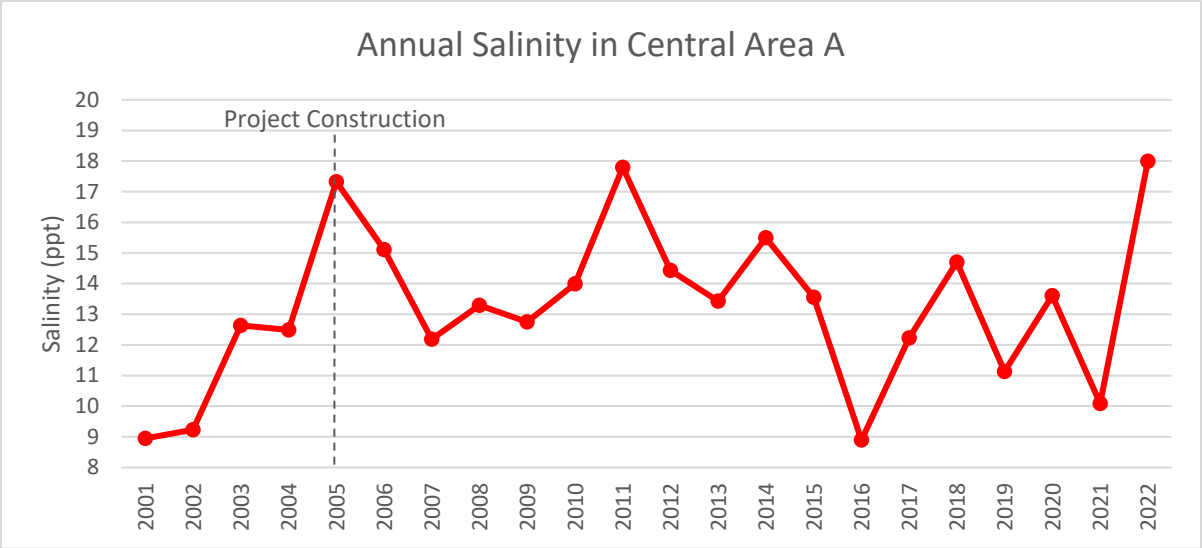


Figure 6a. Annual salinity, calculated from weekly means of continuous salinity data, collected at combined brackish project stations ME16-03 and ME16-06, in Central area A.

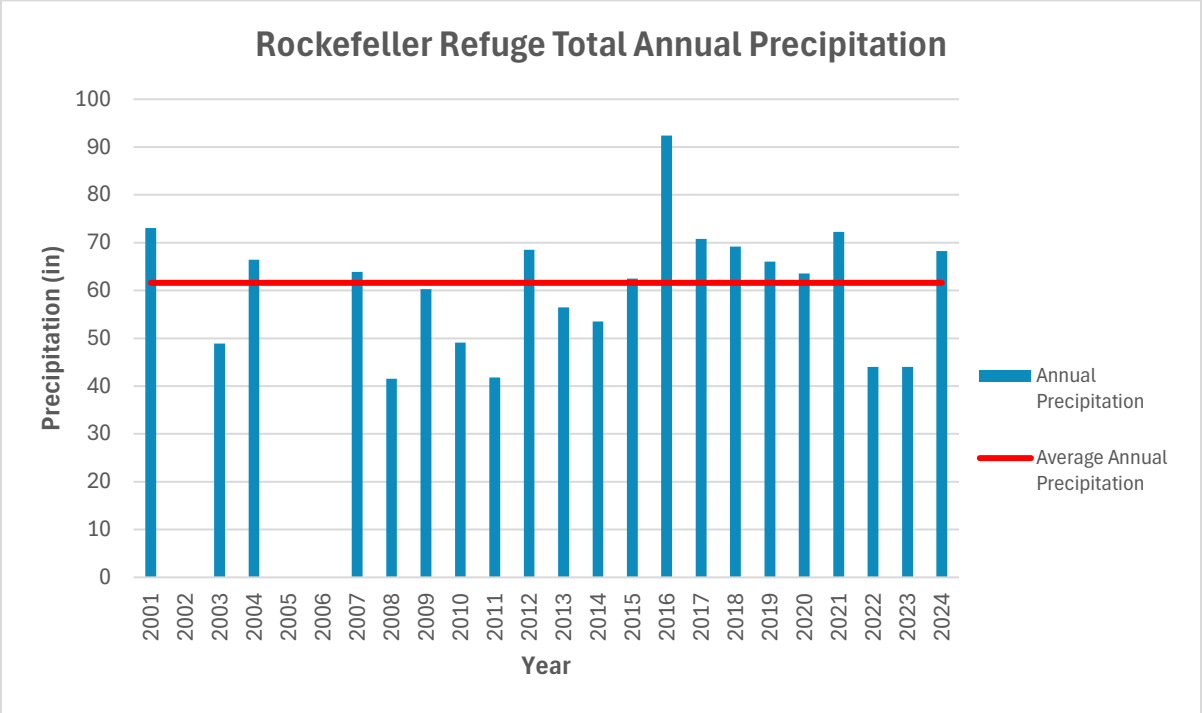


Figure 6b. Annual precipitation for 2001-2018 as collected at Rockefeller Wildlife Refuge (SRCC 2020) and from 2019-2024 as collected at the Lake Charles National Weather Service station (NWS 2025).

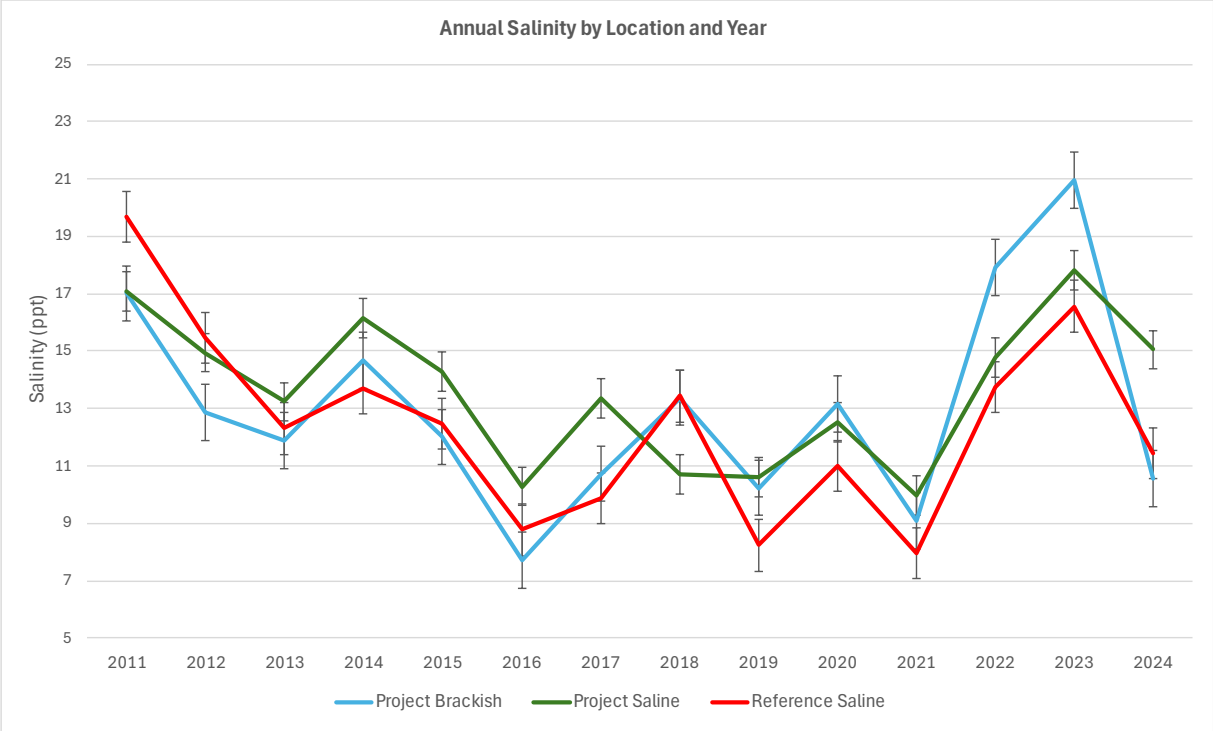


Figure 6c. Annual salinity, calculated from weekly means, and standard errors of continuous salinity collected at project brackish stations (ME16-06, CRMS0609), project saline stations (CRMS599, CRMS0610) and reference saline station CRMS0600 from 2011-2024.

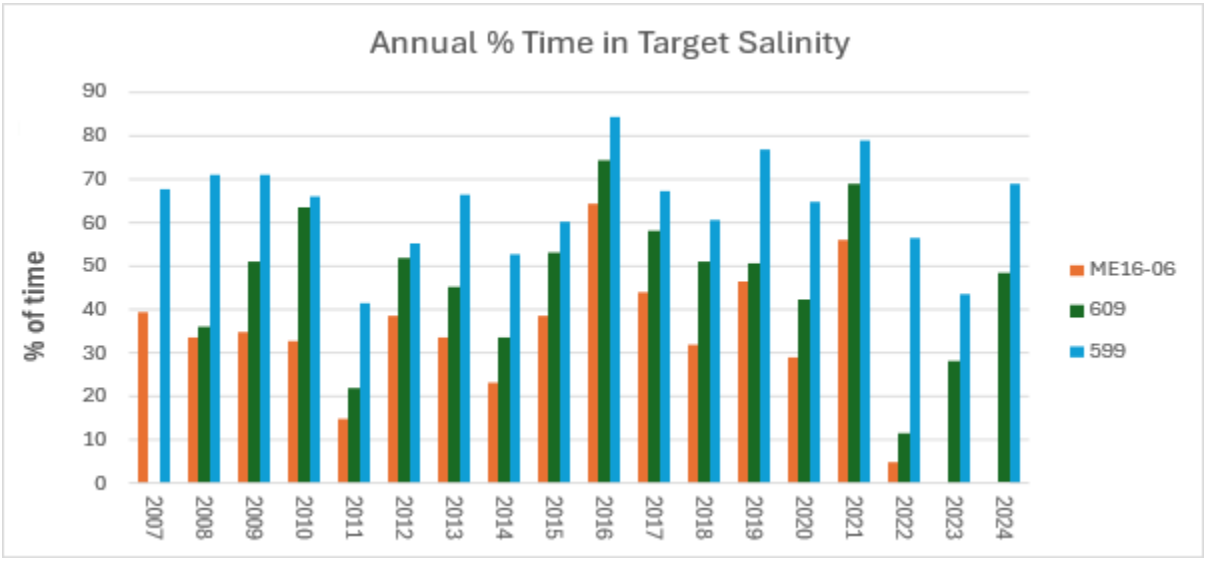


Figure 6d. Percentage of year salinities were inside target range for project brackish stations (ME16-06, CRMS0609) and project saline station CRMS0599.

The percentage of time within the salinity targets was then calculated for the brackish and saline project stations (Figure 6d, Table 2). There have been no structure operations since the last OM&M report (Mouledous and Broussard 2020) and while there may be some restricted

flow through flap gates, additional interpretation for the effect of the project is limited. The connection between the project's ability to reduce salinity levels and climatological conditions are again highlighted by linking drought/high precipitation years and the percentage time sites are within their target salinity. Comparing percent time within target to high water years shows the project is very effective at reducing salinity levels in Area A when adequate water levels exist to open the structures (Table 2). During these maintenance operations, the project met the target salinity goals 69% of the time at CRMS0609 and 56% of the time at ME16-06. Benefits are drastically reduced at lower rainfall levels, especially in periods of drought. It is worth noting, especially in the brackish sites that the 2022 and 2023 droughts appear to have had more of an impact than when the structures were still operable during the 2011 drought. This suggests that although the structures are unable to effectively maintain target salinities in low precipitation events, they may still lessen the hyper salinization effect of extreme drought.

Table 2. Percentage of time salinities were inside of target range for project brackish stations CRMS0609 and ME16-06 and saline station CRMS0599 from 2005 – 2024.

	% Time within Target Salinity		
	599 (Saline)	**609 (Brackish)**	**ME16-06 (Brackish)**
2005			13%
2006			30%
2007	68%		39%
2008	71%	36%	33%
2009	71%	51%	35%
2010	66%	63%	33%
2011[d]	41%	22%	15%
2012	55%	52%	39%
2013	66%	45%	33%
2014	53%	34%	23%
2015	60%	53%	39%
2016[w]	84%	75%	64%
2017	67%	58%	44%
2018[d]	61%	51%	32%
2019	77%	51%	46%
2020	65%	42%	29%
2021[w]	79%	69%	56%
2022[d]	57%	12%	5%
2023[d]	44%	28%	
2024	69%	58%	
Total	**65%**	**47%**	**35%**

[d] Drought year
[w] Wet Year

Based on this information, the project has met the goal of reducing salinities in Area A post-construction but is largely dependent on environmental conditions to do so. High precipitation increases water levels north of the water control structures, allowing structure openings more often and fresh water to flow, subsequently enabling project marshes to meet target salinity levels more frequently. Conversely, the project has limited effect during low rainfall years.

Means by month of interstitial water salinity is presented in Figures 7a and 7b. Prior to Hurricane Laura in 2020, the highest salinities occurred in project sites CRMS0599 and CRMS0600, reflecting the influence of the Gulf on these sites. Project site CRMS0610 (SW Unit A) had seen a steady decline in salinities since 2011, dropping to around 12 ppt at the 10 cm level and dropping from 20 ppt to below 15 ppt at the 30 cm level. However, since 2021, porewater salinity in CRMS0610 has increased beyond CRMS599 as the second highest porewater salinity. CRMS0600 has averaged over 20 ppt for the entire period of record. Porewater salinities rose above 20 ppt at CRMS0599 after the 2011 drought, but have dropped following the heavy rains of 2016 and again in 2021. Project station CRMS0609 (NE Unit A) displays a similar connection to precipitation with salinities spiking during drought (2011, 2018, and 2022) and decreasing during higher precipitation years (2016 and 2021).

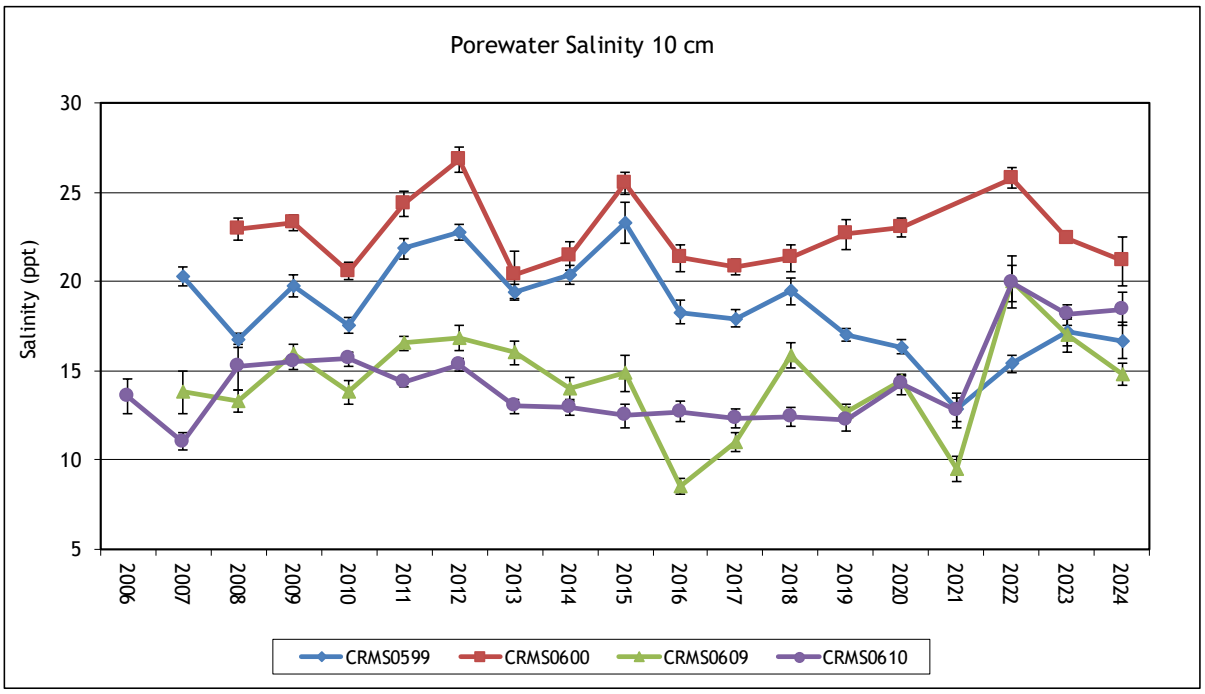


Figure 7a. Yearly Means of Interstitial water salinity at 10 cm below the soil surface. Error bars, where present, represent the mean of stations in that class for that month ± 1 Std Err.

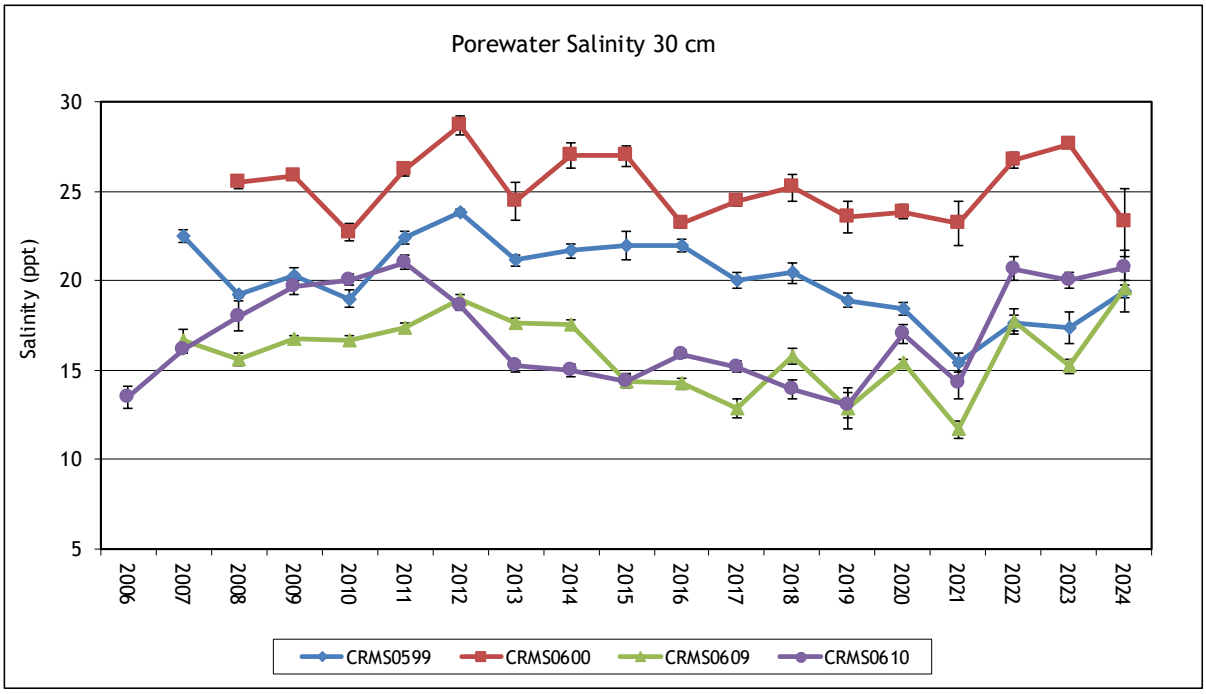


Figure 7b. Yearly Means of Interstitial water salinity at 30 cm below the soil surface. Error bars, where present, represent the mean of stations in that class for that month ± 1 Std Err.

Vegetation

Emergent vegetation data has been collected at project area CRMS sites since construction was completed in 2006. The project's goal for vegetation is to increase the coverage of emergent wetland vegetation within the project area. The coverage of vegetation within the project area increased from 2006 – 2009 (Figure 8a). All stations showed an increase in cover and floristic quality after recovering from the effects of Hurricanes Rita and Ike, but were then impacted in some way by the droughts of 2011, 2022, and 2023 (Figures 8b – 8e). Brackish site 609, located in the northern part of Area A, showed a steady decrease in cover and FQI from 2011 – 2014, presumably due to lingering effects of the drought, but increased in 2015 and has since remained steady at around 80% cover. This site has been largely dominated by *Spartina patens* through all years sampled, with traces of *Bolboschoenus robustus* and *Distichlis spicata*. In 2014, the appearance of *Spartina alterniflora* at the site resulted from higher soil salinities over the several years prior and has remained at the site.

The three CRMS sites within the southern part of the project area (599, 600, 610) have historically been considered to be saline sites. Since the 2019 vegetation survey, there has been an increase in *Spartina alterniflora* at these sites, presumably as they've been trending more brackish through time. Sites 599 and 600 both showed a major dip in vegetative cover in response to the 2020 hurricane season, with a full vegetative cover rebound being observed at both of these sites in the years following. Site 610 spiked in vegetative cover following the hurricane season. The shift in plant species composition towards disturbance species was ubiquitous following 2020, with all sites showing an increase in *Bulboschoenus robustus*. Site 599 also experienced a dramatic shift in this time frame, losing all presence of *Distichilis*

spicata and being replaced by an increase of *Spartina patens*, *Bulboschoenus robustus*, and *Spartina alterniflora*, all three plants having a higher tolerance for flooding stress.

The coverage of vegetation, overall, has increased since construction, meeting the project goal, particularly since percent cover was low following Hurricane Rita (Figure 8a). Project features have enabled project vegetation to recover from storm and drought impacts during normal rainfall years.

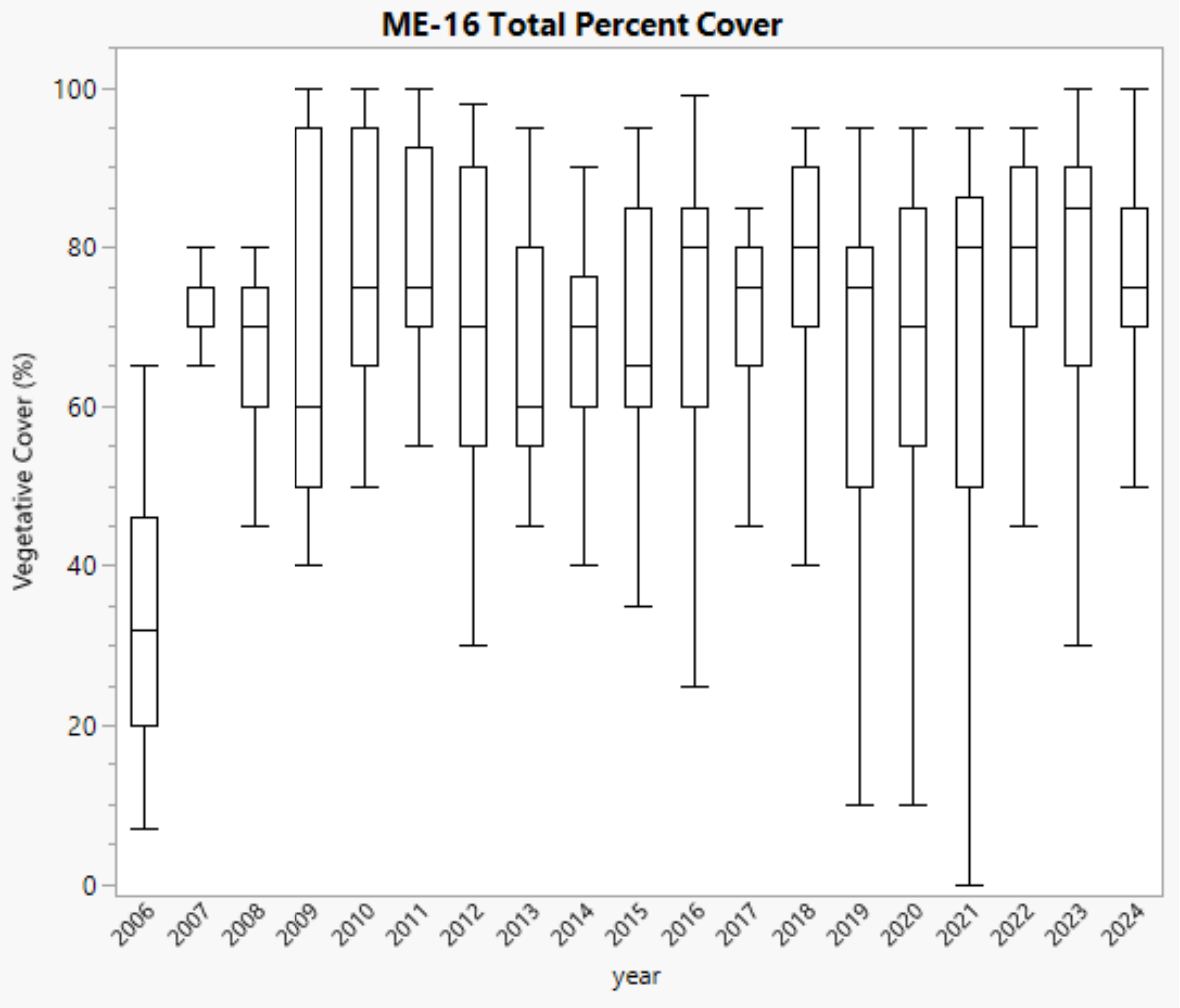


Figure 8a. Percent cover through time for ME-16 averaged across project CRMS sites.

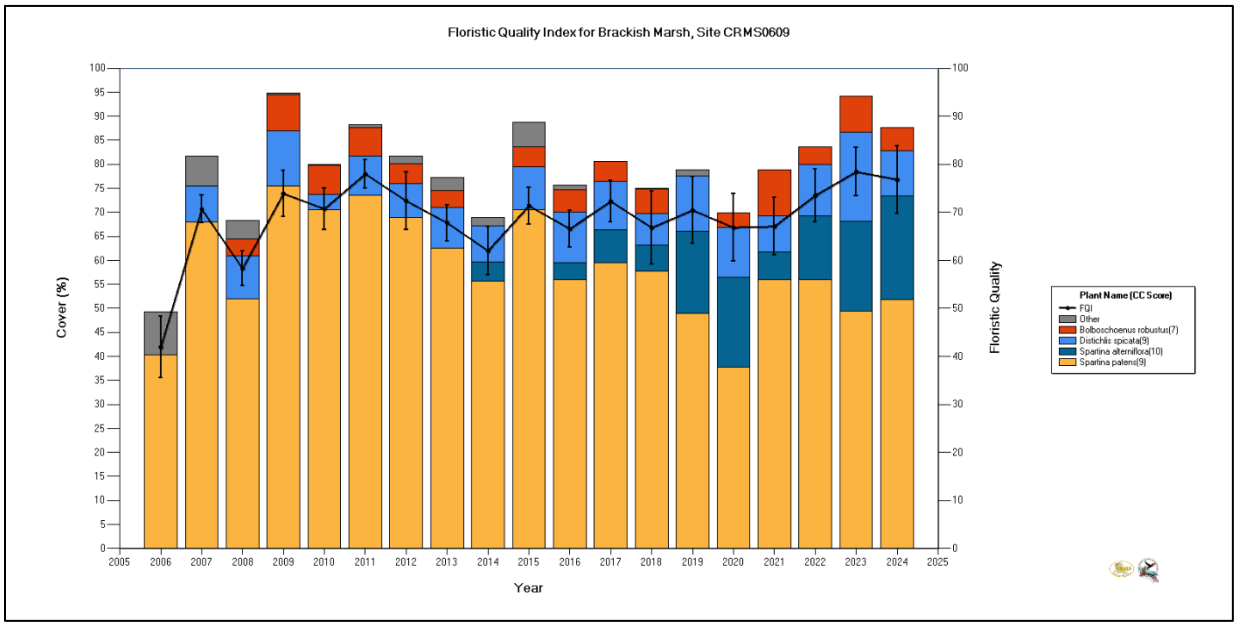


Figure 8b. Percent coverage and floristic quality index of species collected from CRMS0609, NE Area A, within the project area in years 2006 – 2024. The Coefficient of Conservatism (CC) scores represent the quality of individual species from 1 to 10 where 1 represents disturbance species and 10 indicates stable species.

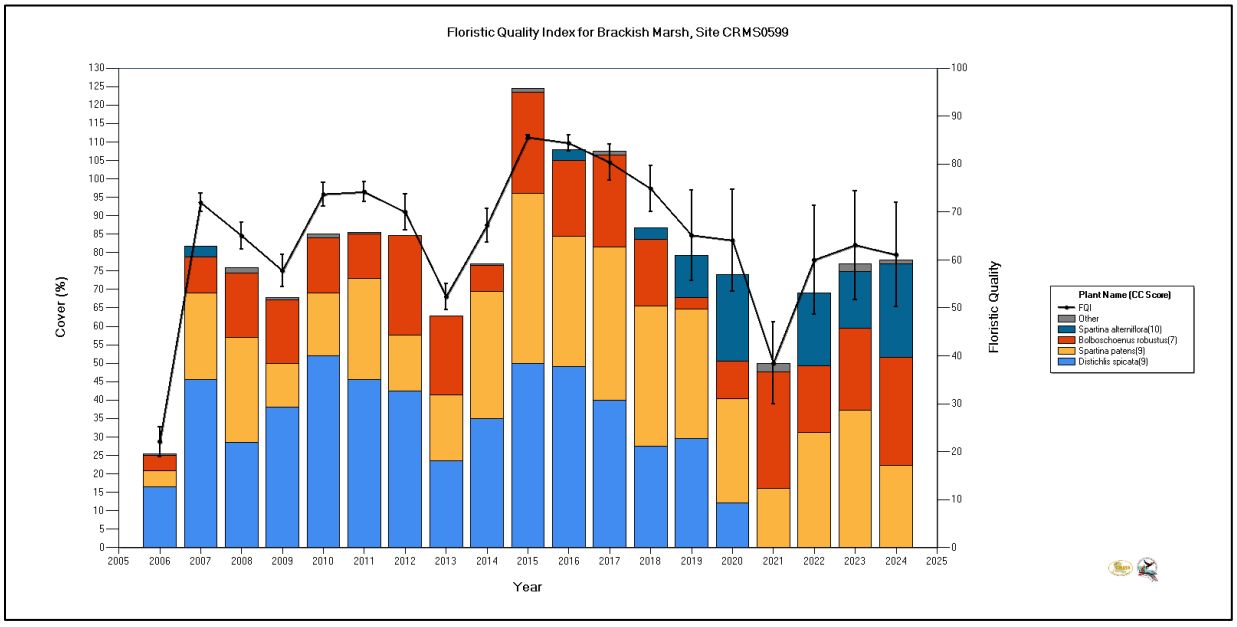


Figure 8b. Percent coverage and floristic quality index of species collected from CRMS0599, SW Area A, within the project area in 2006 - 2024. The CC scores represent the quality of individual species from 1 to 10 where 1 represents disturbance species and 10 indicates stable species.

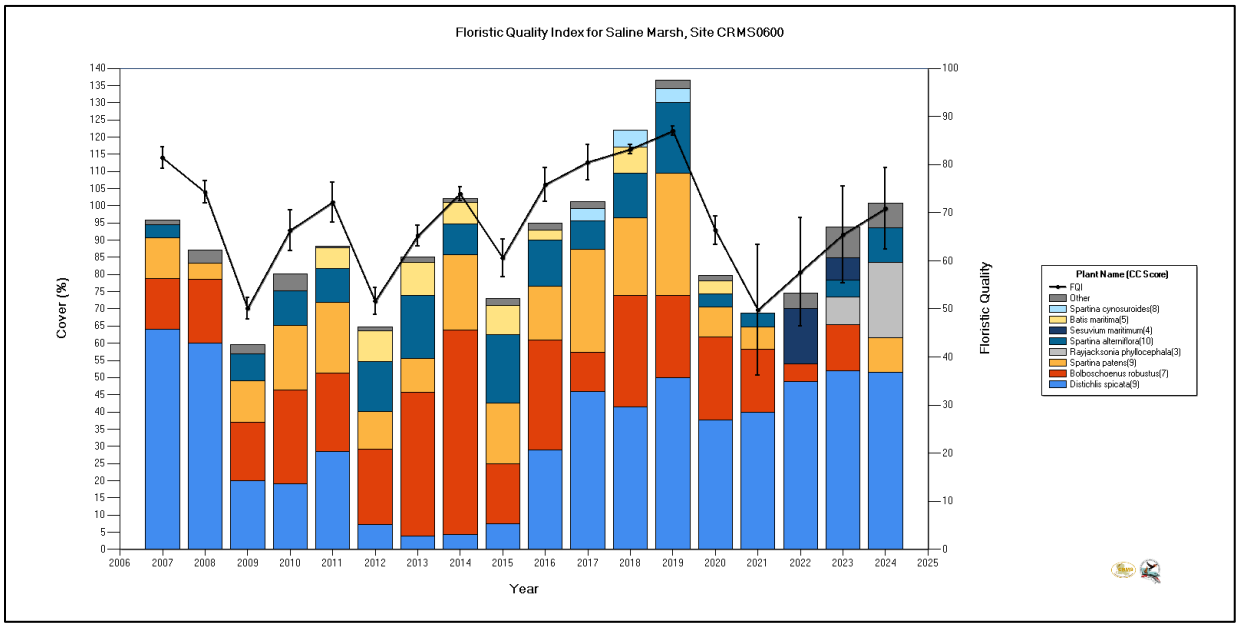


Figure 8c. Percent coverage and floristic quality index of species collected from CRMS0600, SE Area A, within the project area in years 2007 – 2024. The CC scores represent the quality of individual species from 1 to 10 where 1 represents disturbance and 10 indicates stable species.

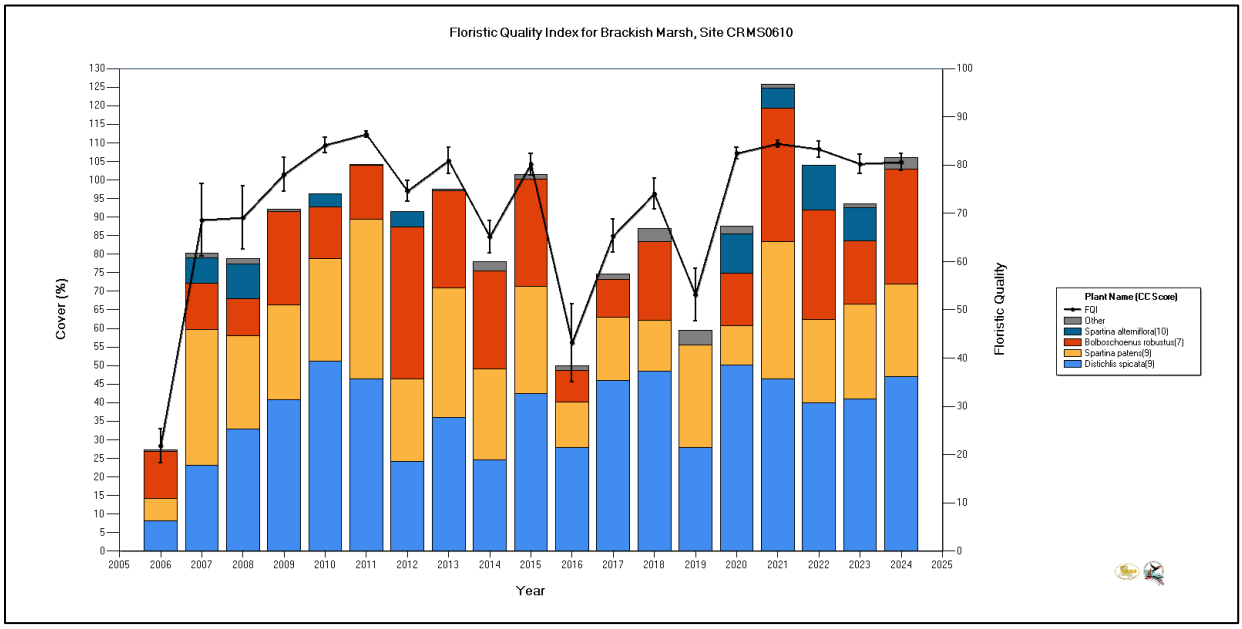


Figure 8d. Percent coverage and floristic quality index of species collected from CRMS0610, SW Area A, within the project area in years 2006 - 2024. The CC scores represent the quality of individual species from 1 to 10 where 1 represents disturbance and 10 indicates stable species.

Submerged Aquatic Vegetation (SAV)

Submerged aquatic vegetation has not been monitored on the ME-16 project, so it's not possible to quantify SAV coverage. Visual observation during O&M inspections, however have shown an increase in SAV colonization in the area of the project terraces since construction (Mouledous and Broussard, 2020).

Water Level

Water level was collected pre-construction as part of the modeling effort and showed a suitable gradient existed to flow water into the project area from the north, particularly during high water events (Figure 9a). Water levels have oscillated through time post-construction, with persistent rainfall years increasing water levels and reducing salinities throughout the project and reference areas. A north-south gradient in water levels is still visible between CRMS0609, just south of the water control structures, and CRMS0600 at the mouth of Rollover Bayou near the Gulf. Three major hurricanes have impacted the area through the monitoring period, temporarily flooding the project area with up to 9 ft of water during Hurricanes Rita and Ike (McGee et al. 2006; East et al. 2008). The project area recorders (ME16-06, CRMS0609) tracked very well with the water levels at CRMS0600, showing the influence of the Gulf on the project area.

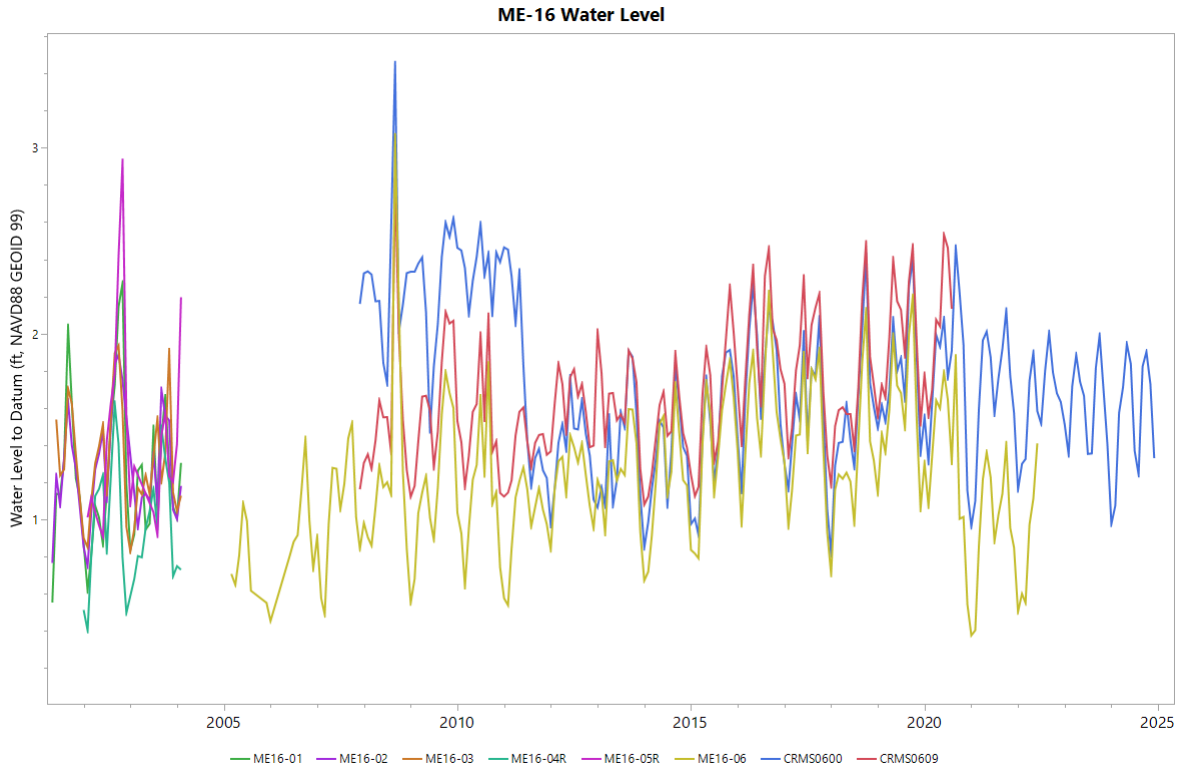


Figure 9. Monthly means of water level data collected pre- and post-construction inside (ME16-01, ME16-02, ME16-03, ME16-06, CRMS0609) and outside (ME16-04R, ME16-05R, CRMS0600) of the ME-16 project area.

Elevation Change

Elevation change data at CRMS sites 599, 600, 609 and 610 show the project area had an overall trend of slight gain across all sites (0.29, 0.76, 0.40, 0.53 cm/yr, respectively; Figure 10). CRMS 600 appears to have received a significant deposition from the 2020 hurricane season (similar to other sites, but at a much higher amount), but since 2024 has been rapidly losing elevation due to lateral erosion from the Gulf. The other three sites appear to be holding these depositional elevation gains. Conversely, the elevation relative to mean water level statistics show that depositional sediments at CRMS 600 have elevated it above the tidal water level range, unlike the other sites which all remain below the intertidal water level (to varying degrees). This highlights the condition of CRMS 600 along the elevated edge of the Gulf where sediment deposition was highest, but also where erosional forces are reworking and are simultaneously building /degrading shoreline. The effect of hurricane sediment deposition was observed at all sites in the surface elevation relative to water level data. Although CRMS 610 had the greatest level of elevation gain from sediment deposition, it is worth nothing that this elevation gain was only enough to get it above the lower 10% of the tidal range during an extreme drought in 2023. Based on these data, elevation change dynamics in the project area appears to be geomorphically dominated by three factors: low marsh elevation relative to sea level (except along the edge), erosional forces from unprotected Gulf shoreline, and the deterioration of interior marsh into open water with no natural sediment source to maintain elevation aside from episodic surface deposition.

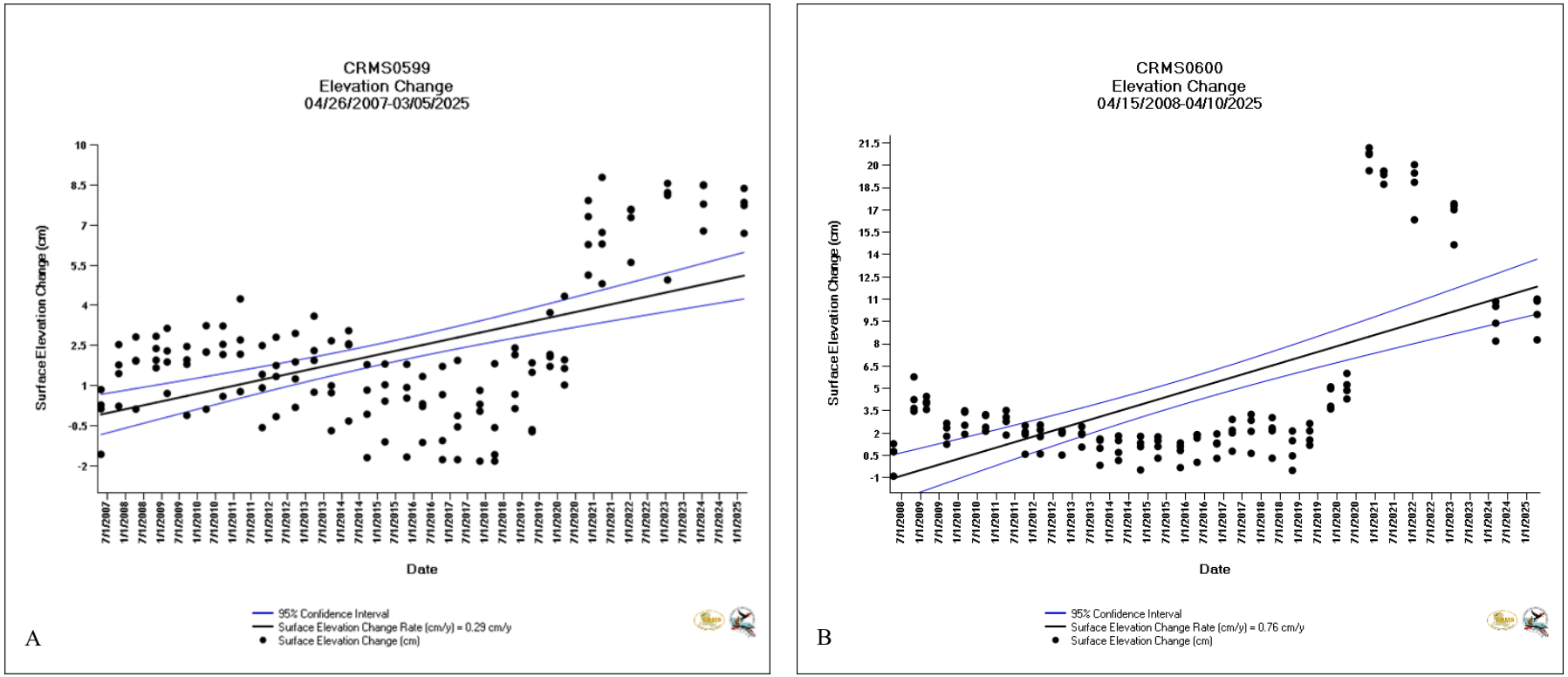
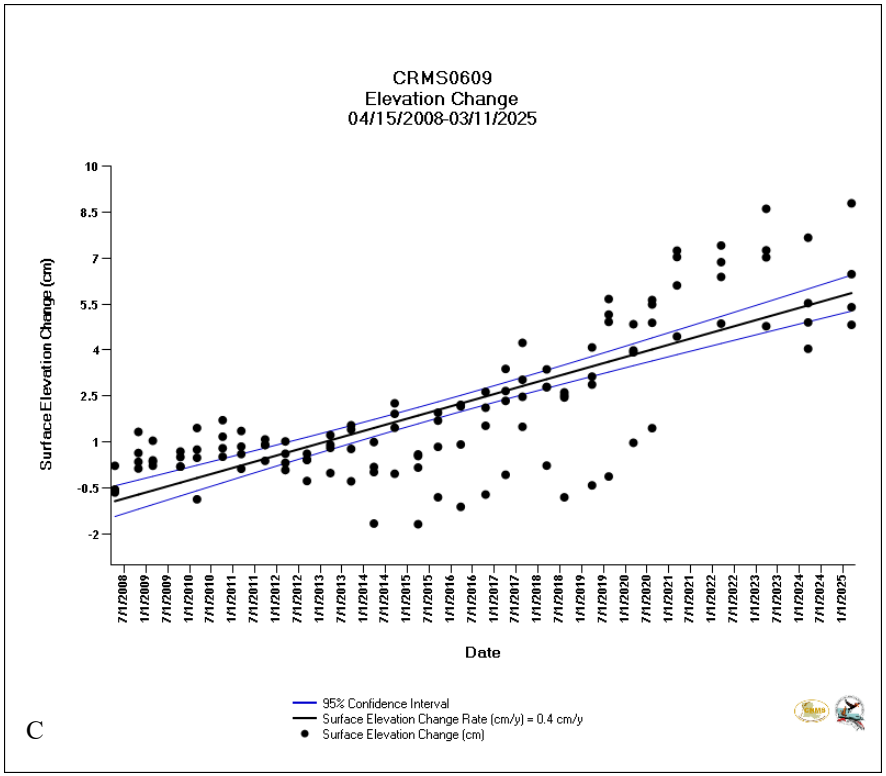


Figure 10. Elevation Change data collected at rod surface elevation table (RSET) stations for project CRMS Sites 599, 600, 609, and 610. Beginning dates range from 2007-2008 and ending dates are all from the most recent data collection in 2025.



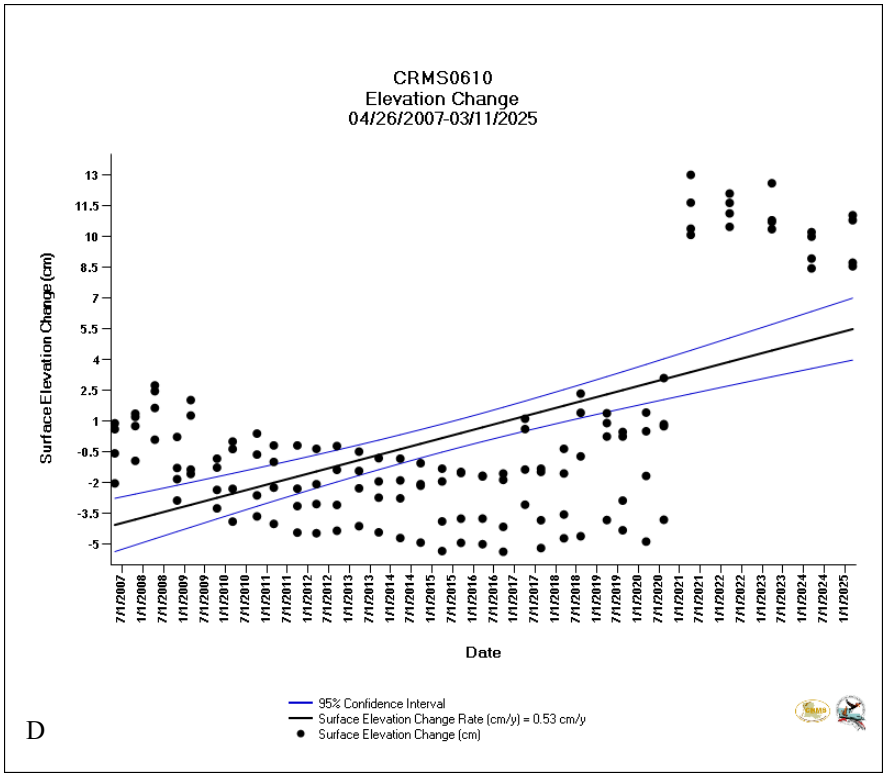


Figure 10. (cont.) Elevation Change data collected at rod surface elevation table (RSET) stations for project CRMS Sites 599, 600, 609, and 610. Beginning dates range from 2007-2008 and ending dates are all from the most recent data collection in 2025.

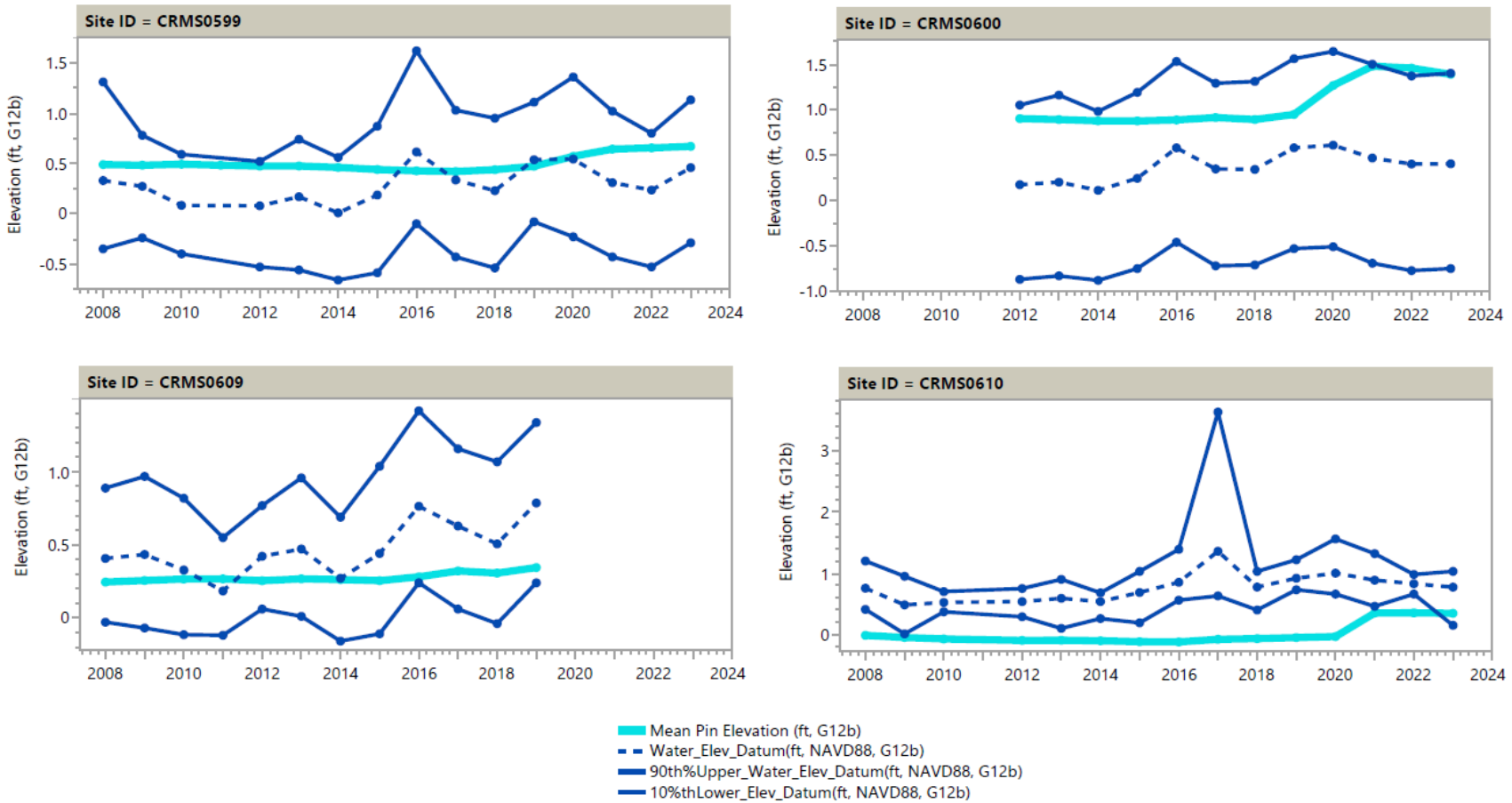


Figure 11. Surface elevation change as mean RSET data converted to datum plotted relative to water level statistics (10th percentile, median, and 90th percentile) at the ME-16 project CRMS Sites (599, 600, 609, and 610).

V. Conclusions

a. Project Effectiveness

Overall, the project area is characterized by the reliance on freshwater inputs to effectively reduce salinity in the interior marshes and continuous shoreline erosion adjacent to the Gulf. Historic precipitation data compared with project salinity trends show that the ability of water control structures to maintain a salinity threshold within target areas is limited by rainwater inputs. Land:Water analyses conducted within the 1 km CRMS sites through 2021 showed relatively stable land area after hurricane recovery in 2010, with the exception of CRMS 600 which continues to see high loss rates due to the shoreline erosion.

The project is effective at reducing surface water salinities in Area A in heavy rainfall years. Climatic conditions have enabled project marshes to meet target salinity levels more frequently through time. Interstitial salinities have been slower to decline and appear to be more heavily impacted by drought events.

Vegetation in the project area has responded to rainfall level and storm events. Emergent wetland vegetation has increased in coverage since project construction, with a demonstrated capacity for ecosystem resilience through specifies assemblage shifts and hurricane recovery. Since project construction, inundation and salinity stress have influenced vegetative cover and species composition, with the most Gulf exposed site experiencing the greatest effects of storm events on total vegetative cover. Fresh water, along with the project terraces reducing wave fetch, has also resulted in increased SAV colonization since construction.

Overall, when operational, the structural components of the Freshwater Introduction South of Hwy 82 Project appear to function as intended, especially under favorable climatic conditions.

b. Recommended Improvements

The post Hurricane Laura repairs will be designed to be more resilient to future storm damage. The design of the structures will be of similar form to the original structures, with additional foundational support to resist overturning moments caused by storm surge.

c. Lessons Learned

The ME-16 operation plan has benefited the project area marshes in Area A. When conditions allow (water levels above target range, the project has shown reduced salinities when water control structures are open allowing freshwater flow to Area A to the south. While interior marshes have remained relatively stable, significant land loss is being observed at unprotected shoreline locations of the project area. This gulf adjacent area experienced the greatest land loss as shoreline ridge sediment was reworked by Gulf wave energy, while simultaneously showing the highest elevation gain of all sites (via storm deposition). As coastal shoreline is eroded, saltwater intrusion into expanded waterbodies and canals will create more limitations for environmental managers' ability to control salinity thresholds to preserve marsh habitat.

d. End of Project Life

The Freshwater Introduction South of LA Hwy 82 has been successful at moving water from Grand and White Lakes to marsh areas south of LA Hwy 82, thereby enhancing marsh time within the target salinity range, especially during times of sufficient precipitation and when adequate head differential exists. Future efforts to sustain emergent marsh between Hwy 82 and the Gulf will be enhanced by the lessons learned on this project, especially in ecosystem response to flood and salinity, providing details of land loss dynamics in the area. Repairs to structures will take place prior to transfer of ownership, and will integrate an improved design for storm impacts. The project has been extended for one (1) year post 20 year end of life. An additional one (1) to two (2) years will need to be requested to allow for storm repairs to be completed. Following completion of the storm repairs, a request will be made to the CWPPRA for transferring the project to LDWF, and closeout within the CWPPRA program.

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APPENDIX A
(Inspection Photographs)

Photo No. 1, New Cop Cop Structure - Risers and wing wall destroyed. Portion of Levee and armament washed away.

Photo No. 2, Perry Bayou Structure - Risers and wing wall destroyed. Portion of Levee and armament washed away.

Photo No. 3, McNeese Bayou Structure - Risers and wing wall destroyed. Portion of Levee and armament washed away.

Photo No. 4, Hess Structure - Risers and wing wall destroyed. Portion of Levee and armament washed away.

Photo No. 5, Little Constance Structure – Erosion and scour around end of structure.

Photo No. 6, Little Constance Structure – Vegetative wrack on structure.

Photo No. 7, Earthen terrace.

APPENDIX B
(Field Inspection Notes)

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: ME-16 Freshwater Intro. S of Hwy 82 — Date of Inspection: September 17, 2020

Structure No. Earthen Terraces — Inspector(s): Jody White and Mark Mouledous (CPRA)

Structure Description: 26,000 LF "duck wing" earthen terraces

Type of Inspection: Annual

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 Walkway					
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Cables	N/A				
Signage /Supports	N/A				
Staff Gages					
Rip Rap (fill)	N/A				
Earthen Terraces	Good			7	Terraces generally look good. One segment of terrace in the southernmost area of the terrace field has eroded.

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: ME-16 Freshwater Intro. S of Hwy 82

Date of Inspection: September 17, 2020

Structure No. Little Constance

Inspector(s): Jody White and Mark Mouledous (CPRA)

Structure Description: Variable crest concrete control structure
Four 4'-8" X 6'-8" flapgates w/ stop logs

Type of Inspection: Annual

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Concrete Control Structure	Good			6	Vegetative rack on structure, but generally faired well. Ladders detached.
Flap Gates	Good				
Stop Logs	Good				
Hardware	Good				
Timber Piles	N/A				
Timber Walkway					
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Cables	Good				
Signage /Supports	N/A				
Staff Gages					
Rip Rap (fill)	Good			5	Some scour around structure. Some light soil and rock placement needed.
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: ME-16 Freshwater Intro. S of Hwy 82

Date of Inspection: September 17, 2020

Structure No. Hess' Cut

Inspector(s): Jody White and Mark Mouledous (CPRA)

Structure Description: Variable crest aluminum culverts
Four 48" diameter culvs. w/ flapgates and stop logs

Type of Inspection: Annual

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Flapgates	Good				
Steel Grating	Fair				Three (3) aluminum grate platforms on the outlet side of structure are detached from the outlets. One (1) aluminum grating platform has broken free.
Stop Logs	Gone				
Hardware	Good				
Timber Piles Timber Walkway	Good				
Timber Wales	Good				
Galv. Pile Caps	Good				
Culverts	Gone			4	All aluminum riser inlets are destroyed.
Signage /Supports Staff Gages	N/A				
Rip Rap (fill)	Gone			4	All rip rap on the inlet side of the structure has washed away.
Earthen Embankment	Bad			4	Approximately 30% of the earthen embankment has washed away.

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: ME-16 Freshwater Intro. S of Hwy 82

Date of Inspection: September 17, 2020

Structure No. New Cop Cop

Inspector(s): Jody White and Mark Mouledous (CPRA)

Structure Description: Variable crest aluminum culverts
Four 48" diameter culvs. w/ flapgates and stop logs

Type of Inspection: Annual

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Flapgates	Good				
Steel Grating	Good				
Stop Logs	Gone				
Hardware	Good				
Timber Piles	Good				
Timber Walkway					
Timber Wales	Good				
Galv. Pile Caps	Good				
Culverts	Gone				Aluminum riser inlets are destroyed.
Signage /Supports Staff Gages	N/A				
Rip Rap (fill)	Gone			1	All rip rap on inlet side of structure has washed away.
Earthen Embankment	Bad			1	Approximately 20% of the earthen embankment on the inlet side of the structure has washed away.

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: ME-16 Freshwater Intro. S of Hwy 82 — Date of Inspection: September 17, 2020

Structure No. McNeese Bayou — Inspector(s): Jody White and Mark Mouledous (CPRA)

Structure Description: Variable crest aluminum culverts
Three 48" diameter culvs. w/ flapgates and stop logs

Type of Inspection: Annual

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Flapgates	Good				
Steel Grating	Good				
Stop Logs	Good				
Hardware	Good				
Timber Piles	Good				
Timber Walkway					
Timber Wales	Good				
Galv. Pile Caps	Good				
Culverts	Gone			3	All riser inlets have been destroyed.
Signage /Supports Staff Gages	N/A				
Rip Rap (fill)	Gone			3	All rip rap on the inlet side of the structure has washed away.
Earthen Embankment	Bad			3	Approximately 30% of the earthen embankment on the inlet side of the structure has been washed away.

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?

Project No. / Name: ME-16 Freshwater Intro. S of Hwy 82 — Date of Inspection: September 17, 2020

Structure No. Perry Bayou — Inspector(s): Jody White and Mark Mouledous (CPRA)

Structure Description: Variable crest aluminum culverts
Three 48" diameter culvs. w/ flapgates and stop logs

Type of Inspection: Annual

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	Good				
Stop Logs	Gone				
Hardware	Good				
Timber Piles	Good				
Timber Wales	Good				
Galv. Pile Caps	Good				
Culverts	Gone			2	All riser inlets are destroyed.
Signage /Supports Staff Gages	N/A				
Rip Rap (fill)	Gone			2	All rip rap on the inlet side of the structure has washed away.
Earthen Embankment	Bad			2	Approximately 80% of the earthen embankment on the inlet side of the structure has washed away.

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?