State of Louisiana

Coastal Protection and Restoration Authority of Louisiana

Monitoring Plan

for

Cameron Creole Freshwater Introduction (CS-0049)

State Project Number CS-0049
Priority Project List 18

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Prepared by:

Thomas McGinnis and Mike Miller
Coastal Protection and Restoration Authority
Lafayette Regional Office
Abdalla Hall, Bldg B
635 Cajundome Blvd
Lafayette, LA 70506

The Coastal Protection and Restoration Authority of Louisiana (CPRA) and the National Resource Conservation Service (NRCS) agree to carry out the terms of this Monitoring Plan (hereinafter referred to as the "Plan") of the accepted, completed project features in accordance with the Cost Sharing Agreement Nos. NRCS CWPPRA-09-002/DNR 2511-09-07, with Amendment No. 3 effective July 23, 2018. The CSA will be included in the Operations and Maintenance (O&M) Plan, along with the construction completion report, the project permits, and the O&M budget. The Monitoring Plan and the O&M Plan will be available on the CPRA Document Referencing System (https://cims.coastal.la.gov/DocLibrary/DocumentSearch.aspx?Root=0&Folder=0).

The project features covered by this plan are inclusive of and are identified as the Cameron- Creole Freshwater Introduction (CS-0049). The intention of the provisions of this Plan is to monitor the project using standardized data collection techniques and to analyze that data to determine whether the project is achieving the anticipated benefits. Reports will be generated and recommendations made to adaptively manage the project.

Construction of CS-0049 was authorized by Section 303(a) of Title III Public Law 101-646, the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) enacted on November 29, 1990, as amended. CS-0049 was approved on the 18th Priority Project List.

1. PROJECT DESCRIPTION, PURPOSE, GOALS, and FEATURES

Description

The Cameron-Creole Freshwater Introduction (CS-0049) project area is located on the east side of Calcasieu Lake and south of the Gulf Intracoastal Waterway (GIWW) within the Cameron-Creole watershed in Cameron Parish, Louisiana (figure 1).

The Cameron Creole Watershed consists of approximately 22,247 acres (9003 ha) of brackish, intermediate, and fresh marsh and open water located along the east side of Calcasieu Lake in the Calcasieu/Sabine Basin in Cameron Parish. Approximately 14,390 acres (32%) of the Cameron-Creole Watershed Project (CCWP) marshes were lost to open water from 1932 to 1990 (USFWS CWPPRA Project Fact Sheet) at an average loss rate of 248 acres/year (0.55 percent/year) due to subsidence, erosion, and saltwater intrusion from the Calcasieu Ship Channel. Hurricanes Rita and Ike in 2005 and 2008 breached the watershed levee scouring the marsh and allowing higher Calcasieu Lake salinities to enter the watershed causing more land loss. The Calcasieu-Sabine Basin lost 28 square miles (17,920 acres) (4.4%) as a result of Hurricane Rita (Barras et al. 2009).

In 1989, the Soil Conservation Service (currently NRCS) constructed a levee and five (5) water control structures along the eastern shore of Calcasieu Lake. The structures were intended to reduce the movement of salt water into the watershed. A borrow canal was also constructed along the wetland side of the levee which may further prevent saltwater intrusion into the marsh. In order to increase control of water flow, isolate management areas, and prevent further saltwater intrusion in the Cameron-Creole Watershed, the CS-0017 plug project placed two plugs in the borrow canal in 1997.

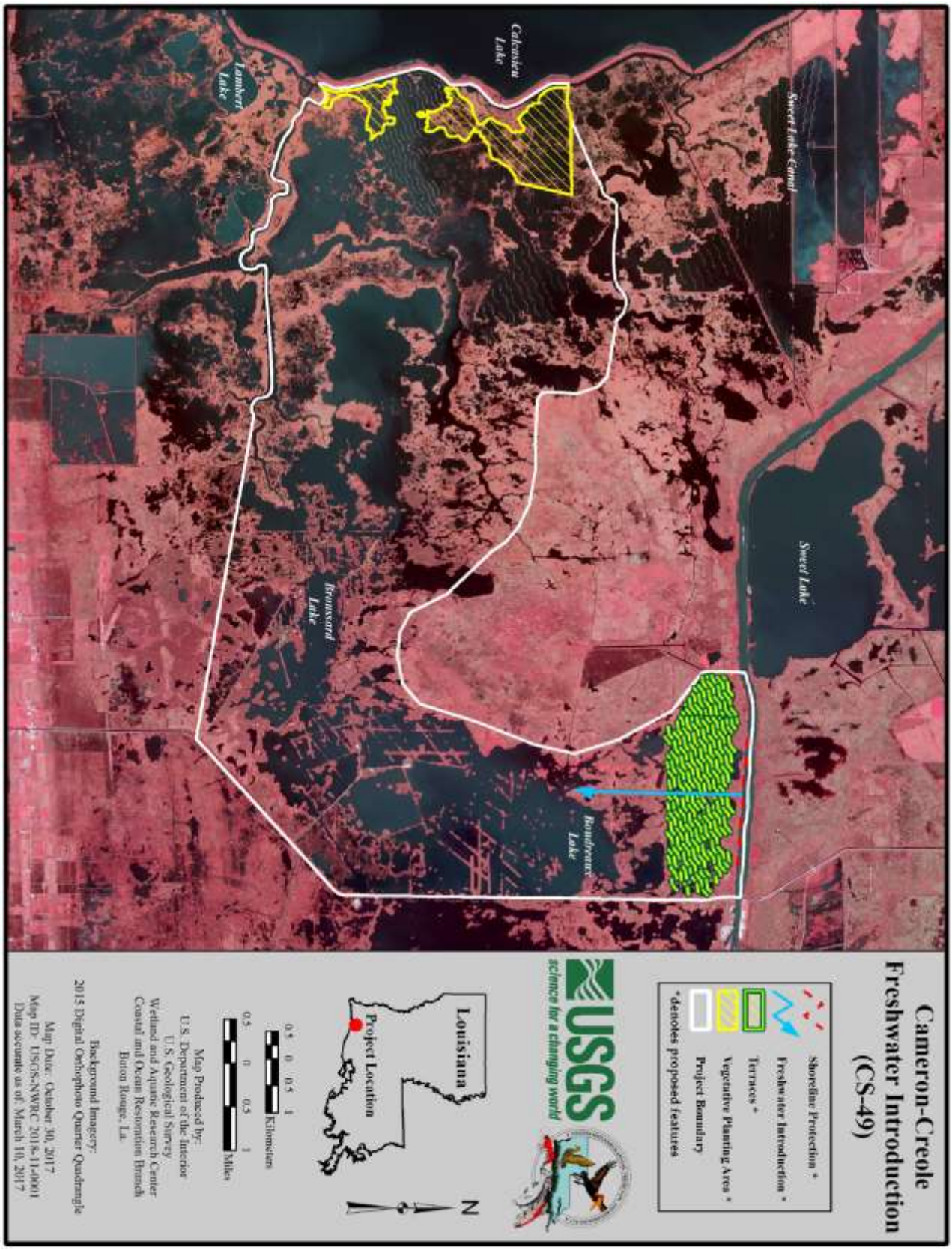

Figure 1. Cameron Creole Freshwater Introduction (CS-49) project features and project area boundaries.

Virtually all of the project area marshes have experienced increased tidal exchange, saltwater intrusion, and reduced freshwater retention resulting from hydrologic changes associated with the Calcasieu Ship Channel and the GIWW. In addition, thousands of acres of marsh were damaged by Hurricane Rita in 2005 and again, more recently by Hurricane Ike in 2008 and Hurricanes Laura and Delta in 2020. Because of man-made alterations to the hydrology, it is unlikely that those marshes will recover without comprehensive restoration efforts. The Cameron Creole Watershed project has successfully reduced salinities and increased marsh productivity. However, the area remains disconnected from freshwater, sediments, and nutrients available from the GIWW.

The Cameron Creole Freshwater Introduction project (CS-0049) would restore the function, value, and sustainability of approximately 22,247 acres of marsh and open water by improving hydrologic conditions via freshwater input from the GIWW.

Purpose

The strategy for the CS-0049 project is to restore the hydrologic function of the Cameron-Creole Watershed by introducing fresh water from the GIWW in the marsh during critical periods of the year. Features include a gated sheet-pile freshwater introduction structure, a rock rip-rap dike to combat shoreline erosion on and prevent breaching along the GIWW, and terraces in the marsh to dissipate wave energy and promote the growth of emergent and submerged aquatic vegetation.

Project Goals

1. Operate the freshwater introduction structure to optimize opportunities to move water north to south through the Cameron-Creole watershed.
2. Reduce salinities within the project area.
3. Maintain and improve the marsh and open-water ponds to increase organic productivity of emergent and submerged aquatic vegetation.
4. Improve wildlife habitat by increasing plant species diversity in emergent marshes.

Features

The freshwater introduction structure was placed in the Monsanto Canal at the GIWW and consists of eight, 5x5 box culverts with sluice gates and flaps. The sluice gates can be closed to prevent flow when needed. Approximately 340 feet of the canal was deepened to a depth of -8.0 ft and filled with rock to a -6.0 ft elevation. The rock will extend north into the GIWW and south through the canal to allow for freshwater input into the watershed (Figure 2).

A rock dike was constructed on the south side of the GIWW to prevent breaching of the shoreline. The rock dike extends west 3,411 feet and east 4,689 ft from the Monsanto Canal. The rock dikes were built to an elevation of +3.0 ft (NAVD 88, Geoid 99) and consist of a 4.0 ft crown with a 2:1 side slope (Figure 3).

The terraces consist of the west and east terrace fields separated by the Monsanto Canal. The terraces were built to an elevation of +2.5 ft (NAVD88, Geoid 99) with a 15 ft crown and 50 ft base. The west terrace field consists of 19 terrace rows, and the east terrace field consists of 17 rows. The terrace rows run from southwest to northeast direction. Each row consists of multiple terraces separated by a fifty-five foot gaps. A transmission line, which was later removed following the 2020 hurricane season, initially disconnected the west terraces; these gaps were filled soon after construction (see red strip in Figure 4).

Figure 2. Project design and features of the structure and water flow corridor through the Monsanto Canal.

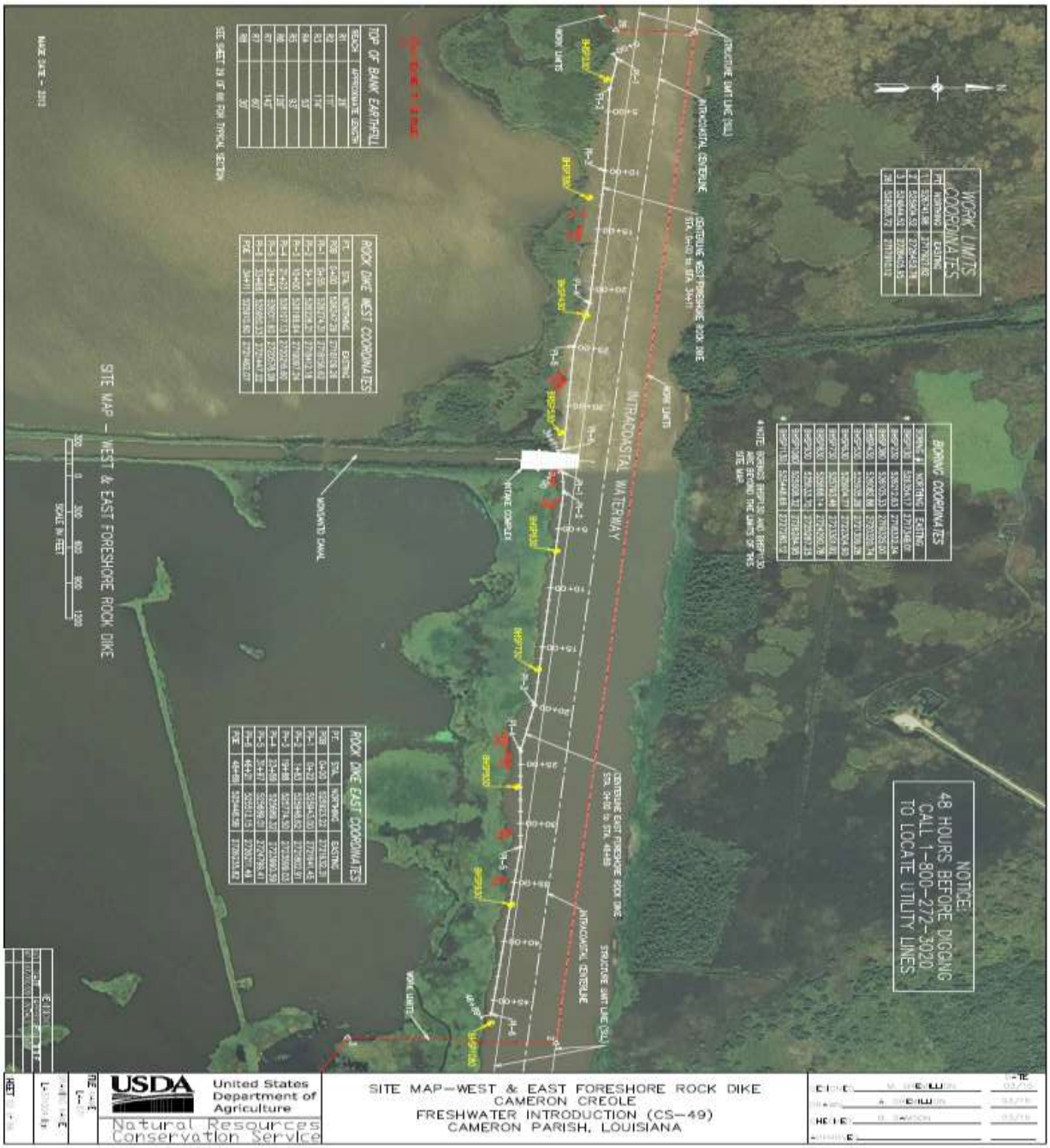

Figure 3. Location of the shoreline rock dike along the GIWW for the Cameron-Creole Freshwater Introduction project.

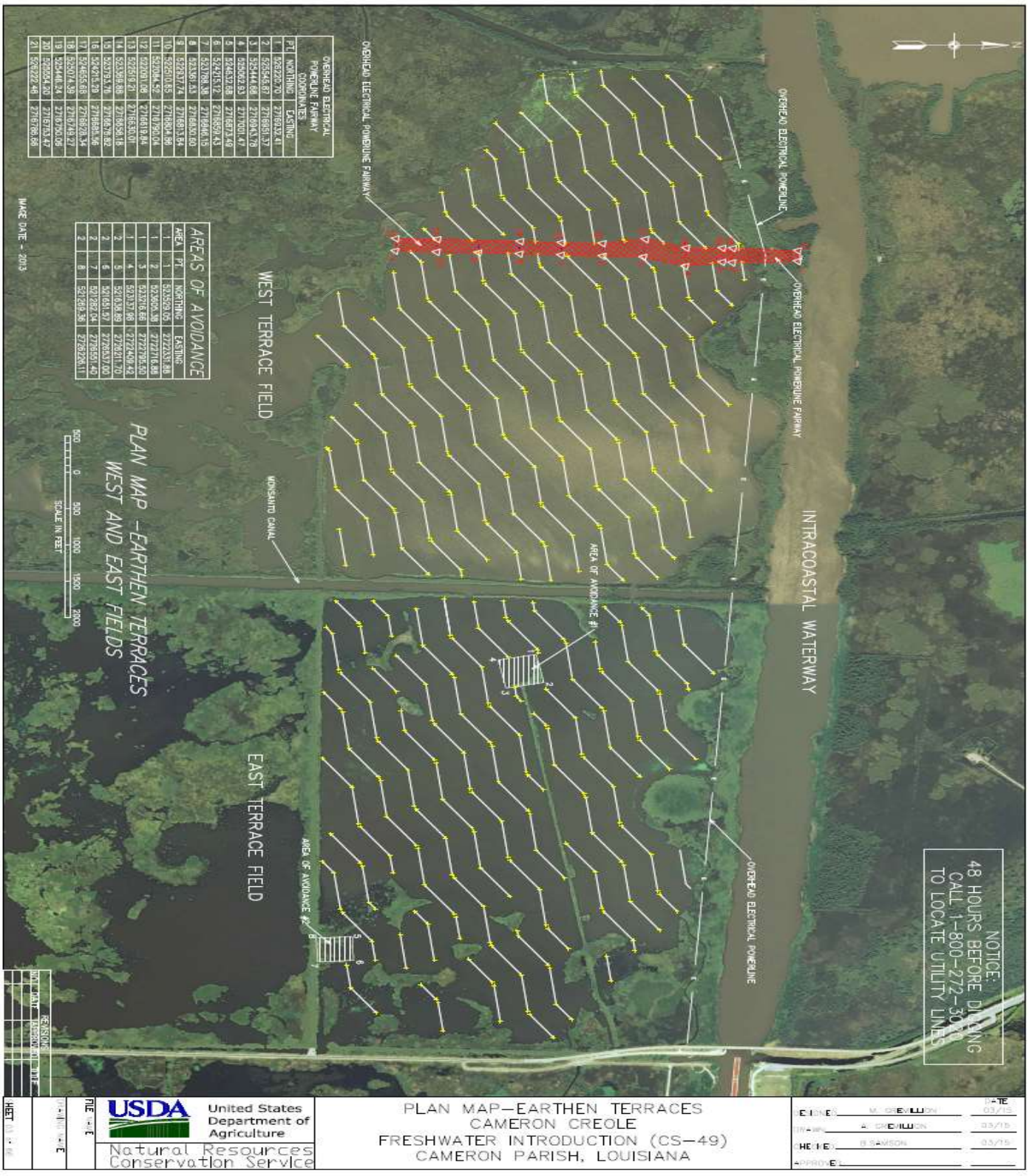

Figure 4. Terrace design within the CS-49 Cameron Creole Freshwater Introduction project.

Cameron Creole Watershed Interaction

The CS-0049 project is within the Cameron Creole Watershed. Cameron Creole is actively operated by CPRA with the guidance of the Cameron Creole Advisory Committee under the CS-0004a Cameron Creole Maintenance project. Five gates along the Calcasieu Lake rim are opened and closed in order to meet the Cameron Creole Watershed project's goals which are to maintain water level and salinity within target range at the 5 ppt isohaline which is approximately 8.9 km (5.5 mi) east of the lake rim and 8.8 km (5.4 mi) south of the CS-0049 structure. The lake rim gates are operated to maintain water level between 2" above and 6" below marsh elevation and salinity < 5 ppt. The CS-0049 freshwater introduction structure will allow more fresh water into the watershed from the north, which may allow the lake rim gates to remain open more often. However, since marsh elevation is relatively low within the watershed and water elevation in Calcasieu Lake can be relatively high, the CS-0049 freshwater introduction structure may have to be closed when water cannot be drained to the lake efficiently. Five operations sondes that measure water level, salinity, and temperature are used to operate the Cameron Creole Watershed structures. Operations sondes are maintained through the CS-04a Cameron Creole Maintenance Project. CS04a-EC7 is the sonde at the 5 ppt isohaline upon which Cameron Creole Watershed operations decisions are made (Figure 5). In the event that the CS04a-EC7 sonde is not maintained by the CS-04a project, nearby CRMS2418 may be used as a proxy. A CS-0049 operations sonde, CS49-01R, will be placed in the GIWW side of the Monsanto Canal to aid in determining water flow possibilities.

2. Cameron Creole Freshwater Introduction (CS-0049) Structure Operations

BASIC OBJECTIVE:
Restore hydrology to the project area by allowing water from the GIWW to flow through the Cameron-Creole watershed into Calcasieu Lake during critical periods throughout the year.

SPECIFIC OBJECTIVES:

1. Operate the freshwater introduction structure to optimize opportunities to move water north to south through the Cameron-Creole watershed;
2. Reduce salinities;
3. Maintain and improve the marsh and open water ponds to increase organic productivity;
4. Improve wildlife habitat by increasing plant species diversity in emergent marshes.

Recommendations for Freshwater Introduction:

1. Allow structure to flow as often as possible;
2. Close structure based on water level trigger at (CS04a-EC7);
3. Close structure based on salinity level trigger at (CS04a-EC7).

To guide these structure operations, a new real time hydrologic operation station (CS49-01R) will be installed in the GIWW as part of the CS-0049 project.

GIWW Water Level > Water Level in Cameron-Creole marsh (EC04a-EC7)

All gates are open and flaps are operating to allow structure to flow as often as possible. If having the CS-0049 structure open is preventing the CS-04a project from reaching its goals, the CS-0049 structure may be temporarily closed until conditions improve. Closures are anticipated to be infrequent and in response to extreme conditions.

a. If water levels in the Cameron Creole Watershed are extremely high such that local flood protection levees are being overtopped, the CS-0049 structure will be closed until water levels drop below levee level.

GIWW Salinities < Salinities in Cameron-Creole marsh (CS04a-EC7)

1. All gates are open and flaps are operating to allow structure to flow as often as possible.

GIWW Salinities > Salinities in Cameron-Creole marsh (CS04a-EC7)

1. Gates may be closed when salinities exceed 10 ppt in the GIWW, OR are 3 ppt higher than salinities in the Cameron-Creole marsh at (CS04a-EC7).

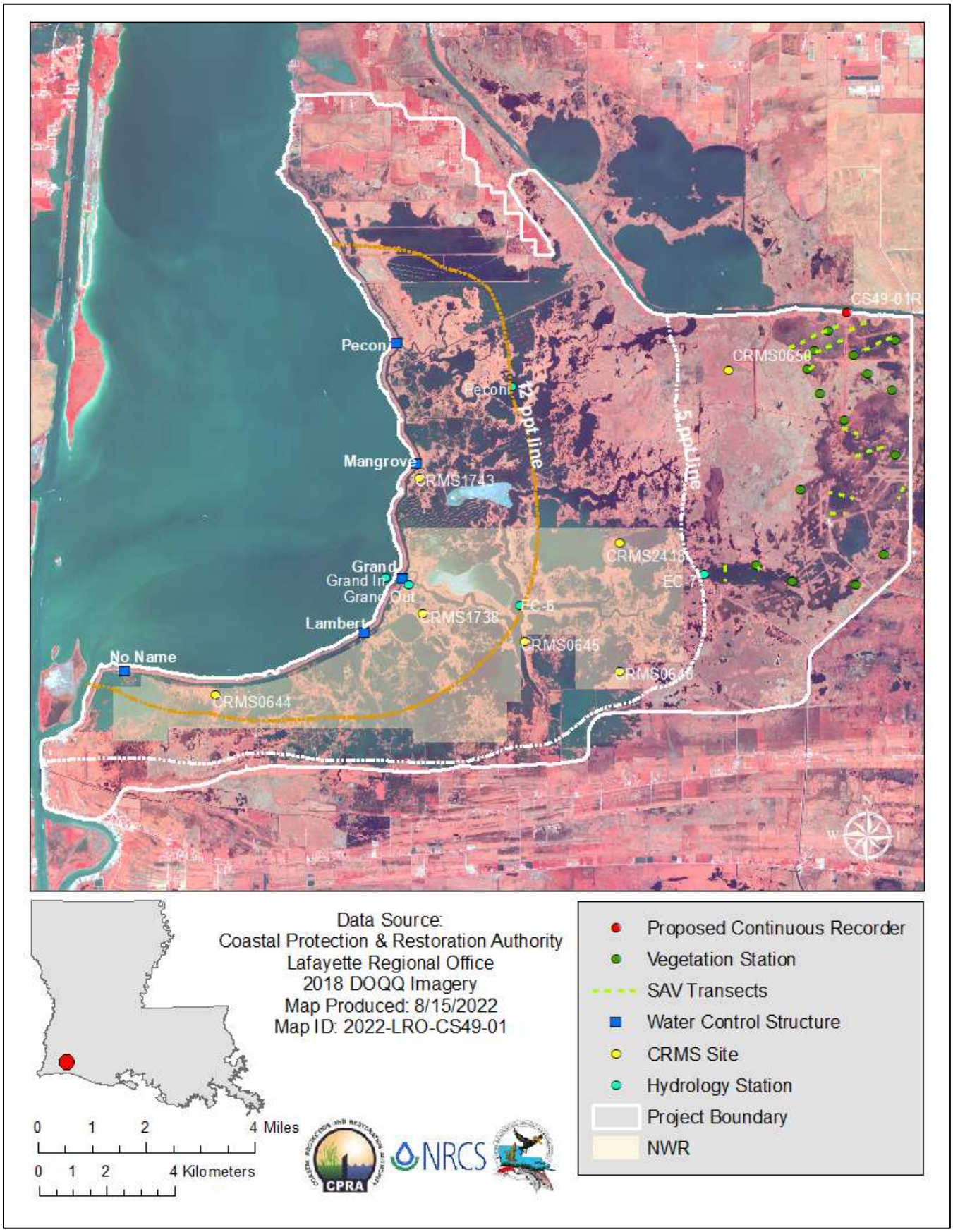

Figure 5. Monitoring locations for the CS-0049 Cameron-Creole Freshwater Introduction project.

3. ITEMS REQUIRING MONITORING

Monitoring Objectives

1. Assess the frequency and volume of water that flow through the freshwater introduction structure.
2. Determine whether salinity is reduced in the project area.
3. Describe the extent to which freshwater and sediment have affected emergent and submerged aquatic vegetation communities.
4. Describe the impact of freshwater introduction on water level and salinity within the CS-0049 project area and within the Cameron Creole Watershed.

The Coastwide Reference Monitoring System (CRMS) - *Wetlands* is a network of 392 monitoring sites distributed throughout the coastal zone of Louisiana where land change, hydrologic, elevation change, vegetation, and soils data are collected. Although no CRMS monitoring stations are located near the CS-0049 outfall, seven (7) CRMS sites (CRMS0644, 0645, 0648, 650, 1738, 1743, and 2418) can aid in determining project effects on water level and salinity in the Cameron-Creole watershed.

The following monitoring strategies will provide the information necessary to evaluate the specific goals.

A. **Aerial Photography** - In order to assess the amount of land and land change in the project area, land/water data will be obtained from digital imagery with 1-meter resolution. The imagery will be georectified using standard operating procedures described by USGS-WARC (Folse et al. 2020; see Chapter 10 Imagery), and land/water ratios will be determined. Aerial photography will be captured by CRMS coast-wide flights preconstruction (as close to construction as available) and post construction around Years 3 (2024), 9 (2030), 12 (2033), and 18 (2039). Spatial analysis will take place in years that coast-wide flight data are available.

B. **Vegetation** - To monitor the relative species composition and general conditions of emergent vegetation within the terrace fields and the outfall area extending southwest near the Cottonwell Road launch, 15 vegetation stations were established (Figure 5). The stations will be used to document % vegetation cover, species composition, and height of dominant plants in 4 m^2 plots as well as soil porewater salinity (Folse et al. 2020; see Chapter 7.1 Emergent Vegetation Sampling). Vegetation will be monitored post construction in Years 1 (2022), 3 (2024), 6 (2027), 9 (2030), 13 (2034), and 18 (2039).

C. **Submerged Aquatic Vegetation** - To determine the occurrence of submersed aquatic vegetation (SAV) within the terrace fields and the outfall area extending southwest near the Cottonwell Road launch, 12 transects will be sampled for presence or absence of SAV using the modified rake method (Nyman and Chabreck 1996) (Figure 5). A minimum of 20 - 100 samples will be taken along each transect depending on length, and SAV species will be identified. SAV will be monitored post construction in Years 1 (2022), 3 (2024), 6 (2027), 9 (2030), 13 (2034), and 18 (2039).

D. **Operations, Maintenance, and Monitoring (OM&M) Reports** - OM&M Reports are scheduled to be written approximately a year after significant data collection in Years 4 (2025), 10 (2031), 14 (2034), and 19 (2040).

4. MONITORING BUDGET

The budget associated with Monitoring this project for the twenty (20) year project life, $717,905.30, is summarized by monitoring item and year in Attachment I.

5. RESPONSIBILITIES

A. CPRA will:

1. Coordinate and oversee all scientific data collection.

2. Ensure that all data goes through quality control procedures and is entered into the public database.

3. Analyze the data and report on the status of the project every three to five years. Should the data indicate that the project is not meeting the goals and objectives, adaptive management recommendations will be made to improve project performance.

4. Review the monitoring plan and budget annually with the NRCS to determine that the data being collected adequately evaluates the project.

B. NRCS will:

1. Review data analysis reports and confer on adaptive management if needed.

2. Review the monitoring plan and budget annually to determine that the data being collected adequately evaluates the project.

REFERENCES

Barras, J.A. 2009. Land area change and overview of major hurricane impacts in coastal Louisiana, 2004-2008. U.S. Geological Survey Scientific Investigations Map 3080, scale 1:250,000. 6 p. pamphlet

Chabreck, R. H. and G. Linscombe 1978. Vegetative type map of the Louisiana coastal marshes. New Orleans: Louisiana Department of Wildlife and Fisheries. Scale1:62,500.

Coastal Protection and Restoration Authority of Louisiana. 2012. *Louisiana's Comprehensive Master Plan for a Sustainable Coast*. Coastal Protection and Restoration Authority of Louisiana. Baton Rouge, LA.

Delany, B. 1991. Cameron-Creole Watershed management, 1988-1990. Creole, Louisiana: Unpublished report prepared for the USACE and LDNR/CMD.

Folse, T.M., T.E. McGinnis, L. A. Sharp, J. L. West, M. K. Hymel, J. P. Troutman, D. Weifenbach, W. M. Boshart, L. B. Rodrigue, D. C. Richardi, W. B. Wood, C. M. Miller, E. M. Robinson, A. M. Freeman, C. L. Stagg, B. R. Couvillion, and H. J. Beck. 2020. A Standard Operating Procedures Manual for the Coastwide Reference Monitoring System-*Wetlands* and the System-Wide Assessment and Monitoring Program: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control. Louisiana Coastal Protection and Restoration Authority. Baton Rouge, LA. 252 pp.

Nyman, J. A., and R. H. Chabreck 1996. Some effects of 30 years of weir management on coastal marsh aquatic vegetation and implications to waterfowl management. Gulf of Mexico Science 14: 16-25.

United States Department of Agriculture, Soil Conservation Service 1995. Soil survey of Cameron Parish, Louisiana. Publication No. 1995-386-441/00020. Washington, D.C.: U.S. Government Printing Office. 135 pp, 122 maps. Scale 1:20,000.

ATTACHMENT I
PROJECT BUDGET

Monitoring budget scheduled for CS-0049 Cameron Creole Freshwater Introduction from Fully Funded Phase II budget (11-15-2017)

	Proj Years	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Monitoring Items	Years	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	
Aerial Photography		28,090.80			29,225.67						32,912.85				35,625.93					39,333.90			$ 165,189.15
Vegetation			11,473.78		15,180.91			15,883.20			16,628.47				17,693.60					19,149.33			$ 96,009.29
SAV			9,200.67		12,907.80			13,470.96			14,068.58				14,922.70					16,090.02			$ 80,660.74
OM&M Reports						39,746.91						44,761.48				48,451.26					53,494.11		$ 186,453.75
Management			7,803.00	7,959.06	8,118.24	8,280.61	8,446.22	8,615.14	8,787.45	8,963.19	9,142.46	9,325.31	9,511.81	9,702.05	9,896.09	10,094.01	10,295.89	10,501.81	10,711.85	10,926.08	11,144.61	11,367.49	$ 189,592.37
Total		28,090.80	28,477.45	7,959.06	65,432.62	48,027.51	8,446.22	37,969.30	8,787.45	8,963.19	72,752.36	54,086.78	9,511.81	9,702.05	78,138.32	58,545.27	10,295.89	10,501.81	10,711.85	85,499.34	64,638.71	11,367.50	**$ 717,905.30**