

Louisiana's Coastwide Reference Monitoring System Program

1. Introduction

The Deepwater Horizon (DWH) oil spill settlement in 2016 provides the Natural Resource Damage Assessment (NRDA) Louisiana Trustee Implementation Group (DWH LA TIG) up to \$8.8 billion, distributed over 15 years, to restore natural resources and services injured by the spill. The DWH Trustees selected a comprehensive, integrated ecosystem approach to restoration as outlined in the Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS) (DWH Trustees 2016). The injuries caused by the DWH oil spill affected such a wide array of linked resources over such a large area that the effects constituted an ecosystem-level injury.

The scale of the DWH oil spill and subsequent restoration effort was unprecedented and the Trustees recognized the need for robust Monitoring and Adaptive Management (MAM) to support restoration planning and implementation (DWH, 2017). One of the goals outlined in the PDARP/PEIS is to "Provide for Monitoring, Adaptive Management, and Administrative Oversight to Support Restoration Implementation" to ensure that the portfolio of restoration projects provides long-term benefits to natural resources and services injured by the spill (Appendix 5.E of the PDARP/PEIS).

Since 2006, Louisiana's Coastwide Reference Monitoring System (CRMS) has been systematically collecting and serving monitoring data from across coastal Louisiana in support of projects constructed through the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA). The availability and ease of access of CRMS data was beneficial to the DWH LA TIG as they began to plan and implement restoration projects in coastal Louisiana. From FY21 forward, the CWPPRA Task Force has capped CRMS funding and has encouraged the state and its federal cost share partner, USGS, to find additional funds from other restoration programs to fully fund CRMS. The CWPPRA Task Force values CRMS but seeks support in funding this publicly available dataset that clearly has value to data users beyond the CWPPRA community. The following request from CPRA on behalf of the CRMS program is for NRDA to pay for 31.2% of the CRMS program from FY21 to FY23. This support will ensure that CRMS data collection continues unimpeded in the near term.

The DWH LA TIG is in the process of implementing restoration projects across Louisiana's coast with a particular focus on the deltaic plain in Louisiana – the area most impacted by the DWH oil spill. Coastal areas including Breton Sound, Terrebonne, and Barataria Basins saw heavy oiling and remediation efforts caused direct mortality and reduced growth of wetland vegetation and allowed for increased erosion of already fragile and degrading marshes (DWH Trustees 2016). The DWH LA TIG is also considering restoration projects in the region. The projects being considered would restore connectivity with the Mississippi River, promote deltaic processes, and create and restore marshes (LA TIG 2018; Nixon et al. 2016). The reference network approach of CRMS monitoring provides both baseline data and references for the DWH LA TIG's restoration efforts (Figure 1).

The scale of funding presented in this request captures the coastwide nature of the DWH LA TIG's restoration planning interest, the focus on the deltaic plain, and the fact that NRDA benefits from CRMS from specific CRMS site level hydrology, vegetation, soils and elevation change data, and also from CRMS programmatic coastal scale data collection efforts including aerial photography acquisition and analysis, elevation surveys, and vegetation classification.

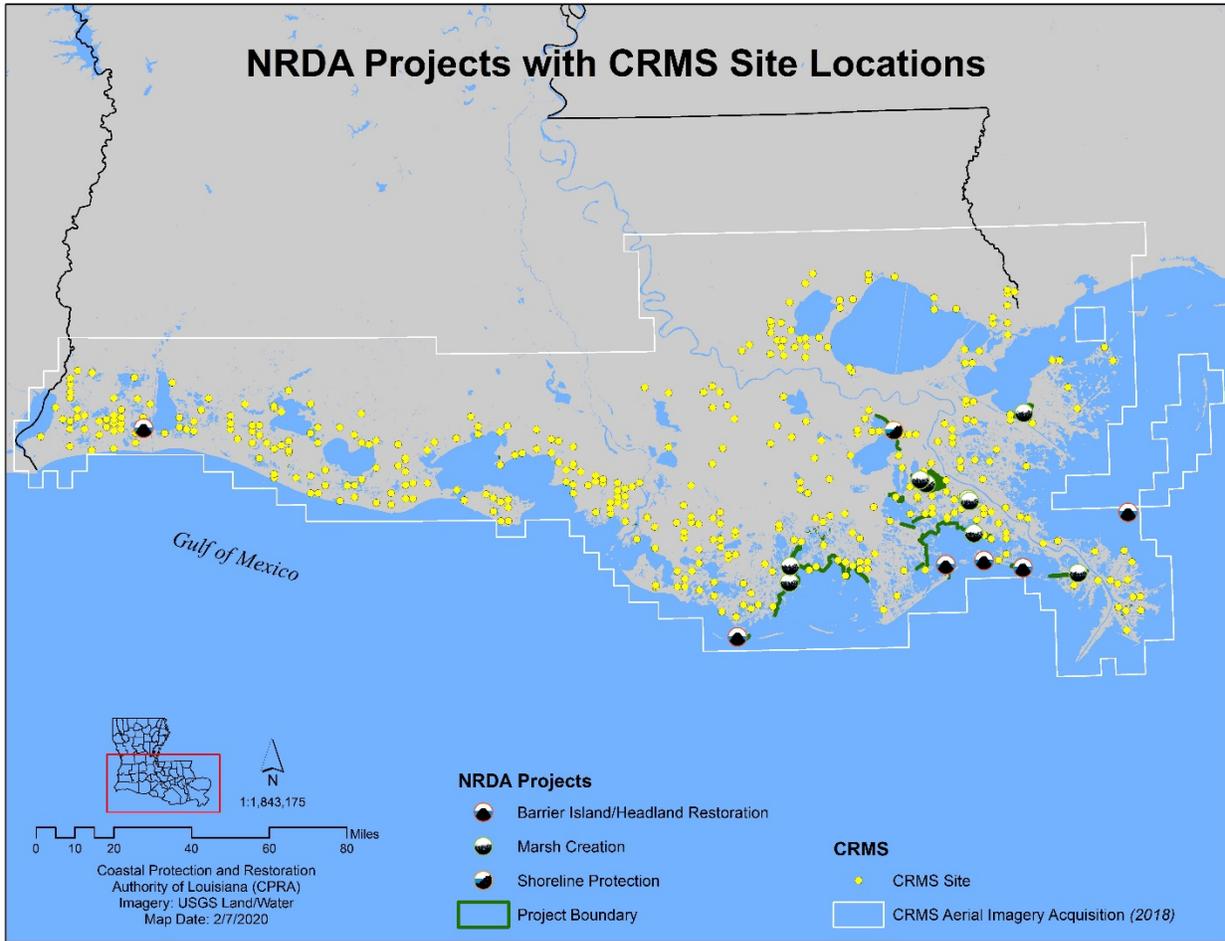


Figure 1. CRMS site locations and planned DWH NRDA restoration projects.

2. Purpose of this document

This MAM Activities Implementation Plan (MAIP) describes the MAM activity, “*Coastwide Reference Monitoring System*” to address restoration priorities described in the PDARP/PEIS. This MAM activity is intended to support evaluation of regional restoration outcomes within the Louisiana Restoration Area; perform data aggregation and data management; inform restoration decision-making; and perform monitoring to inform the design, implementation and adaptive management of existing and future restoration projects. This document provides information about the activities to be implemented; describes their applicability to the PDARP/PEIS and describes their consistency with the programmatic alternative selected by the DWH Trustees in the PDARP/PEIS.

A Louisiana Restoration MAM strategy is currently being developed and that document will help guide future decisions about data types to be collected and their application. CRMS data types were originally selected because they provided information about land loss, changes in vegetation, and processes thought to contribute to land loss and vegetation loss including flooding, saltwater intrusion, erosion and subsidence. The data collected through CRMS is broadly applicable to restoration questions throughout coastal Louisiana and can be applied to design, assess, and adaptively manage NRDA projects.

3. Monitoring and Adaptive Management: Coastwide Reference Monitoring System Program

This MAM Activities Implementation Plan (MAIP) describes the MAM Activity, CRMS, to address the following priorities of various restoration types described in the PDARP/PEIS:

- Wetlands, Coastal, and Nearshore (Section 5.5.2 in PDARP/PEIS)
 - ❖ Goals Addressed:
 - Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.
 - Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
 - While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats
 - ❖ Rationale
 - Since 2006, CRMS has been the largest source of baseline ecological and hydrologic habitat monitoring data for all restoration projects in Louisiana including marsh creation and freshwater/sediment diversions.
 - As such, CRMS data are incorporated into restoration project planning, large- and small-scale ecological models, and restoration assessments at multiple spatial scales.
 - Aerial photography, collected by the CRMS program every 3 years since 2005, is a key data source. The imagery is classified into land/water and habitat composition and compared to historic classifications. As such, NRDA project evaluations are dependent on habitat assessments which originate within the CRMS programmatic data collection.
 - The coastwide elevation surveys provide data in a common vertical datum (ft. NAVD88, Geoid12a) for both ecological assessments and project engineering throughout the coastal zone.
 - Historic and future coastal-scale vegetation type delineations (i.e., Fresh, Intermediate, Brackish, Saline, Swamp) are key sources of baseline condition data and future project assessments as river diversions will influence hydrology and vegetation at the basin scale.
 - CRMS is focused in Louisiana where most of the DWH injury occurred.
- Habitat Projects on Federally Managed Lands (Section 5.5.3 in PDARP/PEIS)
 - ❖ Goals Addressed:
 - Restore federally managed habitats that were affected by the oil spill and response actions through an integrated portfolio of restoration approaches across a variety of habitats.
 - Restore for injuries to federally managed lands by targeting restoration on federal lands where the injuries occurred, while considering approaches that provide resiliency and sustainability.
 - ❖ Rationale
 - CRMS sites have been collecting data on 7 National Wildlife Refuges and 1 National Park and Preserve since 2006

- Impacts and changes to marsh vegetation, soils, and marsh edge has been well documented through CRMS
- CRMS informs science-based operation plans, particularly water management regimes on federal lands
- Monitoring and Adaptive Management (Section 5.5.15 in PDARP/PEIS)
 - ❖ Goals Addressed:
 - Increase the likelihood of successful restoration
 - Provide feed-back for management decisions
 - ❖ Rationale
 - CRMS is the primary wetland monitoring program in Louisiana and was designed to provide data at the coastwide scale to inform adaptive management activities regardless of the funding used for restoration project construction.
 - CRMS data would be used as baseline monitoring for any future sediment diversion projects and would continue after diversions are in operation in order to assess project impacts (both positive and negative) on vegetation and salinity and will allow for adaptive management decisions about diversion operations.
 - CRMS data serve as baseline and post- project monitoring for other coastal restoration project types in the Louisiana Coastal Master Plan (CPRA 2017), including marsh creation, ridge restoration, and barrier island restoration.

3.1. MAM Activity Description

3.1.1. Background

The CRMS program provides valuable data for the nearshore habitats and resources targeted for NRDA restoration, including coastal wetlands and habitats on Federally Managed Lands. CRMS data are available and useful to the DWH LA TIG to plan and evaluate habitat restoration projects in and across hydrologic basins over time, allowing for assessment of the comprehensive, integrated portfolio of restoration projects at a coastwide or regional-scale within the Gulf of Mexico (GOM) and relative to other drivers and long-term trends in the basins. Since its creation, CRMS has been a major component of wetland monitoring and restoration planning and assessment in Louisiana. From 2003 to 2020, the development and maintenance of CRMS network has been primarily funded by CWPPRA and the State of Louisiana. CWPPRA established a state/federal partnership involving Louisiana’s Coastal Protection and Restoration Authority (CPRA), the US Department of Interior (Fish and Wildlife Service), US Department of Commerce (National Marine Fisheries Service), US Environmental Protection Agency, US Department of Agriculture (Natural Resources Conservation Service), and US Army (Corps of Engineers).

CWPPRA of 1990 was enacted to restore, create, enhance and protect Louisiana’s coastal wetlands. Since inception, the CWPPRA program has authorized more than 200 coastal restoration and protection projects. Project types vary by location including marsh creation, shoreline protection, vegetative plantings, terracing, barrier island restoration, hydrologic restoration and diversions. The CRMS network was designed to provide a long-term reference network to replace the paired project and reference site monitoring approach implemented in the 1990s. The CRMS network was intentionally designed to monitor the effectiveness of restoration activities at multiple spatial scales, from site to coastwide, because planned restoration and protection activities were intended to influence the entire coastal zone of Louisiana (Steyer et al. 2003). The CRMS program uses standardized data acquisition, data quality assurance and quality control, and data collection frequency protocols so that the monitoring program can provide data to characterize baseline conditions of Louisiana’s extensive coastal

wetlands and support landscape-scale ecological modeling (CPRA 2017). There are approximately 390 CRMS sites representing fresh, intermediate, brackish, and saline wetland types and forested wetlands. The DWH LA TIG has used CRMS data collection protocols and CRMS data for project planning and evaluation. Additionally, CRMS standardized data collection schedules have been adopted in NRDA restoration monitoring and adaptive management plans.

CWPPRA has fully funded CRMS since the inception of the program. In 2017, the CWPPRA Task Force pledged to continue to fund CRMS for an additional twenty years (from FY20 to FY39) but they capped CWPPRA’s contribution to CRMS at \$10 M/yr from FY21 to FY39 with the intent that other funding sources be solicited to meet projected shortfalls (Table 1). It should be noted that many of the CWPPRA Task Force members (CPRA, EPA, DOI, NOAA, and USDA) are also involved in the DWH NRDA funding approval processes.

CRMS data collection is accomplished with three-year data collection contracts administered by CPRA. This request is intended to cover the shortfall anticipated in the next CRMS contract as a result of the CWPPRA Task Force cap on funding (CRMS6; 1/1/2021 to 12/31/2023). The shortfall varies by year but is estimated to be \$7.2 M over the course of the next contract. The total funding request also includes the state’s 15% CWPPRA cost share for CRMS (\$1.5 M/yr) as the State has indicated that its resources are limited in the near-term as large scale restoration is implemented on many fronts and through multiple programs. Additionally, due to the combination of COVID-19 and global economic conditions impacting the price of oil, the state has indicated that near-term resources are very likely to be further impacted by reduced oil and gas revenues which funds the state’s cost shares. This total funding request is provided in further detail in Section 3.1.3.

If additional funds are not secured to support CRMS as currently implemented, CRMS managers (CPRA and USGS) have determined that modifications to the CRMS program will need to be implemented to reduce the annual costs to \$10M, possibly creating data gaps that would be detrimental to DWH NRDA restoration planning, monitoring and adaptive management. Analyses conducted by CPRA and USGS have shown that CRMS sites are not redundant so removal of sites or cessation of data collection campaigns would impact all CRMS data users including NRDA (Attachment 1).

Table 1. Budget approved by CWPPRA Task Force in 2017 (for contextual and illustrative purposes)

CRMS Budget FY20-39
Approved by CWPPRA Task Force October 2017

	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Admin and Supervision	478,507.62	488,077.77	497,839.33	507,796.12	517,952.04	528,311.08	538,877.30	549,654.85	560,647.94	571,860.90
Landrights	51,000.00	52,020.00	53,060.40	1,109.49	1,131.68	1,154.32	1,177.40	1,200.95	1,224.97	1,249.47
Engineering Services			2,122,416.00					2,343,318.76		
Equipment	1,020.00	1,040.40	1,061.21	1,082.43	1,104.08	1,126.16	1,148.69	1,171.66	1,195.09	1,218.99
Temporal Data Collection	8,858,700.00	9,295,974.00	9,110,470.68	9,292,680.09	9,478,533.70	9,668,104.37	9,976,335.03	10,058,695.79	11,036,679.87	10,465,067.10
Spatial Data Collection and Analysis	606,900.00		240,894.22	644,047.14		255,638.87			271,286.01	
O&M	438,600.00			465,445.83			493,934.84			524,167.60
Database Management	344,760.00	351,655.20	358,688.30	365,862.07	373,179.31	380,642.90	388,255.76	396,020.87	403,941.29	412,020.11
Analysis and Reporting	372,300.00	379,746.00	387,340.92	395,087.74	402,989.49	411,049.28	419,270.27	427,655.67	436,208.79	444,932.96
USACE Project Management	2,040.00	2,080.80	2,122.42	2,164.86	2,208.16	2,252.32	2,297.37	2,343.32	2,390.19	2,437.99
Annual Total Budget	\$11,953,827.62	\$11,386,594.17	\$13,606,213.48	\$12,524,242.18	\$11,643,044.19	\$12,131,543.95	\$12,722,226.59	\$14,699,010.40	\$13,650,901.65	\$13,379,029.18
Budget Funded by CWPPRA Task Force	\$11,953,827.62	\$10,346,648.54	\$10,000,000.00							
Unfunded Budget	\$0.00	-\$1,039,945.63	-\$3,606,213.48	-\$2,524,242.18	-\$1,643,044.19	-\$2,131,543.95	-\$2,722,226.59	-\$4,699,010.40	-\$3,650,901.65	-\$3,379,029.18
			-\$7,170,401.29							

FY30	FY31	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	Totals by Category
583,298.12	594,964.08	606,863.37	619,000.63	631,380.65	644,008.26	656,888.42	670,026.19	683,426.72	697,095.25	11,626,476.65
1,274.46	1,299.95	1,325.95	1,352.47	1,379.52	1,407.11	1,435.25	1,463.95	1,493.23	1,523.10	178,283.67
		2,587,213.26					2,856,492.50			9,909,440.52
1,243.37	1,268.24	1,293.61	1,319.48	1,345.87	1,372.79	1,400.24	1,428.25	1,456.81	1,485.95	24,783.32
11,109,549.45	10,887,855.81	11,234,973.58	11,327,725.18	11,554,279.68	11,785,365.28	12,021,072.58	12,261,494.04	13,599,332.30	13,276,939.98	216,299,828.50
	287,890.89			305,512.12			324,211.89		337,310.06	3,273,691.20
		556,250.85			590,297.85			626,428.80		3,695,125.77
420,260.52	428,665.73	437,239.04	445,983.82	454,903.50	464,001.57	473,281.60	482,747.23	492,402.18	502,250.22	8,376,761.21
453,831.62	462,908.26	472,166.42	481,609.75	491,241.94	501,066.78	511,088.12	521,309.88	531,736.08	542,370.80	9,045,910.78
2,486.75	2,536.48	2,587.21	2,638.96	2,691.74	2,745.57	2,800.48	2,856.49	2,913.62	2,971.89	49,566.63
\$13,547,139.83	\$13,662,088.88	\$16,914,506.72	\$13,914,515.60	\$14,498,318.03	\$15,066,959.88	\$14,766,195.26	\$18,242,223.55	\$17,081,786.73	\$16,527,396.19	\$281,917,764.09
\$10,000,000.00	\$10,000,000.00	\$10,000,000.00	\$10,000,000.00	\$10,000,000.00	\$10,000,000.00	\$10,000,000.00	\$10,000,000.00	\$10,000,000.00	\$10,000,000.00	\$202,300,476.16
-\$3,547,139.83	-\$3,662,088.88	-\$6,914,506.72	-\$3,914,515.60	-\$4,498,318.03	-\$5,066,959.88	-\$4,766,195.26	-\$8,242,223.55	-\$7,081,786.73	-\$6,527,396.19	-\$79,617,287.93

3.1.1.1. Linkages between NRDA and CRMS

Louisiana’s Systemwide Assessment and Monitoring Program (SWAMP) is a monitoring and adaptive management program designed to comprehensively monitor coastal habitats and waters. By leveraging established data collection efforts, SWAMP integrates monitoring activities within inland waters and rivers, wetlands, barrier islands and shoreline, and nearshore coastal waters. CRMS provides data to support wetland assessment and modeling, while the Barrier Island Comprehensive Monitoring Program (BICM) plans and monitors restoration efforts on barrier islands. Both CRMS and BICM are major components of the SWAMP program. CPRA’s participation on the DWH LA TIG helps ensure that monitoring associated with DWH NRDA projects is complementary to the SWAMP, CRMS, and BICM programs. In Louisiana, many of the processes, protocols, and data management structures for coastal monitoring were previously developed by CRMS and BICM, enabling the DWH LA TIG to leverage established infrastructure and thereby reducing the “start-up” investment for large scale DWH NRDA restoration efforts after the DWH oil spill. Therefore, Louisiana’s DWH NRDA program has already benefited from the investments CWPRA and the State of Louisiana made in the CRMS program even before the DWH oil spill occurred.

3.1.1.1.a. Standardized Data Collection and Long-term Dataset

All CRMS data collection, data processing, and quality assurance and quality control procedures follow a standard operating procedure “A Standard Operating Procedures Manual for The Coastwide Reference Monitoring System-Wetlands: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control” (CRMS SOP, Folse et al. 2018) and data are stored in the publicly available Coastal Information Management System (CIMS, <https://cims.coastal.louisiana.gov/default.aspx>) database. The CIMS public web application portal is backed by a relational database that houses observational and geo-spatial data resulting from coastal restoration activities maintained by the Coastal Protection and Restoration Authority (CPRA).

The original CRMS SOP was established in 2005, as part of CRMS program development, and is revised as appropriate. The CRMS SOP is the foundation for all hydrologic and ecological data collection associated with CRMS wetland monitoring in coastal Louisiana. DWH NRDA wetland monitoring protocols have leveraged and taken full advantage of the CRMS SOP. In addition, because data are stored in one publicly accessible database (CIMS), CRMS data are available and used for DWH NRDA project planning and evaluation.

The CRMS program began data collection at some sites in 2006 with the network fully built and operational in 2007. Therefore, the resulting dataset provides extensive information on the vegetation, soils, water levels, flooding, marsh elevation, land/water ratios, etc. throughout the coastal zone. These

data have been used in the DWH NRDA project planning process to determine target elevations for marsh creation projects (i.e., Lake Hermitage, Barataria Basin Ridge and Marsh Creation - Spanish Pass Increment, Terrebonne Basin Ridge and Marsh Creation - Bayou Terrebonne Increment, Lake Borgne Marsh Creation, and Upper Barataria Large Scale Marsh Creation). In addition, the robust CRMS hydrology dataset will be used to calculate depth and duration of flooding within projects while the CRMS vegetation dataset will be used to establish appropriate NRDA performance criteria for percent vegetation cover. In future DWH NRDA injury assessment processes, the CRMS water level data would be available to determine the amount of water on the marsh surface, at the time of injury, to assist with oil penetration calculations. CRMS data are also identified in DWH NRDA monitoring plans (e.g., Lake Hermitage Marsh Creation) as a source of data for project assessment comparisons.

3.1.1.1.b. Database Infrastructure

CPRA is committed to transparency and therefore has granted the general public access to all of the data housed in CIMS by making available full tabular data table dumps that are refreshed weekly, while also allowing for more targeted data extractions. All of the geospatial GIS data associated with the CRMS program is also made publicly available. The CRMS SOP includes data transfer procedures for each data type (e.g., vegetation, hydrologic, soils, etc.) to ensure high quality data are stored and available for a variety of uses. Data transfer processes include automated validation checks, automated email notifications, data summaries and dataset completion reports.

The CRMS program has invested a substantial amount of resources to develop the database structure, web interfaces, automated QA/QC procedures, and web mapping environment. The investment in database infrastructure and web applications has enabled programs such as DWH NRDA to easily access quality data at no additional cost. As it pertains to DWH NRDA funded projects, the CIMS development team is actively working on creating connections between CIMS and DIVER using the Diver Data Specifications. These efforts will result in a full database exchange of information for data types supported by both systems.

3.1.1.1.c. CRMS Funded Programmatic Level Data Collection

Through the development of SWAMP there has been a concerted effort to eliminate data collection redundancy among programs. Some of the efficiencies realized through SWAMP depend upon continued CRMS programmatic level data collection efforts that benefit multiple programs. CRMS programmatic level data collection are in addition to the ecological field-based sampling at individual CRMS sites. Programmatic data collection includes periodic surveys of coastwide vegetation via a helicopter, coastwide aerial photography acquisition, coastwide soil surveys, and coastwide elevation surveys conducted by professional land surveyors.

As an example, the CRMS program has supported acquisition of high-resolution, color-infrared aerial photography of the entire coastal zone every 3 years since 2005. Because the CRMS imagery is made available to partners, the DWH NRDA program indirectly benefits from the fixed CRMS acquisition schedule. Historically, the CRMS program paid for coastwide photography which is the foundation for Barrier Island Comprehensive Monitoring Program (BICM) habitat classifications. The BICM-funded habitat classifications, based on CRMS imagery, are then used by DWH NRDA for project evaluations reducing the need for DWH NRDA to pay for large scale photo acquisition and classification. As such, planned CRMS photography acquisitions are an asset to the DWH NRDA program.

Dating back to 1949, the entire coastal zone has been surveyed via helicopter to classify vegetation types (i.e., Fresh, Intermediate, Brackish, Saline, Swamp) approximately every 10 years. Delineation of coastwide vegetation types is an integral part of large-scale baseline condition

assessments and determining the resiliency and sustainability of the coastal habitats. The CRMS program funded the 2007 and 2013 surveys. If sufficient funds exist, the next survey is planned for FY21.

In 2014, CRMS funded a coastwide elevation survey to ensure a common vertical datum (ft. NAVD88, Geoid12a) for data collection throughout the network such that data are comparable across the entire Louisiana coast. In order to complete the survey, it was necessary for the land survey contractor to also survey in 61 Secondary GPS monuments within the coastal zone. The secondary benchmark network is used for project design and engineering regardless of program funding source. One direct benefit of having a coastwide elevation survey is that the output provides accurate data for water and marsh surface elevations regardless of location or marsh type. The accurate known elevations have been used for DWH NRDA project planning and implementation (e.g., target elevations for marsh creation projects, target water surface elevation for diversion projects). Additionally, the elevations from CRMS sites are a key validation data source for the creation of a seamless Light Detection and Ranging (LIDAR) surface for coastal Louisiana and digital elevation models (DEMs). The resulting DEMs are used extensively for DWH NRDA-funded barrier island restoration and habitat classifications for DWH NRDA project assessments. Within the CRMS programmatic budget, the next comprehensive coastwide elevation survey is scheduled for FY22 (\$2.1M) and is a large portion of the anticipated funding deficit.

3.1.2. Objectives

The objective of this MAIP is to maintain the continuity of CRMS datasets that are fundamental to Louisiana coastal restoration planning, implementation, monitoring, and adaptive management.

In order for the CRMS program to continue to collect data coastwide through the next three-year contract without interruption, additional funds are needed. The LA TIG's NRDA restoration program has benefitted from CRMS data availability and supplementing CRMS' current funding with NRDA funding would help ensure CRMS data collection continues uninterrupted. We propose that the LA TIG, through DWH NRDA funding, fund the CRMS Program's unfunded budget (\$11,722,399). This value represents 31.2% of the total CRMS costs for the next three years (FY21 – 23; \$11,722,399; (Table 2) and it approximates the portion of the state impacted by the oil spill within which the DWH NRDA program has an interest and need for CRMS data. The Barataria (BA) and Terrebonne (TE) basins, which saw the most oil spill related damages, account for 39% of the state's coastal area; the 139 CRMS sites within the BA and TE basins account for 36% of CRMS sites coastwide. DWH NRDA projects are also located in Breton Sound, Pontchartrain and Calcasieu/Sabine basins all of which have CRMS sites available for project evaluation.

Actual costs associated with the CRMS program are not known at this time. The RFP for the field data collection contract is to be advertised this summer with a contract commencement date of 1/1/2021. Other CRMS programmatic costs that are estimated but not known at this time include a new elevation survey in FY22 where every site will be surveyed into the new gravimetric datum currently in development by the National Geodetic Survey (NGS), a helicopter survey to define habitat types across coastal Louisiana in FY21 and a coastwide flight to provide imagery for land change analysis planned for FY22.

The amount requested represents sufficient funds to cover the anticipated CRMS budget shortfall and the state's CWPPRA cost share for three years.

3.1.3. Budget

Table 2. CRMS Budget Presented to and Approved by CWPPRA in October, 2017 (FY21-23 subset).

	FY21	FY22	FY23	Total FY21-23
Admin and Supervision	\$488,078	\$497,839	\$507,796	
Landrights	\$52,020	\$53,060	\$1,109	
Engineering Services (coastwide elevation)		\$2,122,416		
Equipment	\$1,040	\$1,061	\$1,082	
Temporal Data Collection	\$8,931,834	\$9,110,471	\$9,292,680	
Heli Coastwide Veg	\$364,140			
Spatial Data Collection and Analysis		\$240,894	\$644,047	
O&M			\$465,446	
Database Management	\$351,655	\$358,688	\$365,862	
Analysis and Reporting	\$379,746	\$387,341	\$395,088	
USACE Project Management	\$2,081	\$2,122	\$2,165	
Annual Total Budget	\$11,386,594	\$13,606,213	\$12,524,242	\$37,517,050
Budget Funded by CWPPRA Task Force	\$10,346,649	\$10,000,000	\$10,000,000	\$30,346,649
Unfunded Budget	\$1,039,946	\$3,606,213	\$2,524,242	\$7,170,401
CPRA's Cost Share	\$1,551,997	\$1,500,000	\$1,500,000	\$4,551,997
Amount Requested (Unfunded Budget + CPRA Cost Share)	\$11,722,399			

3.1.4. Timeline

The activities described above will occur during State of Louisiana FY21, FY22, and FY23, beginning June 30, 2020.

3.1.5. Data management and reporting

Well-established data management procedures outlined in the CRMS SOP have been in place since 2006, and were described in previous sections of this MAIP (sections 3.1.1.1.a and 3.1.1.1.b). All CRMS data are publicly available and direct linkages between the CIMS database and NRDA's DIVER database are under development. Additionally, progress will be reported through the Restoration Management Portal. In the near future, CPRA and NOAA intend to collaborate with USGS to develop a data exchange strategy that reaches beyond CIMS and DIVER. That work will result in a system agnostic data exchange mechanism that uses XML formatted, self-describing data to enable any standards-compliant system to participate in bi-directional data exchange.

4. Consistency of MAM Activity with the PDARP/PEIS

This MAM activity is consistent with and supports multiple programmatic goals (section 5.3) in the PDARP/PEIS, including a variety of restoration types (section 5.5) and restoration approaches (Appendix 5.D). This MAM activity supports the programmatic goals of, (1) Restore and conserve habitat; and (2) Provide for monitoring, adaptive management, and administrative oversight to support restoration implementation. A fully funded CRMS program will support a variety of restoration types described in the PDARP/PEIS, including but not limited to Sections 5.5.2, *Wetlands, Coastal, and Nearshore Habitats*, 5.5.3, *Habitat Projects on Federally Managed Lands*, and 5.5.15, *Monitoring and Adaptive Management*. The PDARP/PEIS makes numerous references to creation and restoration of multiple habitat types, especially through river diversions, marsh creation, and barrier island restoration which are listed as main strategies for restoring habitat (Section 5.5.2.2). A fully funded CRMS network will also provide data for monitoring and adaptive management of wetland resources, including determining recovery from injury during the DWH. Therefore, CRMS provides baseline data for future

projects, important resource management data, and is an essential part of Operations, Maintenance, Monitoring, and Adaptive Management Plans (OMMAM) for current and possible future large-scale restoration projects in Louisiana. Rationale for how these data support and are consistent with a variety of restoration approaches found in the DWH PDARP/PEIS appendices 5.D and 5.E. Linkages between CRMS activities and the restoration approaches as identified in the PDARP/PEIS as appropriate under the Oil Pollution Act (OPA) are provided below.

- Habitat Restoration Approaches (D.1)
 - Create, Restore, and Enhance Coastal Wetlands (D.1.1)
 - CRMS provides elevation data for marsh creation project planning and implementation (e.g., target elevations for marsh creation projects, target water surface elevation for diversion projects).
 - CRMS provides hydrology data to determine if salinity gradients and flow regimes are suitable to enhance coastal habitats.
 - CRMS provides vegetation and soils data to determine if projects are colonizing with communities capable of supporting sustainable marshes.
 - Restore and Preserve Mississippi-Atchafalaya River Processes (D.1.2)
 - River diversions represent a long-term strategy to restore injured wetlands and resources by reducing widespread loss of existing wetlands.
 - Currently no large-scale sediment diversions exist on the Mississippi River.
 - CRMS data would be used to update models for any diversion planning, act as baseline, construction phase and post-construction monitoring data for basin hydrology, vegetation, soils, and land change providing the ability to adaptively manage project outcomes as benefits and impacts become clear.
 - Create, Restore, and Enhance Barrier and Coastal Islands and Headlands (D.1.4)
 - The CRMS program has and will continue to fund high resolution coastwide photography which is the basis for barrier island habitat classifications used to assess barrier island project effectiveness.
 - The CRMS program has and will continue to support coastwide elevation surveys providing a key validation data source for the creation of a seamless Light Detection and Ranging (LIDAR) surface for coastal Louisiana and digital elevation models (DEMs). The resulting DEMs are being used extensively for DWH NRDA funded barrier island restoration and habitat classifications for DWH NRDA project assessments.
 - Protect and Conserve Marine, Coastal, Estuarine, and Riparian Habitats (D.1.7)
 - The CRMS program would inform the restoration approach to develop and implement management activities at restoration projects by providing hydrology data to inform the need for debris removal within choked canals. Additionally, reference vegetation and elevation data inform planning and implementation of vegetation plantings.
- Monitoring and Adaptive Management (5.E)
 - CRMS would provide both project level (E.3.1), resource level (E.3.2), and cross-resource level (E.3.3) monitoring
 - This coastwide data set would provide for project specific monitoring that would *“inform restoration planning, supports the evaluation of project performance and ensures project compliance.”* It would also provide feedback information in order to adaptively manage projects.
 - The coastwide data set would also provide important resource information and *“can fulfill data and information needs for multiple projects benefitting a common injured resource, thereby promoting efficiency and consistency in data collection and restoration evaluation.”*

- The CRMS programmatic data collections would apply directly to wetlands and barrier islands providing “*cross-resource-level monitoring and scientific support to fulfill data and information needs common among multiple injured resources, thereby promoting efficiency and consistency in data collection and restoration evaluation.*”

The CRMS activities described above would clearly address many of the key areas of restoration outlined in the PDARP/PEIS by leveraging a coastwide, long-term data set that monitors coastal wetlands and barrier islands that received direct injury during the DWH oil spill. A fully funded CRMS would provide valuable data towards the DWH LA TIG’s vision of large-scale restoration of multiple coastal and estuarine habitats and the ability to conduct proper monitoring and adaptive management on restoration projects. Without additional funding, the CRMS program will have to remove sites from the monitoring network or cancel planned data collection campaigns which will impact restoration efforts coastwide including DWH NRDA’s ability to assess projects.

5. National Environmental Policy Act (NEPA) Review

The Trustees’ approach to compliance with NEPA summarized in this section is consistent with, and follows where applicable from the PDARP/PEIS Section 6.4.14. Resources considered and impacts definitions (minor, moderate, major) align with the PDARP/PEIS. Relevant analyses from the PDARP/PEIS are incorporated by reference. Such incorporation by reference of information from existing plans, studies or other material is used in this analysis to streamline the NEPA process and to present a concise document that briefly provides sufficient evidence and analysis to address the LA TIG’s compliance with NEPA (40 CFR 1506.3, 40 CFR § 1508.9). All source documents relied upon are available to the public and links are provided in the discussion where applicable.

No additional NEPA evaluation would be needed for activities that can be carried out under existing permits and authorizations. The data gathered are expected to lead to beneficial impacts to biological resources through increased understanding of Louisiana coastal resources and the application of this understanding to future restoration activities. Should there be activities that fall outside of current permits or that would require modification of current permits, those actions would be fully evaluated and any requisite NEPA for such permit modification would be completed prior to such actions being taken.

Based on review of the proposed activities against those actions previously evaluated in the PDARP/PEIS and actions authorized under existing permits, no additional NEPA evaluation is necessary at this time.

6. Compliance with Environmental Laws and Regulations

This project would consist mainly of field data collection and data analysis. Field activities for the installation and maintenance of the CRMS network are authorized under Category 1 of the Programmatic General Permit by the United States Army Corps of Engineers (Attachment 2). A water quality certification from the Louisiana Department of Environmental Quality is applicable per the determination of consistency with the USACE Programmatic General Permit. Additionally, the project has been reviewed and deemed consistent with the approved Louisiana Coastal Resource Program (LCRP) as required by Section 307 (c)(1)(A) of the Coastal Zone Management Act of 1972, as amended by the Louisiana Department of Natural Resources, Office of Coastal Management (Attachment 3).

7. Literature Cited

Deepwater Horizon (DWH) Natural Resource Damage Assessment Trustees. 2017. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. December.

DWH Trustees. 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Deepwater Horizon (DWH) Natural Resource Damage Assessment Trustees Retrieved from <http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan>

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State of Louisiana's Office of Coastal Protection and Restoration, April 2020, Coastal Information Management System (CIMS) Data Descriptions. Baton Rouge, LA. 27 pp.

Steyer, G.D., C. E. Sasser, J. M. Visser, E. M. Swensen, J. A. Nyman, and R.C. Raynie. 2003. A proposed coast-wide reference monitoring system for evaluating wetland restoration trajectories in Louisiana. *Environmental Monitoring and Assessment* 81:107-117.

Attachment 1. Summary of CRMS Analytical Activities Related to Reducing Program Costs

Summary of CRMS Analytical Activities Related to Reducing Program Costs

The CRMS program has Analytical Teams focused on hydrology, soils, vegetation, landscape change, and advanced applications. Historically, the Analytical Teams have used CRMS data to develop ecological indices for multi-spatial scale ecological assessments, data summaries, and data visualizations. The Analytical Teams have focused their efforts on the needs of the CWPPRA community providing tools to support CWPPRA project planning and evaluation.

In 2017 prior to a 20-year programmatic budget request to CWPPRA, the CRMS Analytical Teams assessed site/data redundancy in order to justify the proposed costs of the 391 site network through FY2039. The analyses initially focused on individual site redundancy of hydrologic equipment because collecting hydrology data represents approximately 75% of the annual temporal data collection costs. CRMS sites are made up of numerous sampling stations for multiple parameters. The approach was to determine whether individual hydrographic stations were providing the same data such that one station could be used to represent hydrology for two or more stations (other CRMS sites). Sites with similar hydrology were then reassessed to determine whether they also provided similar data for vegetation. Results indicated 21 pairs of hydrology stations were providing statistically equivalent data (defined as daily mean salinity and water level), within those 21 pairs, none of the sites were providing the same vegetation data (80% vegetation similarity). Therefore, it was not possible to remove an entire CRMS site but was possible to remove multiple hydrology stations. After considering whether removing 1 hydrology station in each pair would impact the programs ability to assess existing or future restoration areas, 7 hydrologic stations were identified as redundant and removed.

Based on the analysis described above, removing a large number of hydrologic stations was not practical; therefore, the Analytical Teams investigated if a change to operations with existing hydrologic stations could provide efficiencies. Specifically, whether extending the time between hydro station servicing (maintenance interval) would negatively impact the data quality by increasing the number of lost records and/or data adjustments due to biofouling. Analyses indicated the program could extend the maintenance interval from the current average of 40 days to a maximum of 80 days (Schoolmaster and Piazza 2020). The current CRMS contract requires the CRMS field contractor service the data sondes at least every 60 days. The Analytical Teams recommended and the CWPPRA Monitoring Workgroup approved a change to the future CRMS field contract allowing the maintenance interval to be lengthened to 75 days with a maximum of 6 trips per station per year. The 75-day maximum took into account the results of the data analysis and the hydrologic data completeness requirements for calculation of the CRMS hydrologic index which is used for ecological assessment. Lengthening the maintenance interval is expected to decrease temporal data collection costs as the field contractor gets paid per servicing event.

The CRMS annual vegetation survey samples 10 stations per herbaceous marsh site (9 stations per forested wetland site). Another analysis was conducted to determine the effect of sampling fewer vegetation stations (removing between 1 and 5 vegetation stations per site). In order for vegetation station reduction to translate into cost savings, 4 or 5 stations per site would need to be removed. If sampling fewer vegetation stations per site would produce similar vegetation output, then sampling more CRMS sites per day during vegetation sampling would translate into reduced costs. Five vegetation

metrics were analyzed to compare results using 10 stations, and, then, a subset of remaining stations (i.e., 9, 8...5) using all combinations of station removal. The 5 metrics were 1) probability that the dominant species was correctly identified, 2) proportion of species from full sample observed, 3) Jaccard's index of similarity, 4) difference in total cover, 5) difference in diversity index. Although results varied by habitat type (i.e., fresh, intermediate, brackish, saline, and swamp), it was determined that by removing 4 or 5 stations, the resulting dataset would misrepresent the dominant species 20% of the time, could fail to observe 20% of species present, the observed species compositions would be 25-40% different, and total cover would be 5-10% different than the full dataset. Because the annual vegetation effort represents only 10 to 12% of the data collection costs, the cost savings was not substantial enough to balance reduced precision in the vegetation dataset.

Historically the CRMS program has sampled RSET and accretion twice per year, spring and fall, accounting for approximately 10% of field collection costs. Another analysis was completed to look at elevation change and accretion dynamics and determine if sampling once per year would generate comparable data. Although seasonal changes in elevation change have been observed through CRMS, ultimately, only the annual rates are used for ecological assessments. Therefore, the Analytical Teams recommended, and the CWPPRA Monitoring Workgroup approved, spring only sampling of RSET and accretion in future CRMS field contracts starting January 2021.

In the early 2000s, the original CRMS design was reviewed by numerous external expert panels. They recommended 700 sites with sampling of 200 sites annually, representing the true coastwide vegetation composition within 14 vegetation classes with greater than 95% confidence. Of the remaining 500 sites, approximately 1/3 would be sampled each year. The intent of the rotational design was to enhance the temporal coverage in the network design, provide reference sites, and provide sampling efficiency with personnel and equipment. In 2007, the rotational design was eliminated due to cost, sampling time, and landrights issues. A fixed 392 site network was approved by CWPPRA for implementation. This design has been operating at full capacity since 2007/2008. The CRMS program is a key component of restoration project planning, implementation, evaluation, and modeling. Not only for CWPPRA, but also the State's Master Plan, Systemwide Assessment and Monitoring Plan (SWAMP), NRDA, RESTORE, and diversion teams. Any major change to the CRMS network design should consider other data users but would have to be reviewed by the CWPPRA Monitoring Workgroup and approved by the CWPPRA Technical Committee and Task Force.

The Analytical Teams are actively exploring scientifically defensible options for reducing the number of CRMS sites if budget cuts require such action. Based on previous analyses it is known that CRMS sites are not providing redundant data, therefore an analytical process must be developed to determine what other types of information can inform a site elimination strategy. There are very few published studies that address this issue directly. One approach analyzes aspects of the trend and dynamics of the time series generated by each site and uses that information to assess the uniqueness of information provided by multiple metrics at each CRMS site and determines how much "new/unique" information each site is contributing (Sarno 2005). Another approach uses the stratified sampling design used to develop CRMS and determines how many sites of each vegetation classification within basin could be removed to keep the proportional design. Both approaches can consider other factors such as how often or how much a site's data is accessed or where a site is located compared to known future restoration efforts. This analytical exercise is currently a work in progress and is not ready for public dissemination. The plan is to present all avenues of investigation to the CWPPRA Monitoring Workgroup in late

summer/early fall. The CRMS team is willing to present details of historic and future analytical exercises to all interested parties. If funding from NRDA is approved, a process will be developed to integrate feedback from both the CWPPRA and NRDA communities.

It should be stated that, to date, the recommendation has always been to keep the network design intact and address the budget shortfalls through operational and procedural changes. The CRMS project management team has substantially changed the data collection requirements for the future CRMS contract which will start January 1, 2021. By extending the hydrologic servicing schedule and eliminating fall RSET/accretion, the program should see cost savings for temporal data collection.

Attachment 2. USACE Programmatic General Permit



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVE
NEW ORLEANS, LA 70118-3651

15 June 2018

Operations Division
Eastern Evaluation Section

SUBJECT: MVN-2004-04612-MM

Coastal Protection and Restoration Authority of Louisiana
Attention: Mr. Bill Boshart
2045 Lakeshore Drive
New Orleans, Louisiana 70122

Dear Mr. Boshart:

The proposed work, to install and maintain 390 Coastwide Reference Monitoring Systems (CRMS) stations for the purpose of assessing the ecological condition of coastal wetlands located throughout the Louisiana Coastal Zone, as shown on the enclosed drawings, is authorized under **Category 1** of the **Programmatic General Permit** provided that all conditions of the permit are met.

In addition, you must comply with the enclosed "Standard Manatee Conditions for In-water Activities".

The permittee is advised that a portion of the work will take place over Government-owned easement areas. Because the activities proposed in this permit application are temporary in nature, they do not interfere with the rights of the Government at this time. As such, no real estate documentation is necessary. However, the permittee is advised that the United States shall in no case be liable for any damage or injury to persons performing the activities in those areas over which the Government owns easements. Furthermore, the Government shall not be liable for any damages to property caused by the permittee in its performance of the proposed activities.

This authorization has a blanket water quality certification from the Louisiana Department of Environmental Quality; therefore, no additional authorization from DEQ is required.

However, prior to commencing work on your project, you must obtain approvals from state and local agencies as required by law and by terms of this permit. These approvals include, but are not limited to, a permit, consistency determination or determination of "no direct or significant impact (NDSI) on coastal waters" from the Louisiana Department of Natural Resources, Office of Coastal Management.

This approval to perform work is valid for 5 years from the date of this letter. Permittee is aware that this office may reevaluate its decision on this permit at any time the circumstances warrant.

Should you have any further questions concerning this matter, please contact Melissa Marino at (504) 862-2637 or melissa.l.marino@usace.army.mil.

Sincerely,

for
Martin S. Mayer
Chief, Regulatory Branch

Enclosures

Copies furnished:

Ms. Sarai Piazza, USGS

1. Activities authorized under this general permit shall not be used for piecemeal work and shall be applied to single and complete projects. All components of a single and complete project shall be treated together as constituting one single and complete project. All planned phases of multi-phased projects shall be treated together as constituting one single and complete project. This general permit shall not be used for any activity that is part of an overall project for which an individual permit is required.
2. No activity is authorized under this general permit which may adversely affect significant cultural resources listed or eligible for listing in the National Register of Historic Places until the requirements for Section 106 of the National Historic Preservation Act are met. Upon discovery of the presence of previously unknown historic and/or prehistoric cultural resources, all work must cease and the permittee must notify the State Historic Preservation Office and the Corps of Engineers. The authorization is suspended until it is determined whether or not the activity will have an adverse effect on cultural resources. The authorization may be reactivated or modified through specific conditions if necessary, if it is determined that the activity will have no adverse effect on cultural resources. The PGP authorization will be revoked if it is determined that cultural resources would be adversely affected, and an individual permit may be necessary.
3. There shall be no unreasonable interference with navigation by the existence or use of the activity authorized herein. The permittee will, at his or her expense, install and maintain any safety lights, signals, and signs prescribed by the United States Coast Guard, through regulations or otherwise, on authorized facilities or on equipment used in performing work under the authorization.
4. No activity may substantially disrupt the movement of those species of aquatic life indigenous to the water body, including those species which normally migrate through the area, unless the activity's primary purpose is to block or impound water.
5. If the **authorized** activity involves the installation of aerial transmission lines, submerged cable, or submerged pipelines across navigable waters of the United States the following is applicable:

The National Ocean Service (NOS) has been notified of this authorization. You must notify NOS and this office in writing, at least two weeks before you begin work and upon completion of the activity authorized by this permit. Your notification of completion must include a drawing which certifies the location and configuration of the completed activity (a certified permit drawing may be used). Notification to NOS will be sent to the following address: National Ocean Service, Office of Coast Survey, N/CS261, 1315 East West Highway, Silver Spring, Maryland 20910-3282.

6. For pipelines under an anchorage or a designated fairway in the Gulf of Mexico, the following is applicable: The NOS has been notified of this authorization. You must notify NOS and this office in writing, at least two weeks before you begin work and upon completion of the activity authorized by this permit. Within 30 days of completion of the pipeline, 'as built' drawings certified by a professional engineer registered in Louisiana or by a registered surveyor shall be furnished to this office, the Commander (dpw), Eighth Coast Guard District, Hale Boggs Federal Building, 500 Poydras Street, Room 1230, New Orleans, Louisiana 70130, and to the Director, National Ocean Service, Office of Coast Survey, N/CS261, 1315 East West Highway, Silver Spring, Maryland 20910-3282. The plans must include the location, configuration and actual burial depth of the completed pipeline project.

7. If the **authorized** project, or future maintenance work, involves the use of floating construction equipment (barge mounted cranes, barge mounted pile driving equipment, floating dredge equipment, dredge discharge pipelines, etc.) in the waterway, you are advised to notify the Eighth Coast Guard District so that a Notice to Mariners, if required, may be prepared. Notification with a copy of your permit approval and drawings should be mailed to the Commander (dpw), Eighth Coast Guard District, Hale Boggs Federal Building, 500 Poydras Street, Room 1230, New Orleans, Louisiana 70130, about 1 month before you plan to start work. Telephone inquiries can be directed to the Eighth Coast Guard District, Waterways Management at (504) 671-2107.

8. All activities authorized herein shall, if they involve, during their construction or operation, any discharge of pollutants into waters of the United States, be at all times consistent with applicable water quality standards, effluent limitations and standards of performance, prohibitions, pretreatment standards and management practices established pursuant to the Clean Water Act (PL 92-500: 86 Stat 816), or pursuant to applicable state and local laws.

9. Substantive changes to the Louisiana Coastal Resources Program may require immediate suspension and revocation of this permit in accordance with 33 CFR 325.7.

10. Irrespective of whether a project meets the other conditions of this permit, the Corps of Engineers retains discretionary authority to require an individual Department of the Army permit when circumstances of the proposal warrant this requirement.

11. Any individual authorization granted under this permit may be modified, suspended, or revoked in whole or in part if the Secretary of the Army or his authorized representative determines that there has been a violation of any of the terms or conditions of this permit or that such action would otherwise be in the public interest.

12. The Corps of Engineers may suspend, modify, or revoke this general permit if it is found in the public interest to do so.

13. Activities proposed for authorization under the PGP must comply with all other necessary federal, state, and/or local permits, licenses, or approvals. Failure to do so would result in a violation of the terms and conditions of PGP.

14. The permittee shall permit the District Commander or his authorized representative(s) or designee(s) to make periodic inspections of the project site(s) and disposal site(s) if different from the project site(s) at any time deemed necessary in order to assure that the activity being performed under authority of this permit is in accordance with the terms and conditions prescribed herein.

15. This general permit does not convey any property rights, either in real estate or material, or any exclusive privileges; and it does not authorize any injury to property or invasion of rights or any infringement of federal, state, or local laws or regulations nor does it obviate the requirements to obtain state or local assent required by law for the activity authorized herein.

16. In issuing authorizations under this permit, the federal government will rely upon information and data supplied by the applicant. If, subsequent to the issuance of an authorization, such information and data prove to be false, incomplete, or inaccurate, the authorization may be modified, suspended, or revoked, in whole or in part.

17. For activities resulting in sewage generation at the project site, such sewage shall be processed through a municipal sewage treatment system or, in areas where tie-in to a municipal system is not practical, the on-site sewerage system must be approved by the local parish sanitarian before construction.

18. Any modification, suspension, or revocation of the PGP, or any individual authorization granted under this permit, will not be the basis for any claim for damages against the United States.

19. Additional conditions deemed necessary to protect the public interest may be added to the general permit by the District Commander at any time. If additional conditions are added, the public will be advised by public notice. Individual authorizations under the PGP may include special conditions deemed necessary to ensure minimal impact and compliance with the PGP.

20. The PGP is subject to periodic formal review by MVN and OCM in coordination with the Environmental Protection Agency, US Fish and Wildlife Service, the National Marine Fisheries Service, and the Louisiana Department of Wildlife and Fisheries. Comments from reviewing agencies will be considered in determination as to whether modifications to the general permit are needed. Should the District Commander make a determination not to incorporate a change proposed by a reviewing agency, after normal negotiations between the respective agencies, the District Commander will explain in writing to the reviewing agency the basis and rationale for his decision.

21. CEMVN retains discretion to review the PGP, its terms, conditions, and processing procedures, and decide whether to modify, reissue, or revoke the permit. If the PGP is not modified or reissued within 5 years of its effective date, it automatically expires and becomes null and void.

22. The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

23. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party as described in Special Condition 25 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

24. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

25. If you sell the property associated with this permit, you must provide this office with a copy of the permit and a letter noting your agreement to transfer the permit to the new owner and the new owner's agreement to accept the permit and abide by all conditions of the permit. This letter must be signed by both parties.

26. Many local governing bodies have instituted laws and/or ordinances in order to regulate dredge and/or fill activities in floodplains to assure maintenance of floodwater storage capacity and avoid disruption of drainage patterns that may affect surrounding properties. Your project involves dredging and/or placement of fill; therefore, you must contact the local municipal and/or parish governing body regarding potential impacts to floodplains and compliance of your proposed activities with local floodplain ordinances, regulations or permits.

27. In issuing authorizations under this permit, the federal government does not assume any liability for: damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes; damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest; damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit, and; design or construction deficiencies associated with the permitted work.

STANDARD MANATEE CONDITIONS FOR IN-WATER ACTIVITIES

During in-water work in areas that potentially support manatees, all personnel associated with the project shall be instructed and aware of the potential presence of manatees, manatee speed zones, and the need to avoid collisions with, and injury to, manatee. All personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. Additionally, personnel shall be instructed not to attempt to feed or otherwise interact with the animal.

All on-site personnel are responsible for observing water-related activities for the presence of manatee(s). To minimize potential impacts to manatees in areas of their potential presence, the permittee shall insure the following are adhered to:

- All work, equipment, and vessel operation shall cease if a manatee is spotted within a 50-foot radius (buffer zone) of the active work area. Once the manatee has left the buffer zone on its own accord (manatees must not be herded or harassed into leaving), or after 30 minutes have passed without additional sightings of manatee(s) in the buffer zone, in-water work can resume under careful observation for manatee(s).
- If a manatee(s) is sighted in or near the project area, all vessels associated with the project shall operate at “no wake/idle” speeds within the construction area and at all times while in waters where the draft of the vessel provides less than a four-foot clearance from the bottom. Vessels shall follow routes of deep water whenever possible.
- If used, siltation or turbidity barriers shall be properly secured, made of material in which manatees cannot become entangled, and be monitored to avoid manatee entrapment or impeding their movement.
- Temporary signs concerning manatees shall be posted prior to and during all in-water project activities and removed upon completion. Each vessel involved in construction activities shall display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8½ " X 11" reading language similar to the following: “CAUTION BOATERS: MANATEE AREA/ IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA AND WHERE THERE IS LESS THAN FOUR FOOT BOTTOM CLEARANCE WHEN MANATEE IS PRESENT”. A second temporary sign measuring 8½ " X 11" shall be posted at a location prominently visible to all personnel engaged in water-related activities and shall read language similar to the following: “CAUTION: MANATEE AREA/ EQUIPMENT MUST BE SHUTDOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION”.
- Collisions with, injury to, or sightings of manatees shall be immediately reported to the U.S. Fish and Wildlife Service’s, Louisiana Ecological Services Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821). Please provide the nature of the call (i.e., report of an incident, manatee sighting, etc.); time of incident/sighting; and the approximate location, including the latitude and longitude coordinates, if possible.

CRMS Sites

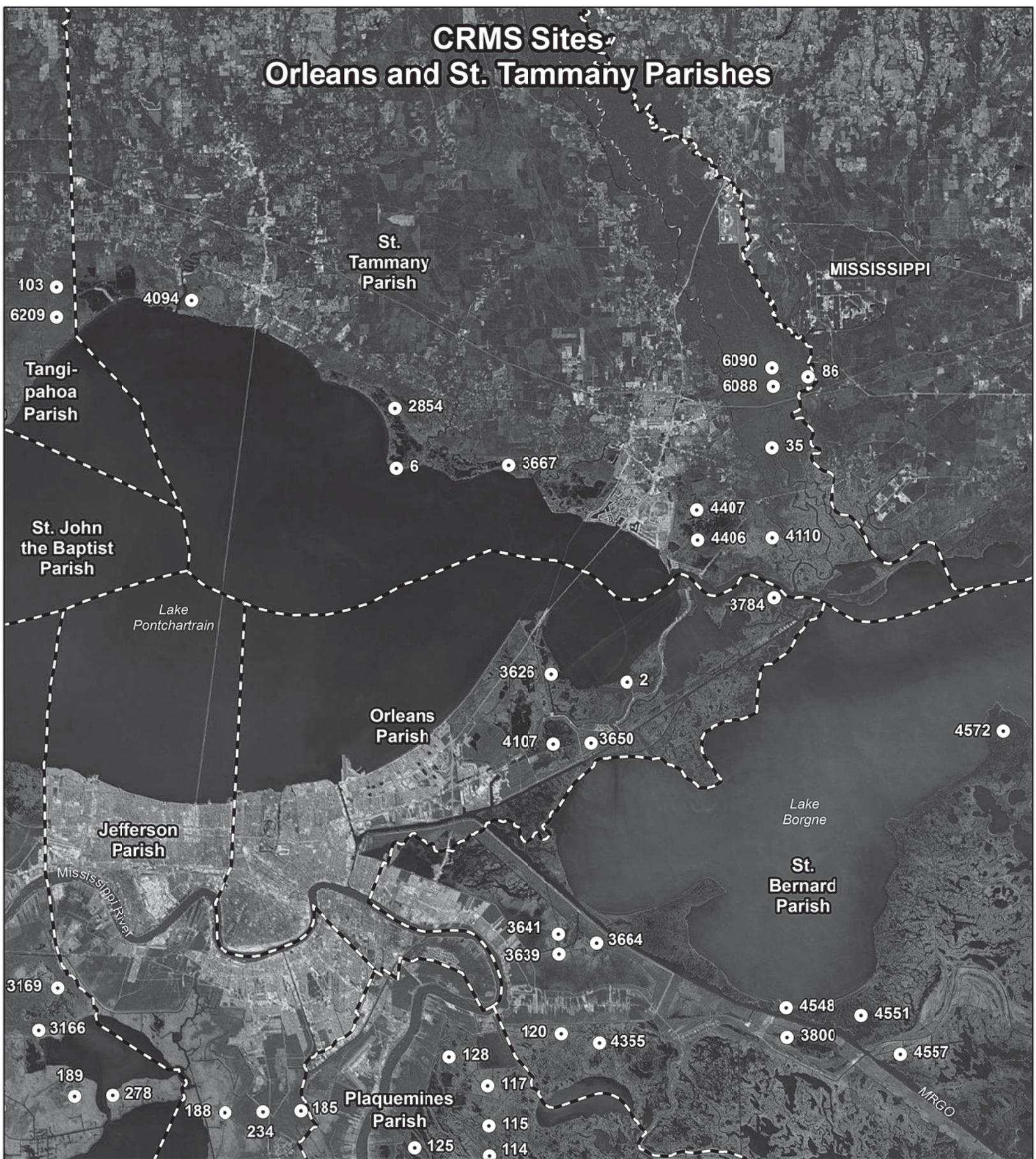


- CRMS Site
- ▭ Parish Boundary



Map Date: 8/16/2017
Path: //2017040339/
Service Layer Credits: Sources: Esri, DigitalGlobe, GeoEye,
Earthstar Geographics, CNES/Airbus DS, USDA, USGS,
AeroGRID, IGN, and the GIS User Community

CRMS Sites Orleans and St. Tammany Parishes



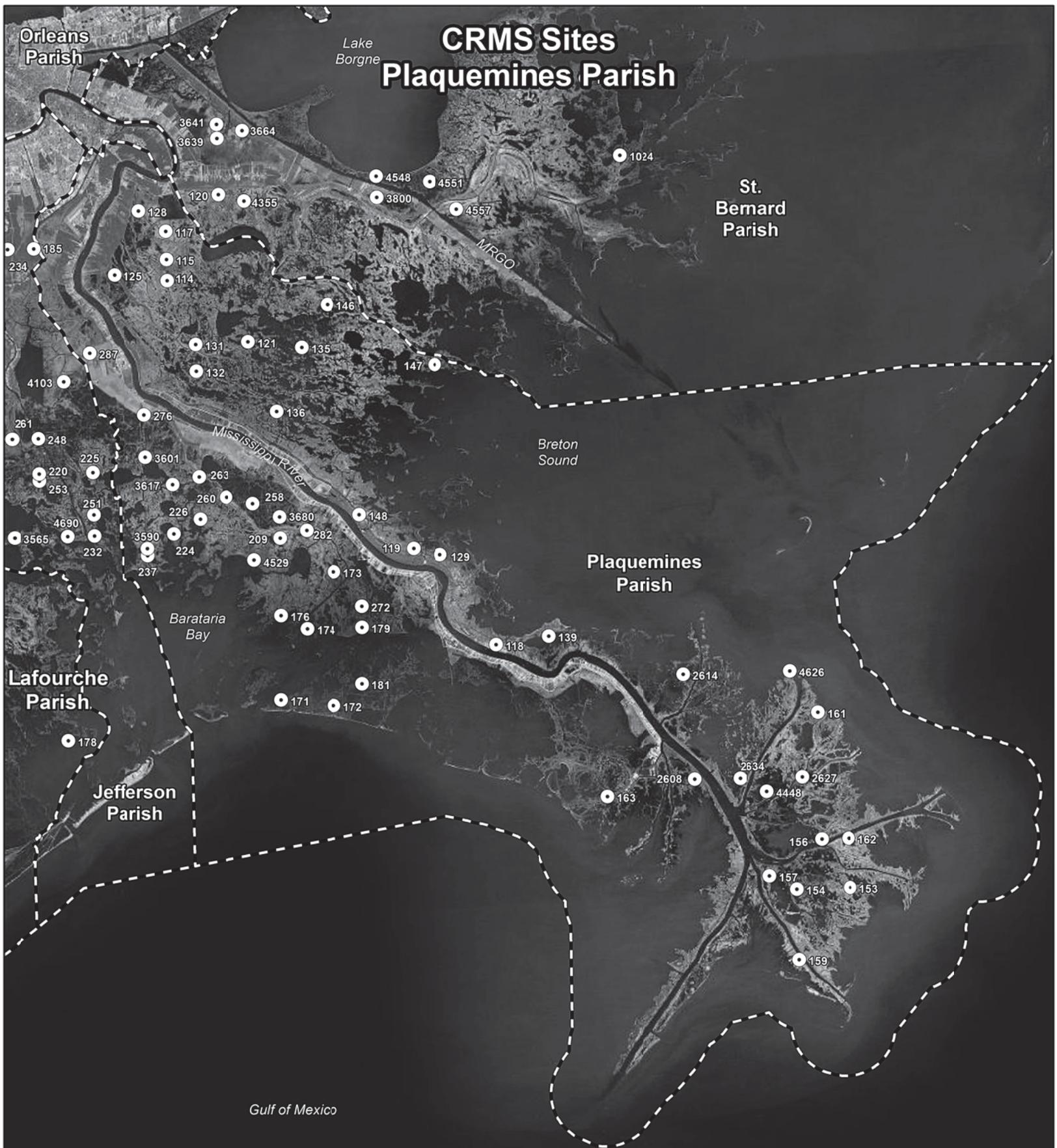
● CRMS Site
 - - - Parish Boundary



Map Date: 8/7/2017
 Path: //2017040339/

Service Layer Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus

CRMS Sites Plaquemines Parish



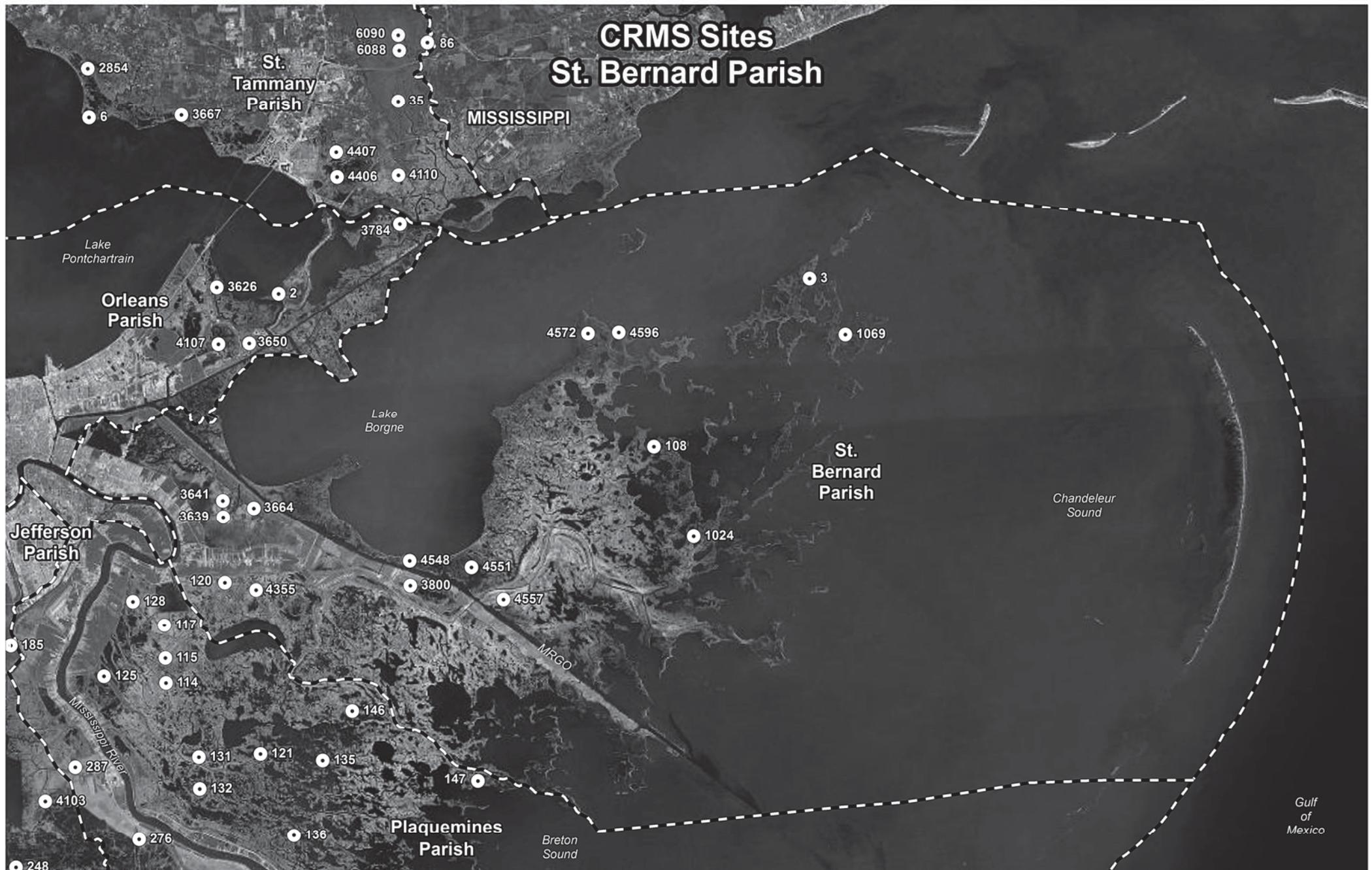
● CRMS Site
- - - Parish Boundary



Map Date: 8/7/2017
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Service Layer Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus

CRMS Sites St. Bernard Parish



● CRMS Site
- - - Parish Boundary



Map Date: 8/7/2017
Path: //2017040339/
Service Layer Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

CRMS Sites Terrebonne Parish



● CRMS Site
- - - Parish Boundary



Map Date: 8/7/2017
Path: //2017040339/

Service Layer Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus

CRMS Sites Vermilion Parish

Jefferson
Davis
Parish

Lafayette
Parish

Acadia
Parish

Vermilion
Parish

Cameron
Parish

Iberia
Parish



● CRMS Site

--- Parish Boundary



Map Date: 8/7/2017
Path: //2017040339/

Service Layer Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus

CRMS Sites Ascension, Assumption, and St. James Parishes



● CRMS Site
 - - - Parish Boundary



Map Date: 8/7/2017
 Path: //2017040339/

Service Layer Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus

CRMS Sites Iberia, St. Martin, and St. Mary Parishes



Lafayette Parish

St. Martin Parish

Iberville Parish

Iberia Parish

Assumption Parish

Vermilion Parish

St. Martin Parish

St. Mary Parish

Terrebonne Parish

Vermilion Bay

West Cote Blanche Bay

East Cote Blanche Bay

Atchafalaya Bay

Gulf of Mexico

Mississippi River

Lake Fausse Pointe

Lake Verret

● CRMS Site

--- Parish Boundary

Map Date: 8/7/2017

Path: //2017040339/

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● CRMS Site

--- Parish Boundary



CRMS Sites

Jefferson, Lafourche, and St. Charles Parishes

Gulf of Mexico

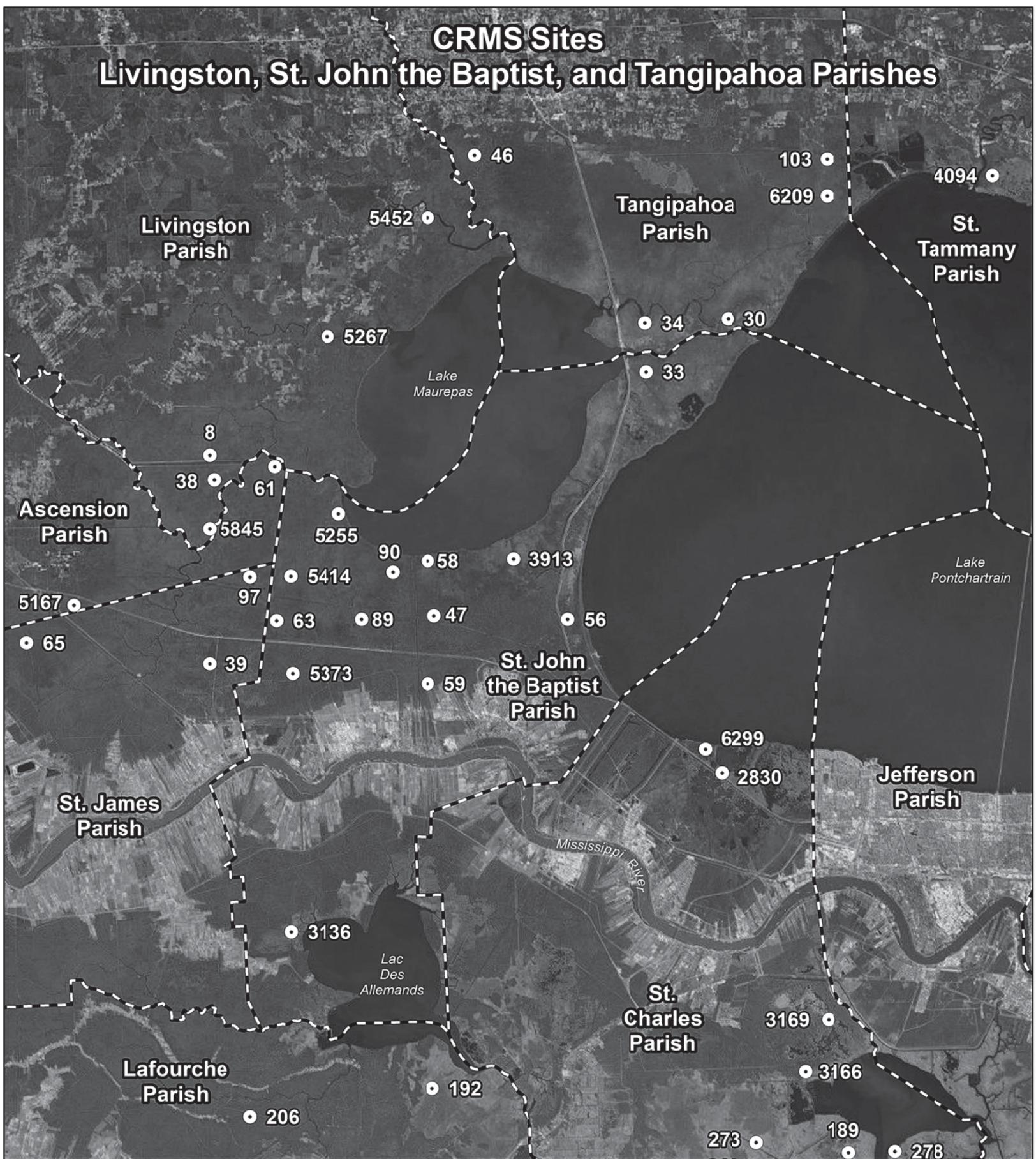


Map Date: 8/7/2017
 Path: //2017040339/

Service Layer Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus



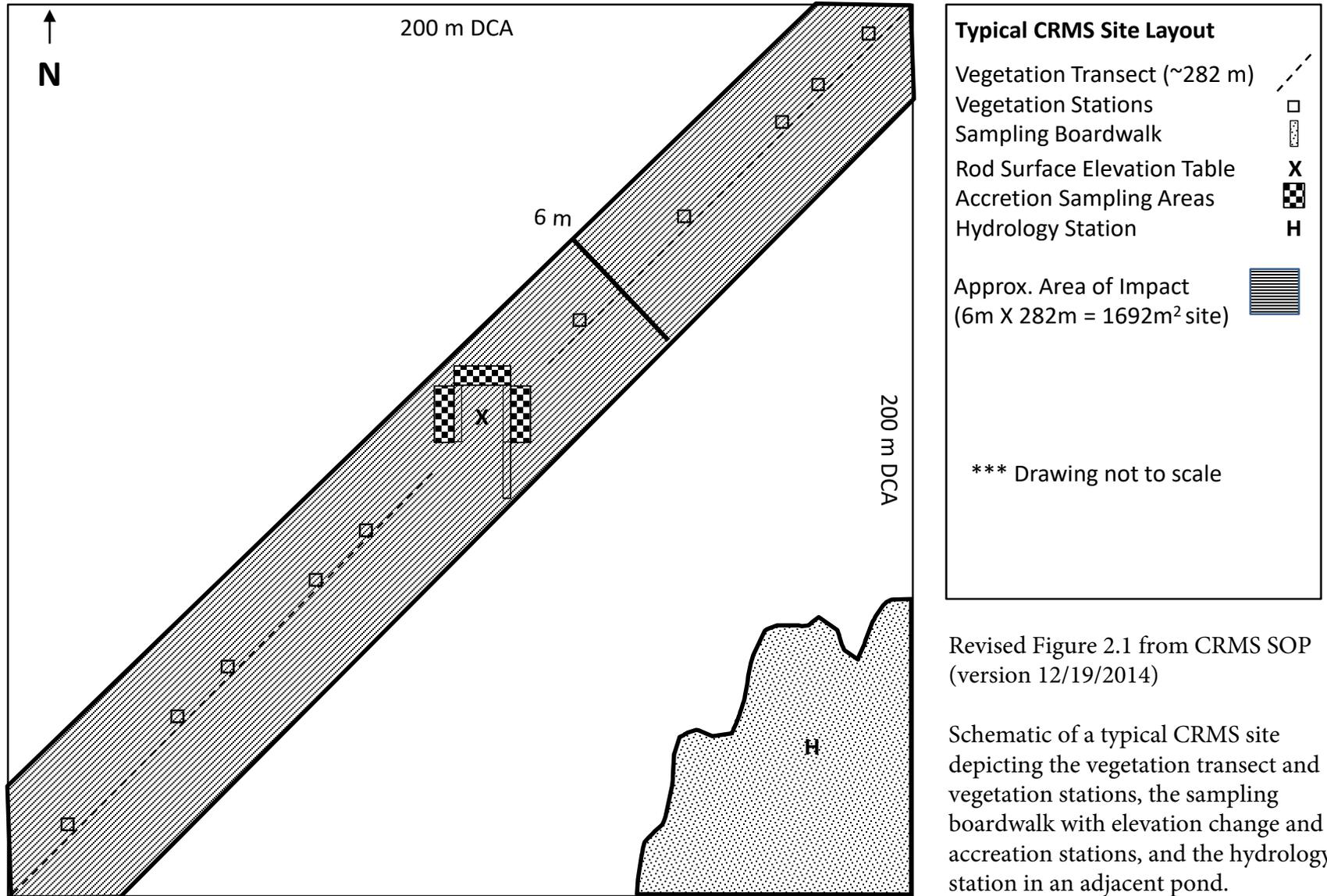
CRMS Sites Livingston, St. John the Baptist, and Tangipahoa Parishes



● CRMS Site
 - - - Parish Boundary



Map Date: 8/7/2017
 Path: //2017040339/
 Service Layer Credits: Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus



Typical CRMS Site Layout

- Vegetation Transect (~282 m)
- Vegetation Stations
- Sampling Boardwalk
- Rod Surface Elevation Table
- Accretion Sampling Areas
- Hydrology Station

Approx. Area of Impact
(6m X 282m = 1692m² site)

*** Drawing not to scale

Revised Figure 2.1 from CRMS SOP (version 12/19/2014)

Schematic of a typical CRMS site depicting the vegetation transect and vegetation stations, the sampling boardwalk with elevation change and accretion stations, and the hydrology station in an adjacent pond. Approximate area of impact includes access to stations along length of vegetation transect

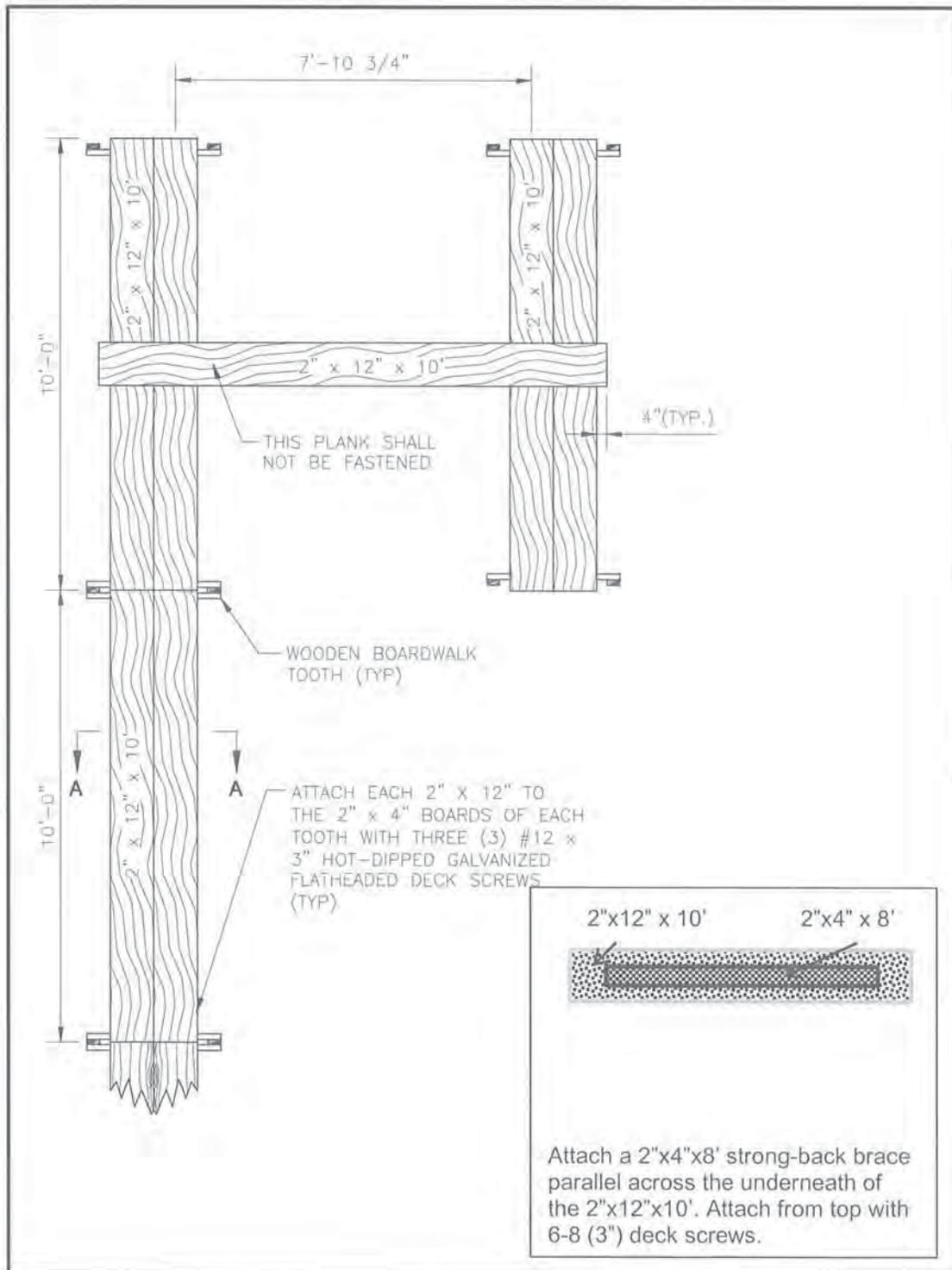


Figure 2.5a. Typical schematic of a base boardwalk in an attached marsh.

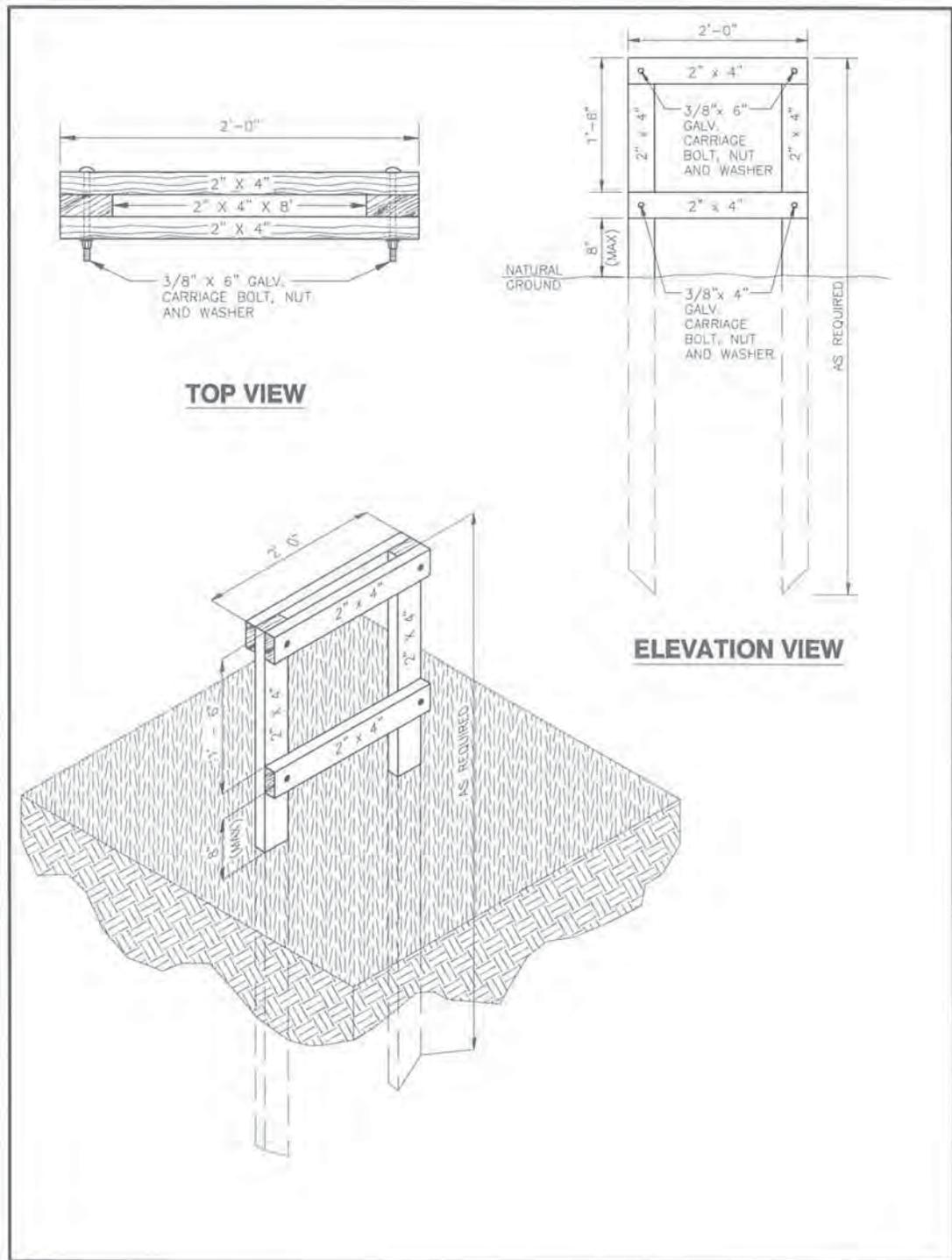


Figure 2.6a. Tooth construction diagram used to support the boardwalk for access to the data collection stations.

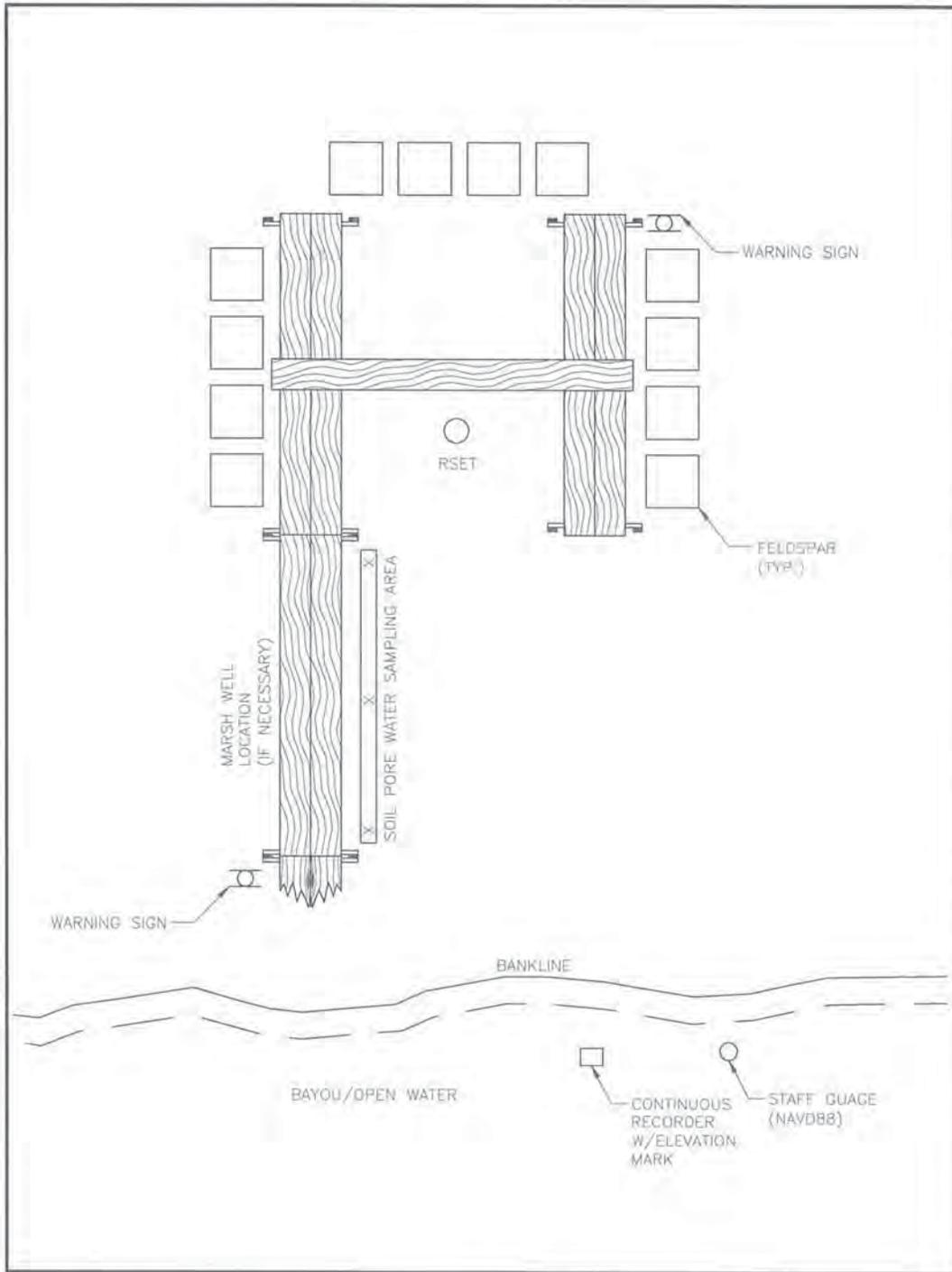


Figure 2.7. Typical layout schematic of the constructed site features at an attached marsh site.

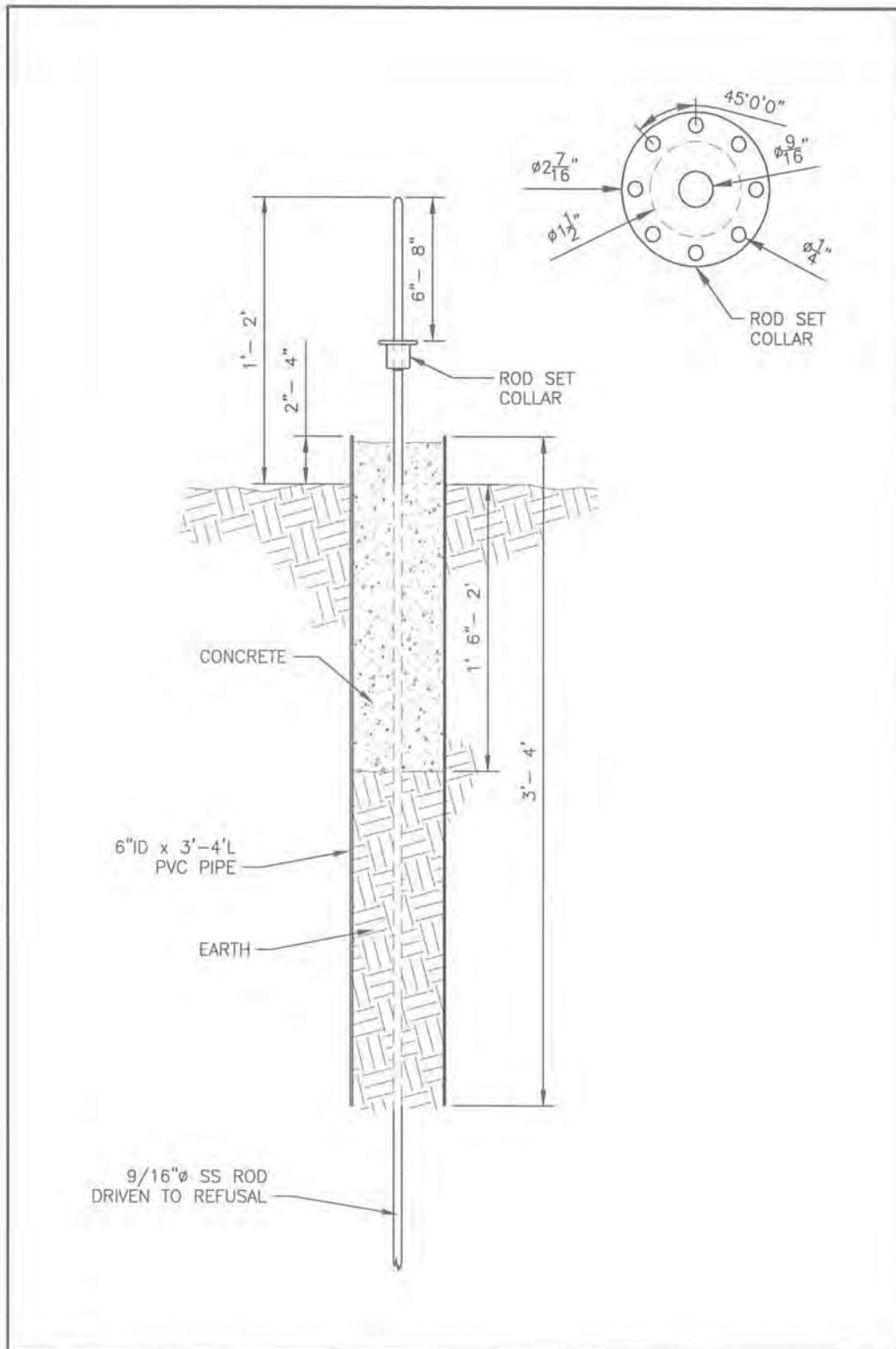


Figure 4.3a. Detailed construction drawing of a typical RSET station with collar. Inset: Collar detail.

Attachment 3. Louisiana Coastal Resource Program Consistency Letter



State of Louisiana
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL MANAGEMENT

September 27, 2017

Bill Boshart
Coastal Protection and Restoration Authority of Louisiana
2045 Lakeshore Drive
New Orleans, LA 70122
Via e-mail: Bill.Boshart@la.gov

RE: **C20170169**, Coastal Zone Consistency
U. S. Geological Survey
Direct Federal Action
Maintenance and Operation of the Coastwide Reference Monitoring System (CRMS)
Louisiana Coastal Zone

Dear Mr. Boshart:

The above referenced project has been reviewed for consistency with the approved Louisiana Coastal Resource Program (LCRP) as required by Section 307 (c)(1)(A) of the Coastal Zone Management Act of 1972, as amended. The project, as proposed in the application, is consistent with the LCRP.

If you have any questions concerning this determination please contact Jim Bondy of the Consistency Section at (225) 342-3870 or 1-800-267-4019.

Sincerely,

/S/ Don Haydel
Acting Administrator
Interagency Affairs/Field Services Division

DH/SK/jab

cc: Sarai Piazza, USGS
Martin Mayer, NOD-COE
Dave Butler, LDWF