

**Addendum: Mississippi Canyon 252 Oil Spill
Sampling and Analysis Plan for Jean Lafitte National
Historic Park and Preserve Submerged Aquatic Vegetation
Natural Resource Damage Assessment**

APPROVED:

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Addendum: Deepwater Horizon/Mississippi Canyon
252 Oil Spill
Sampling and Analysis Plan for
Jean Lafitte National Historic Park and Preserve
Submerged Aquatic Vegetation
Natural Resource Damage Assessment

Spring and Fall 2012 Surveys

Prepared for:

The National Park Service
Environmental Quality Division
P.O. Box 25287
Denver, CO 80225-0287

and

Submerged Aquatic Vegetation Technical Working Group

August 2012



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Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment. Each party reserves its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.

This plan will be implemented consistent with existing trustee regulations and policies. All applicable state and federal permits must be obtained prior to conducting work.

All samples will be sent to the University of Maryland Center for Environmental Science Chesapeake Biological Laboratory

Each laboratory shall simultaneously deliver raw data, including all necessary metadata, generated as part of this work plan as a Laboratory Analytical Data Package (LADP) to the trustee Data Management Team (DMT) and the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana. The electronic data deliverable (EDD) spreadsheet with pre-validated analytical results, which is a component of the complete LADP, will also be delivered to the secure FTP drop box maintained by the trustees' Data Management Team (DMT). Any preliminary data distributed to the DMT shall also be distributed to LOSCO. Thereafter, the DMT will validate and perform quality assurance/quality control (QA/QC) procedures on the LADP consistent with the authorized Quality Assurance Project Plan, after which time the validated/QA/QC'd data shall be made available simultaneously to all trustees. Any questions raised on the validated/QA/QC results shall be handled per the procedures in the Quality Assurance Project Plan and the issue and results shall be distributed to all parties. In the interest of maintaining one consistent data set for use by all parties, only the validated/QA/QC'd data set released by the DMT shall be considered the consensus data set. In order to assure reliability of the consensus data and full review by the parties, no party shall publish consensus data until 7 days after such data has been made available to the parties. Also, the LADP shall not be released by the DMT or LOSCO prior to validation/QA/QC absent a showing of critical operational need. Should any party show a critical operational need for data prior to validation/QA/QC, any released data will be clearly marked "preliminary/unvalidated" and will be made available equally to all trustees.

The trustees have developed a preliminary conceptual model of the DWH release, potential pathways and routes of exposure, and potential receptors. This preliminary model has informed the trustees' decision to pursue the studies outlined in the work plan.

Except as explicitly stated herein, by signing this Plan, the Parties make no admission of fact or law.

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ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
cm	centimeters
DO	dissolved oxygen
FAV	floating aquatic vegetation
FTP	file transfer protocol
GPS	global positioning system
ID	identification
JELA	Jean Lafitte National Historic Park and Preserve
L	liter
mg/L	milligram per liter
mL	milliliter
MC 252	Deepwater Horizon/Mississippi Canyon 252
MLLW	mean lower low water
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
NTU	nephelometric turbidity unit
PAR	photosynthetically active radiation
ppt	parts per thousand
QA/QC	quality assurance/quality control
QAP	quality assurance plan
SAV	submerged aquatic vegetation
SM	standard methods
TN	Total Nitrogen
TP	Total Phosphorous
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

During the response to the Deepwater Horizon/Mississippi Canyon 252 (MC 252) Oil Spill, Mississippi River freshwater flows were diverted from the Davis Pond Diversion to Lake Cataouatche, which is adjacent to Jean Lafitte National Historical Park and Preserve (JELA), to reduce the potential for oil intrusion into the inland marshes. As a result, the submerged aquatic vegetation (SAV) community at JELA may be impacted by the increase in freshwater, as well as nutrients into the interior marshes. Potential effects of increased freshwater and nutrients include eutrophication and diminished water quality, including reduced dissolved oxygen (DO) levels which may result in reductions in the diversity and abundance of SAV species and proliferation of nuisance or harmful algal blooms. This document presents a work plan detailing methods for assessments of freshwater SAV habitat following the diversion of Mississippi River water into JELA as a response to the MC 252 Oil Spill.

Previous studies have shown that increased nutrients to lakes result in reductions in species of SAV due to increased density and abundance of phytoplankton and algal epiphytes (Kalff, 2002). In lakes, shifts from SAV-dominated communities to phytoplankton-dominated communities can occur with nutrient addition (Dodson, 2005). Similarly, in marine and estuarine communities SAV is replaced by macroalgae with nutrient addition (Day et al., 1989). Increased nutrients can also result in altering the diversity of the SAV community structure changing it to one that is dominated by species more tolerant to nutrient loading. One means of controlling unwanted SAV in warm-water farm ponds is to add fertilizer to produce algal blooms in early spring which shade new SAV growth from the bottom (Summers, 1963). Based on fundamental SAV ecology, high loading of nitrogen and phosphorus from the incremental increase over historical levels of Mississippi River flow through the Davis Pond Diversion has the potential to adversely affect the SAV community in JELA. These effects may vary seasonally, since nutrients can affect seasonal recruitment and growth patterns of SAV, as well as phytoplankton, floating aquatics, and macroalgae. Therefore, injury assessment studies conducted in the spring and fall of 2012 are needed to continue to assess potential large-scale changes in SAV community structure, floating aquatic vegetation density, and water quality.

1.1 Sampling and Testing Objectives

The objective of this study is to collect data that can be used to assess potential impacts from incremental increases in freshwater inputs above historical levels into JELA due to the diversion of Mississippi River freshwater into JELA during the MC 252 Oil Spill. An initial field survey, conducted in September 2010 and two follow-up surveys conducted in May and September 2011 collected SAV community structure and water quality data at stations located within JELA and within a nearby reference area. Results from these studies indicate that the SAV community was likely affected by the increased freshwater flow to JELA during the oil spill response. Further studies are needed to evaluate the extent and magnitude of observed changes within the SAV community and to assess if recovery to baseline conditions is occurring or has occurred. Spring and Fall surveys will be performed in May 2012 and September 2012, respectively, to delineate seasonally distinct changes to water quality, floating aquatic vegetation (FAV) and the SAV community within JELA. Data from these surveys will also be used to assess spatial and temporal changes that have occurred within the SAV community in JELA following the oil spill

response. Surveys will collect data on physical and chemical water quality parameters, sediment and water nutrient levels, and potential shifts in SAV community structure and/or floating aquatic species abundance as compared to reference stations, the Fall 2010, Spring 2011, and Fall 2011 surveys, the Poirrier et al. (2009) survey, and other relevant historical studies.

Surveys will include assessments of SAV species composition at 39 stations located within the northeast portion of the Barataria Estuary in JELA and at five reference stations located north of the Davis Pond Diversion. The reference stations, located along Humble Canal and Bayou Des Allemandes, are in an area that was not subjected to the increased flow of freshwater from the Mississippi River from May to August of 2010. Determination of the number of stations was based on the U.S. Environmental Protection Agency's (USEPA's) *Guidance for the Data Quality Objectives Process* (USEPA, 2006a) and *Data Quality Assessment: Statistical Methods for Practitioners* (USEPA, 2006b).

Determinations of the relative abundance and distribution of SAV and FAV, as well as physical water quality assessments, will be performed at all 39 JELA stations and at all five reference stations using methods similar to those used in the June 2006 through April 2008 SAV surveys of 146 locations conducted within JELA by Poirrier et al. (2009). At 14 JELA stations and the five reference stations (referred to as full-analysis stations), water and sediment samples will also be collected for analysis of nutrients (total nitrogen [TN] and total phosphorous [TP]). Nutrient analyses will be performed to measure the levels of nitrogen and phosphorous in JELA as compared to the reference stations.

2.0 FIELD COLLECTION PROTOCOL FOR SAV CURRENT CONDITIONS DETERMINATIONS

Surveys will be conducted aboard shallow-draft vessels, such as air boats, pontoon boats, or mud boats, which will allow access to SAV throughout JELA and the reference area. A field crew of five personnel will complete each survey over a seven-day period. The crew will consist of a field lead familiar with the SAV survey protocols and local species; two field scientists with experience in SAV surveys, sediment and water chemistry sampling and water quality sampling; and a boat operator knowledgeable of JELA.

2.1 Sample Locations

A total of 39 JELA stations and five reference stations will be sampled in the Spring 2012 and Fall 2012 surveys. Sample stations are defined to be areas of approximately 100 square meters (m²) located along shorelines or within channels with SAV. The SAV community structure and physical water quality will be surveyed at all stations. Water and sediment nutrient chemistry (measured as TN and TP) will be assessed at the 14 full-analysis JELA stations and five reference stations (**Table 1**). The JELA stations are located in the northeast portion of Barataria Bay and were selected to correspond with station locations used in the Fall 2010, Spring 2011, Fall 2011, and Poirrier et al. (2009) studies. September 2010 JELA station locations are shown in Figure 1, and Spring 2011 and Fall 2011 station locations are shown in Figure 2. Thirty-three of the 39 JELA stations and five reference stations sampled in Spring 2011 and Fall 2011 are

identical in location to those previously surveyed in the initial impact study in 2010 (Figure 2 and Figure 3). All station locations proposed for Spring 2012 and Fall 2012 are identical to those previously surveyed in the Spring 2011 and Fall 2011 studies.

The station locations proposed for the Spring 2012 and Fall 2012 studies are subject to change in the field, as a result of access limitations. However, any changes in station locations in the field will be discussed and documented on data sheets. All of the sampling stations are located in areas of JELA that have been previously found to support SAV, including the lake shorelines and inland marsh areas. Reference stations are located approximately 17 miles west of JELA along Humble Canal and Bayou des Allemands in an area that was not subjected to increased flow from the Mississippi River through the Davis Pond Diversion. The reference stations were previously found to support a lower-diversity SAV community than JELA.

Table 1. Sample Locations and Types of Sampling Performed.

Station	Water Body	Latitude	Longitude	Water and Sediment Nutrient Chemistry	SAV Distribution and Relative Abundance of Floating Aquatics	Physical Water Quality	Photo and GPS Documentation
1	Bayou Segnette	29.86379	-90.16611	X	X	X	X
2	Tarpaper Canal	29.83468	-90.15472	X	X	X	X
3	Parallel Canal	29.82385	-90.12327	X	X	X	X
4	Pipeline Canal	29.77149	-90.14011	X	X	X	X
5	Lower Kenta Canal	29.77394	-90.11115	X	X	X	X
6	Bayou Segnette	29.74202	-90.14191	X	X	X	X
7	Lake Salvador Shoreline	29.79626	-90.16219	X	X	X	X
8	Lake Salvador Shoreline	29.80490	-90.16862		X	X	X
9	Bayou Bardeaux	29.81844	-90.16347	X	X	X	X
10	Lake Cataouatche Shoreline	29.84334	-90.19146	X	X	X	X
11	Horseshoe Canal	29.84441	-90.14751		X	X	X
12	Horseshoe Canal	29.84799	-90.14327		X	X	X
13	Bayou Boeuf	29.84390	-90.15637	X	X	X	X
14	Betty's Crack	29.81397	-90.12721		X	X	X
15	Pipeline Canal	29.78840	-90.13789	X	X	X	X
16	Bayou Aux Carpes	29.78804	-90.07485		X	X	X
17	Bayou Aux Carpes	29.77721	-90.07310		X	X	X
18	Lower Kenta Canal	29.76833	-90.10720		X	X	X
19	Pipeline Canal	29.78662	-90.13634		X	X	X
20	Bayou Aux Carpes	29.78609	-90.08852		X	X	X
21	Lake Salvador Shoreline	29.75728	-90.15387		X	X	X
22	Lake Cataouatche Shoreline	29.86887	-90.23629	X	X	X	X
23	Lake Cataouatche Shoreline	29.86118	-90.21838		X	X	X

Station	Water Body	Latitude	Longitude	Water and Sediment Nutrient Chemistry	SAV Distribution and Relative Abundance of Floating Aquatics	Physical Water Quality	Photo and GPS Documentation
24	Lake Cataouatche Shoreline	29.83181	-90.18000		X	X	X
25	Twin Canals	29.80821	-90.12647		X	X	X
26	Bayou Segnette	29.84260	-90.17283		X	X	X
27	Lake Salvador Shoreline	29.74565	-90.15247		X	X	X
28	Bayou Segnette	29.80517	-90.15751		X	X	X
29	Bayou Segnette	29.79054	-90.13033	X	X	X	X
30	Bayou Segnette	29.76074	-90.14570		X	X	X
31	Bayou Segnette	29.83225	-90.16592		X	X	X
32	Lake Salvador	29.80436	-90.18500		X	X	X
33	Bayou Bardeaux	29.81702	-90.17032		X	X	X
34	Tarpaper Canal	29.83339	-90.15176		X	X	X
35	Yankee Pond	29.85033	-90.17363		X	X	X
36	Lake Cataouatche Shoreline	29.84257	-90.18951		X	X	X
37	Tarpaper Canal	29.82738	-90.13346		X	X	X
38	Whiskey Canal	29.86321	-90.20282		X	X	X
39	Bayou Segnette	29.84257	-90.18951	X	X	X	X
R1	Humble Canal	29.85936	-90.47194	X	X	X	X
R2	Bayou des Allemands	29.85770	-90.48682	X	X	X	X
R3	Bayou des Allemands	29.84702	-90.48385	X	X	X	X
R4	Humble Canal	29.86502	-90.46877	X	X	X	X
R5	Humble Canal	29.85659	-90.46111	X	X	X	X

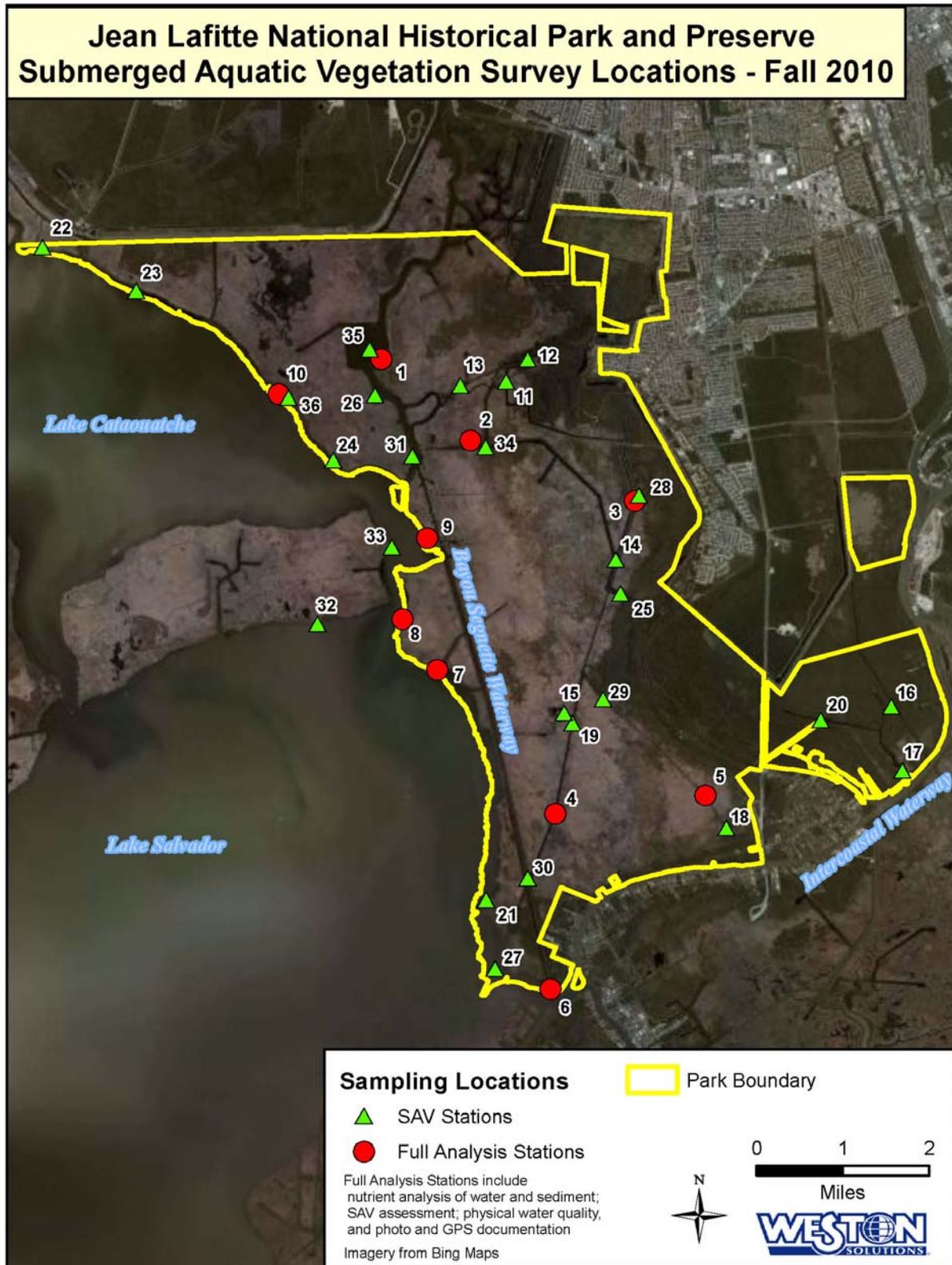


Figure 1. September 2010 Jean Lafitte National Historic Park and Preserve Station Locations

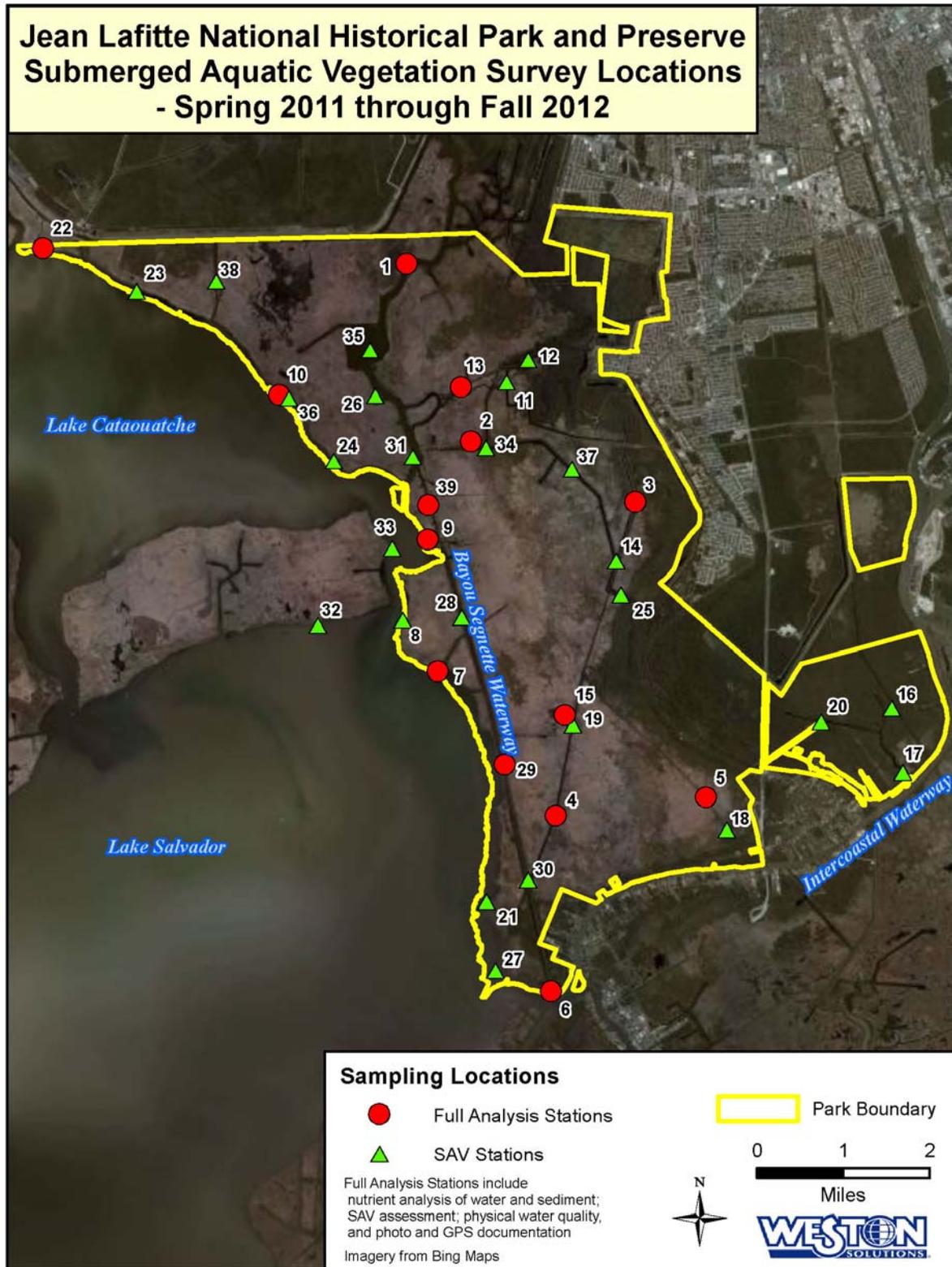


Figure 2. Jean Lafitte National Historical Park and Preserve Study Area Station Locations Used for Spring 2011 and Fall 2011 Surveys and Proposed for Spring 2012 and Fall 2012 Surveys

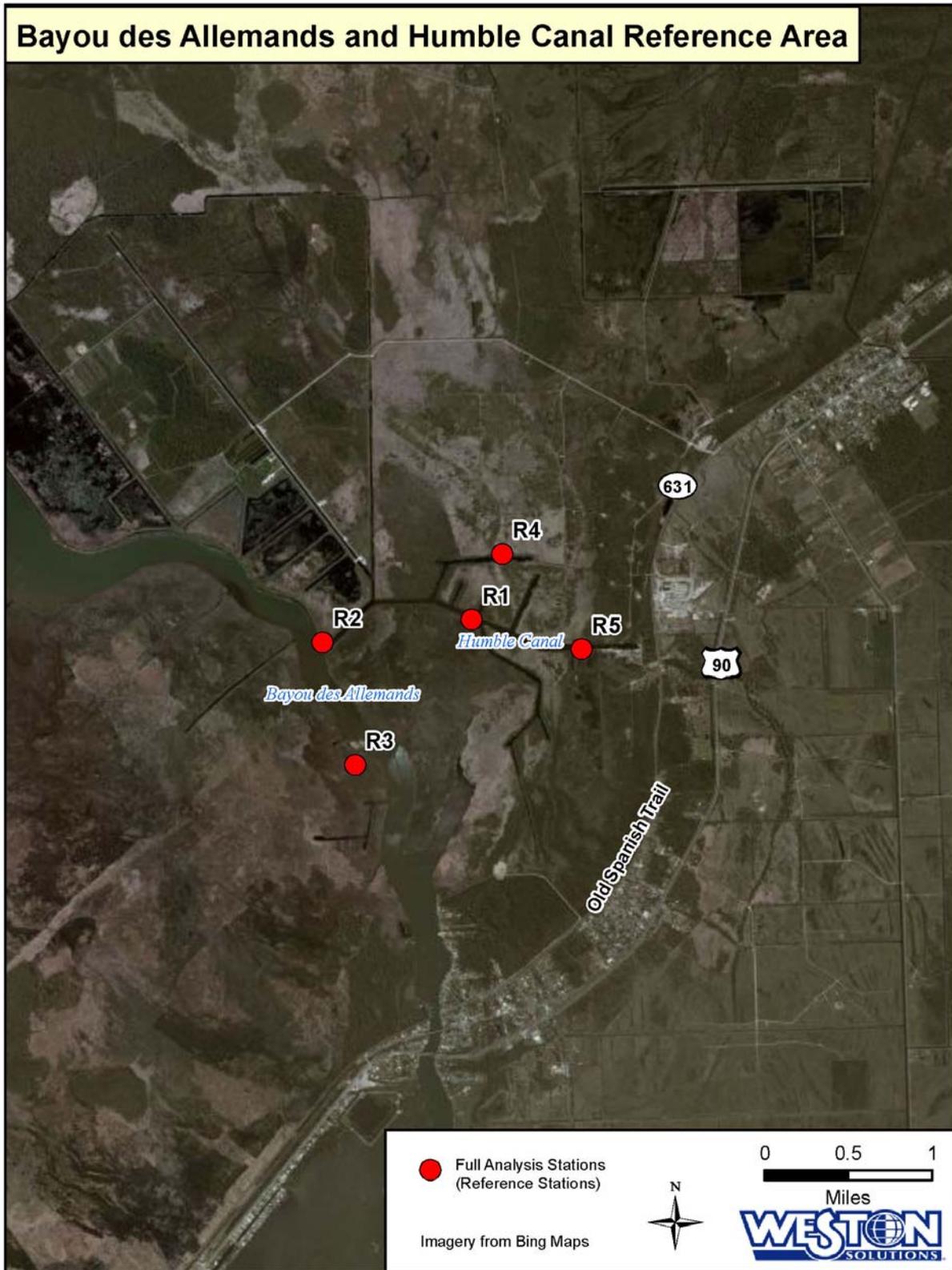


Figure 3. Bayou des Allemands and Humble Canal Reference Station Locations

2.2 Overview of Site Assessment Protocols

The field crew will perform station assessments consistent with the following protocols:

- Upon approaching the station, the boat operator will take care to arrive at the sampling destination without creating substantial disturbance in the water or sediments. No nutrient chemistry sampling or water quality sampling will be performed at a given station if it appears that turbidity plumes have occurred as a result of the boat's approach. If disturbance has occurred, a minimum waiting period of one hour will pass before returning to the same station to perform sampling.
- The location of the station will be recorded by taking a global positioning system (GPS) way point and recording the latitude and longitude of the station on appropriate forms; and a photograph of the GPS unit will be taken to synchronize the GPS track with the station.
- Photographs of the stations will be taken to record the overall condition of the station and presence of SAV and FAV. General notes on SAV and FAV will be recorded in field forms for all station locations.
- Water quality monitoring will be performed at all stations and will include measurements of pH, temperature, dissolved oxygen (DO), salinity, turbidity, and chlorophyll *a*.
- Water quality and water chemistry sampling will be performed prior to conducting SAV surveys and sediment sampling in order to limit suspension of sediments at the full-analysis stations.
- SAV community assessments will be performed within four 10-m² "survey areas".
- FAV percent cover assessments will be estimated within four 10-m² "survey areas".
- Relative cover of FAV species will be also assessed within four 0.25-m² quadrats.
- Sediment samples and water samples will be collected for nutrient analyses at the 14 JELA full-analysis stations and five reference stations.
- Information on herbicide spraying in JELA will be obtained by the Trustees. Evidence of herbicide spraying will be noted on field data sheets.

2.3 Sampling Equipment

Sampling equipment for SAV surveys will include:

- Study area maps with pre-determined sampling points;
- Hand-held GPS unit with an extra set of batteries;
- Digital camera and extra set of batteries for visual observations;
- Waterproof notebooks, waterproof pens, and waterproof data forms, including SAV site characterization forms (as shown in Appendix A), chain-of-custody, Natural Resource Damage Assessment (NRDA) sample collection forms for both water and sediments, and photo logger forms;
- Graduated five feet (ft) long garden rakes (with graduations on rake handle every ft) for retrieving deeper SAV that may not be visible from the surface;
- 0.25-m² quadrats; and
- Meter stick or weighted transect tape will be used to measure water depth.

Water quality sampling equipment will include:

- Secchi disk and line;
- Photosynthetically active radiation (PAR) sensor with data logger (LICOR spherical sensors, one for air and one for water, and LICOR 1400 data logger, or equivalent setup);
- YSI 6920 sonde with sensors for DO, turbidity, pH, salinity, conductivity, and temperature; and
- 250-milliliter (mL) (8-oz) glass jars for chlorophyll *a* analysis.

Water nutrient chemistry samples will be collected in:

- 60-mL high-density polyethylene (HDPE) sample bottles.

Sediment sampling equipment will include:

- Ponar grab for sediment samples;
- Powdered Alconox™ detergent and de-ionized water for cleaning and decontaminating the ponar grab between sampling locations; and
- 250-mL (8-oz) glass jars for sediment nutrient samples.

2.4 Station Characterization

2.4.1 GPS Locations

Stations will be located using hand-held GPS units accurate to within ten feet. The field crew will take a waypoint with the GPS unit at each site, and record coordinates in decimal degrees with WGS84 as the datum. The field crew will also take a photograph of the GPS unit, with the time and date visible, in accordance with NRDA field protocols, to synchronize the photos with the GPS track.

2.4.2 Photographs

The digital field camera will be set up in accordance with NRDA Field Photography Guidance (NRDA_Field_Photoaphy_Guidance.doc, available on the case file transfer protocol [FTP] site). Photographs will be taken of the station and sample collection procedures, if possible. Because each photograph or series of photographs must be associated with the corresponding sampling locations (e.g., through the use of GPS Photolink software or by keeping a detailed photo log), no photographs may be deleted as it would create gaps and alter the numbering sequence of the photos when they are uploaded from the camera (see separate NRDA Field Photography Guidance).

All photographs will be entered into the National Oceanic and Atmospheric Administration (NOAA) NRDA Trustees Sampler Photo Logger Form, and all required Chain of Custody procedures followed. Original photo files will either be left on flash cards and placed in locked storage or uploaded to a hard drive and not opened. If photo files need to be opened for any reason, a copy must be made of the original, and the copy may then be opened.

2.5 Water Quality and Chemistry Assessments

Following initial assessment of the station to establish the presence of SAV and completion of the station characterization, the field crew will complete water quality assessments and collect discrete water samples for chemical analysis at full-analysis stations. Water quality assessments will be completed first, prior to raking for SAV or collecting water chemistry or sediment chemistry samples. Water quality sampling will consist of measuring light penetration with a Secchi disk; light attenuation with a light meter; and pH, turbidity, DO, temperature, conductivity, and salinity with a YSI water quality sonde. Water samples will be collected in 250-mL sample jars for analysis of chlorophyll *a*. Specific procedures for performing water quality assessments are described below.

2.5.1 Water Quality Observations

Light penetration (i.e., Secchi depth) will be measured using a Secchi disk — a round black and white weighted 20-centimeter (cm) disc that is lowered through the water until the distinction between white and black quadrants is no longer visible to the human eye. The disk is attached to a non-stretching rope, marked at 10-cm intervals. The observer will lower the disk over the side of the boat facing the sun and not in the shadow of the vessel, until the disk disappears, then raise it until it reappears. The depth at which the disk reappears will then be recorded. Time of day and cloud cover will also be recorded. Sunglasses will not be worn when taking this measurement.

Light attenuation will be measured using a LICOR 1400 data logger (or equivalent) with spherical sensors for air and water. Light attenuation in the water can be calculated using either a 2 pi or 4 pi quantum sensor attached to a data recorder. The sensor will be lowered into the water column to obtain a profile of light readings. A sub-surface reading will be taken just below the water surface and at a minimum of three additional depths down to the bottom. Readings will be taken at closer intervals near the surface to capture higher rates of light attenuation. At each depth, the irradiance value displayed on the data logger will be recorded. At the time of the measurement, the time of day and cloud cover will be recorded. Four profiles will be performed per station.

Light attenuation in each profile can be calculated by taking the natural log of the irradiance values and regressing light on depth. The attenuation coefficient is the absolute value of the slope of the line.

Water quality measurements will also be collected for DO recorded in milligrams per liter (mg/L), salinity recorded in parts per thousand (ppt), conductance measured in milli-Siemens/cm, turbidity measured in nephelometric turbidity units (NTU), and temperature recorded in degrees Celsius (°C) using a YSI 6920 sonde. All values will be recorded onto the SAV site characterization data sheets. Sub-surface grab samples will be collected in laboratory-certified clean jars for analysis of chlorophyll *a*.

2.5.2 Water Chemistry Sampling

Water samples for nutrient analysis will be collected from within the first of the four 10-m² SAV survey areas positioned at each of the 14 full-analysis and five reference stations. Samples will be collected in an area free from sediment re-suspension due to boat operation. Water chemistry samples will be collected directly into the sample container to minimize risks of cross-contamination. Water nutrient samples will be collected in 60-mL HDPE sample bottles. Nutrient samples will be collected from below the surface of the water to characterize constituents present in particulate and/or dissolved state in the water column. These subsurface samples will be collected by deploying the sample bottle beneath the water's surface, unsealing the cap, allowing water to enter the sample bottle, and then resealing the cap below the surface to avoid inadvertently including surface water constituents. Nutrient and chlorophyll *a* samples will be collected in laboratory-certified clean jars and sent to University of Maryland Center for Environmental Science Chesapeake Biological Laboratory for analysis. Chlorophyll *a* samples will be filtered in the field using a glass microfiber filter.

Two field duplicates will be collected, including one at JELA full-analysis station 1 and one at reference station 1. Field duplicates will be clearly marked and will be assigned a new sample number distinct from the original duplicated sample. On the sample form, the Sample Quality Assurance/Quality Control (QA/QC) column will be marked to indicate that the sample is a duplicate. The associated parent sample number will be identified in the Sample Notes column (the entire Sample Identification [ID] should not be required in most situations since the location ID, matrix, and data should be the same).

Sample ID labels will be affixed to each container and covered with clear tape wrapped around the entire container circumference. Sample labeling will follow NRDA protocols as described in Section 2.8.1.

2.6 SAV Characterization

The waters within JELA range from freshwater to low-salinity, brackish water and have been found to support ten SAV species (Poirrier et al. 2009). Of the ten, seven were determined to be native species: *Cabomba caroliniana*, *Ceratophyllum demersum*, *Heteranthera dubia*, *Najas guadalupensis*, *Potamogeton pusillus*, *Vallisneria Americana*, and *Zannichellia palustris*, and three were exotic species: *Egeria densa*, *Hydrilla verticillata*, and *Myriophyllum spicatum*. SAV within JELA is sub-tidal with little lunar tidal variation.

The SAV characterization will be performed to allow rank order comparisons to previous studies, including “An Inventory and Assessment of the Distribution of Submersed Aquatic Vegetation at Jean Lafitte National Historical Park and Preserve (Poirrier et al. 2009)” and the September 2010 survey.

2.6.1 SAV Assessment of Species Relative Abundance

The SAV community will be assessed at all JELA and reference stations. Photographs will be taken to document SAV and floating aquatic plant cover at each station. Daily water level will

be recorded using a staff gage located within Jean Lafitte National Historical Park and Preserve. At each station, the habitat setting (canal, bayou, pond, or lake) of the SAV bed will be indicated on the field form and maximum and minimum depth of rooted SAV will be recorded for each replicate survey area. Characterization of SAV will include assessments of the relative abundance of observed SAV species and associated floating aquatics, as well as the presence of epiphyte growth on SAV, as described below.

SAV Survey Area Assessments

Four 10-m² SAV survey areas will be positioned in areas representative of the SAV community within each of the thirty-nine 100-m² JELA stations and five reference stations. The SAV survey area is comprised of two 1- m by 5-m quadrats positioned along both sides of the sampling vessel. The boat will be moved four times within a station to obtain four replicate 10-m² SAV survey area assessments per station. Distances among replicate SAV survey areas will vary somewhat with bed size, depth variation, and water body type. Approximate distances of 15-20 m between replicate sites are anticipated for each of the stations. Each survey area will be recorded with a GPS.

SAV species composition will be determined by direct observation of species present within the four 10-m² replicate SAV survey areas. Raking near the bottom with a 5-ft rake will be used to determine the presence of vegetation not visible from the surface. Raking will be performed in areas immediately adjacent to the sampling vessel in a manner that will minimize bottom disturbance. The occurrence of a species as either floating or rooted will be recorded, as will the presence of flowering shoots. Digital photography will be used to document observed species. In the event that SAV cannot be definitively identified in the field, samples will be collected for a more detailed examination.

Percent SAV surface cover will be estimated in the 10-m² SAV survey areas to provide an assessment of overall SAV cover and relative species abundance. Where it is possible to supplement SAV abundance data, total SAV percent cover, relative SAV species percent cover, and the ranking of SAV species in order of abundance will be recorded. This assessment will be dependent on visibility since dense floating and emergent vegetation and poor water clarity may limit assessments. Areas where water clarity precludes these assessments will be noted on the data sheets.

Quadrat Assessments

Total percent cover of native floating plants, emergent plants, and surface algae will be estimated using randomly tossed 0.25-m² quadrats within each of the 10-m² replicate SAV survey areas. Additionally, the percent cover of exotic, invasive floating aquatics such as giant salvinia (*Salvinia molesta*), common salvinia (*Salvinia minima*) and Cuban club rush (*Oxycaryum cubense*), as well as other dominant invasive species that potentially shade SAV will also be recorded in the 0.25-m² quadrats. An estimation of SAV cover within each 0.25-m² quadrat will also be recorded.

SAV Epiphyte Assessment

Assessments of epiphyte abundance on SAV will be performed at the 14 full-analysis and five reference stations. Epiphyte cover on five representative SAV leaf samples of all species present

in each of the four replicate SAV survey areas will be quantified according to the five following categories:

- (1) Epiphyte growth not visible to the naked eye and no filamentous algae present.
- (2) Filamentous algae present which covers up to 25% of leaf surface.
- (3) Filamentous algae cover 25% to 50% of leaf surface.
- (4) Filamentous algae 50% to 75% of leaf surface.
- (5) Filamentous algae cover 75% to 100% of leaf surface.

The species of SAV on which the percent cover of epiphytic growth was derived will also be recorded.

2.7 Sediment Sampling

Sediment samples will be collected at the 14 full-analysis and five reference stations within the first of the four replicate 10-m² SAV survey areas. All non-disposable sampling gear will be decontaminated before using and between sampling stations. Equipment will be washed with laboratory-grade detergent (Alconox) and then rinsed well with clean de-ionized water prior to use. A Ponar grab sampling device will be lowered at a controlled speed of ~1 foot per second during sample collection. The device should contact the bottom gently, with only its weight used to penetrate the sediment. Care will be taken to minimize disturbance to the surface flocculence, which is likely to contain the most recent depositional material.

The sample will be inspected upon retrieval to ensure that it meets the following criteria:

- The sampler is not overfilled and the sediment surface is not pressed against the sampler top.
- Overlying water is present, indicating minimal leakage and likely little to no loss of flocculent material.
- Sediment surface is undisturbed, indicating lack of channeling or sample washout.
- Desired penetration depth is achieved (e.g., 4-5 centimeters [cm] for a 2 cm sample).

Once the Ponar sampler has been brought aboard the sampling vessel, the overlying water will be drained off from the sampler until the sediment is exposed. Special attention will be paid to ensure retention of any surface flocculence. Field staff will wear nitrile or other non-contaminating gloves when handling samples and sampling equipment. A clean stainless steel spoon or scoop will be used to collect the top 2-cm layer while avoiding sediments in contact with the sides or top of the sampler. To avoid cross-contamination, a clean scoop will be used for each sample. The sample will be placed into a clean stainless steel bowl and homogenized before being transferred into a sample jar. Transfer of the sediment from the sampler to the mixing bowl and from the mixing bowl to sample containers will be performed in clean areas of the vessel, up-wind of exhausts. Samples will be labeled in accordance with NRDA protocols and immediately placed into a cooler and kept on ice. Samples will be shipped or delivered to a Sample Intake Center within three days of collection and sent to University of Maryland Center for Environmental Science Chesapeake Biological Laboratory for analysis within the required holding times.

Two field duplicates will be collected, including one at JELA full-analysis station 1 and one at reference station 1. Field duplicates will be clearly marked and will be assigned a new sample number distinct from the original duplicated sample. On the sample form, the Sample QA/QC column will be marked to indicate that the sample is a duplicate. The associated parent sample number will be identified in the Sample Notes column (the entire Sample ID should not be required in most situations since the location ID, matrix, and data should be the same).

Sample ID labels will be affixed to each container and covered with clear tape wrapped around the entire container circumference. Sample labeling will follow NRDA protocols as described in Section 2.8.1.

2.8 Sample Collection Documentation

The field crew will adhere to the following procedures:

The individual who collected the sample will be specified on the field data form. If more than one person, list the field party leader and the person who entered the data (if different).

Sample IDs will be clearly listed under each category. Sample IDs should be assigned in accordance with the instructions in the **NOAA Field Sampling Workbooks** (available on the case's FTP site).

Samples will be recorded in the appropriate case-wide NRDA Sample Collection Form (also available on the case's FTP site).

If a particular type of sample is not collected at a site, “none” will be entered for that sample type.

2.8.1 Chemistry Sample Labeling and Documentation

- Sample labels will be prepared following sample ID protocol provided in the instructions from the trustee data management team and will contain the following information:
 - Location code (e.g., LAAN37 for Louisiana grid section 37)
 - Letter indicating the study year that the sample was collected (e.g., A was the first year, B will be the second year, etc.)
 - Month and day of collection (e.g., 0915 for September 15)
 - Matrix (e.g., W or S for sediment or water)
 - Team number (e.g. I9) and the sample number (e.g., 03 if it was the third station sampled)
 - Thus, a water sample taken of September 7 as the 4th sample collected would be labeled “LAAN37-A0907-WI904.
- Sample ID labels will be affixed to each container and covered with clear tape wrapped around the entire container circumference. Tape will also be applied to secure the container lid.
- The collection of samples will be recorded in both the **SAV Site Characterization Form (Appendix A)** and in the **NRDA Sample Collection Form for Soils and Sediments**.

- Field duplicates will be clearly marked as separate samples, and will be assigned a new sample number distinct from the original duplicated sample. On the sample form, the Sample QA/QC Type column will be used to indicate that the sample is a duplicate. The associated parent sample number will then be identified in the Sample Notes column (the entire Sample ID should not be required in most situations since the location ID, matrix, and data should be the same).
- All original field notebooks, forms, and notes, will be preserved and will be signed and dated by the field lead. If incorrect entry occurs, the original entry will be crossed out, dated, and initialed. All original records will be gathered and kept on file by the trustees.

2.9 Sample Handling and Shipping

All collected samples will be stored on ice by the field team. Field sampling crews will follow NRDA protocol documents for specific sample shipping and notification/sampling documentation instructions.

2.9.1 Preservation/Holding Times

All chemistry samples will be placed immediately in coolers and kept at 4°C. Samples will be stored on ice and shipped to the appropriate analytical laboratory within 7 days of field collection by the field team. Water and sediment chemistry samples for nutrient analyses will be analyzed within the 28-day holding time. Chlorophyll *a* samples will be filtered in the field and the filters will be subsequently frozen and stored in foil packs until their arrival at the chemistry laboratory where analysis will be performed.

3.0 COST ESTIMATE

The estimated cost for this Addendum is \$245,495. This budget is an estimate, and actual costs may differ.

3.1.1 Durable Equipment

Any durable equipment (such as cameras, GPS, etc.) purchased by NPS for this study will be returned to NPS at the conclusion of its use for this study.

4.0 SAFETY

Field teams will comply with all existing training and safety protocols as applicable to operations. Prior to commencement of field activities, the Trustees will agree upon a person or persons to whom study participants may report any safety concerns. Such person(s) will take action to address and resolve reported concerns in a timely fashion.

5.0 DATA SHARING

Field teams will complete data sheets each day. Each team member will sign the data sheet indicating agreement on the content of the data sheet. The field team will retain custody of all completed data sheets until they are transferred to the National Park Service’s Natural Resource Stewardship and Science office at the end of the study for archiving. State of Louisiana representatives, if present, may photograph or scan data sheets on a daily basis if desired. Field team members will also share electronic copies of all photographs taken on a daily basis, unless this is impracticable. The field team’s camera memory card will remain in the custody of the field team until the completion of the study and will be archived at the NPS office. If a survey is carried out without a Louisiana Wildlife and Fisheries representative, the data can be provided via e-mail and/or Fed Ex to LOSCO within 48 hours of completion of the study, if requested.

At the completion of all field work for each of the studies (Spring 2012 and Fall 2012), all data sheets and photographs will be compiled onto one or more CDs (or other electronic storage device) for distribution to the Louisiana Oil Spill Coordinator’s Office (LOSCO) on behalf of the State of Louisiana Natural Resource Trustees, and other Trustee agencies, as requested by such Trustee agencies.

5.0 REFERENCES

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- Poirrier, M.A., K. Burt-Utley, J.F. Utley, E.A. Spalding. 2009 An Inventory and Assessment of the Distribution of Submersed Aquatic Vegetation at Jean Lafitte National Historical Park and Preserve, New Orleans, April 2009.
- Summers, M.W. 1963. Managing Louisiana Fish Ponds. Louisiana Wild Life & Fisheries Commission. New Orleans 64 pp.
- U.S. Environmental Protection Agency (USEPA). 2002, National Water Quality Inventory: 2000 Report, U.S. Environmental Protection Agency Report EPA-841-R-02-001, Washington, D. C.
- USEPA. 2006a. *Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA QA/G-4.* EPA/240/B-06/001. U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.
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APPENDIX A

SAV Data Form

SAV TWG- Jean Lafitte NPS Sampling Plan
SAV Site Characterization Form #1 [Page 1 of 4]
Survey Team ID: Team 41

Data Recorder/Affiliation: Brian Riley- Weston Solutions

Other Team Members/Affiliation: Dan McCoy- Weston Solutions; Mike Poirrier- Weston Solutions.

Location Descriptors

Site Name: _____ Lat: _____ Long: _____

Time: _____ Date: _____ Weather conditions: _____

Habitat Setting (check one): Canal (provide canal width) _____ Lake _____ Bayou _____
Maximum Depth within Quadrat 1(m) _____ Quadrat 2(m) _____ Quadrat 3(m) _____ Quadrat 4(m) _____

Light meter reading: Time: _____ Cloud cover: _____
Irradiance Reading/depth: Above water _____ Below surface _____ 1/3 depth _____
2/3 depth _____ Bottom _____

Water Quality:
pH _____ Temp. (°C) _____ DO (mg/L) _____ Turbidity (NTU) _____ Cond. (mS/cm) _____

Salinity (ppt) _____ Secchi Disk Depth (cm) _____ Area recently sprayed with Herbicide? Yes No

SAV species present:

Quadrat 1:

- | | | |
|--|--|--|
| <input type="checkbox"/> No SAV | <input type="checkbox"/> <u>Check if Quadrat was raked</u> | Area Raked (m ²) _____ |
| <input type="checkbox"/> <i>Cabomba caroliniana</i> | <input type="checkbox"/> <i>Hydrilla verticillata</i> | <input type="checkbox"/> <i>Potamogeton pusillus</i> |
| <input type="checkbox"/> <i>Ceratophyllum demersum</i> | <input type="checkbox"/> <i>Myriophyllum spicatum</i> | <input type="checkbox"/> <i>Vallisneria americana</i> |
| <input type="checkbox"/> <i>Egeria densa</i> | <input type="checkbox"/> <i>Najas guadalupensis</i> | <input type="checkbox"/> <i>Zannichellia palustris</i> |
| <input type="checkbox"/> <i>Heteranthera dubia</i> | <input type="checkbox"/> <i>Elodea canadensis</i> | <input type="checkbox"/> Other |

Quadrat 2:

- | | | |
|--|--|--|
| <input type="checkbox"/> No SAV | <input type="checkbox"/> <u>Check if Quadrat was raked</u> | Area Raked (m ²) _____ |
| <input type="checkbox"/> <i>Cabomba caroliniana</i> | <input type="checkbox"/> <i>Hydrilla verticillata</i> | <input type="checkbox"/> <i>Potamogeton pusillus</i> |
| <input type="checkbox"/> <i>Ceratophyllum demersum</i> | <input type="checkbox"/> <i>Myriophyllum spicatum</i> | <input type="checkbox"/> <i>Vallisneria americana</i> |
| <input type="checkbox"/> <i>Egeria densa</i> | <input type="checkbox"/> <i>Najas guadalupensis</i> | <input type="checkbox"/> <i>Zannichellia palustris</i> |
| <input type="checkbox"/> <i>Heteranthera dubia</i> | <input type="checkbox"/> <i>Elodea canadensis</i> | <input type="checkbox"/> Other |

Quadrat 3:

- | | | |
|--|--|--|
| <input type="checkbox"/> No SAV | <input type="checkbox"/> <u>Check if Quadrat was raked</u> | Area Raked (m ²) _____ |
| <input type="checkbox"/> <i>Cabomba caroliniana</i> | <input type="checkbox"/> <i>Hydrilla verticillata</i> | <input type="checkbox"/> <i>Potamogeton pusillus</i> |
| <input type="checkbox"/> <i>Ceratophyllum demersum</i> | <input type="checkbox"/> <i>Myriophyllum spicatum</i> | <input type="checkbox"/> <i>Vallisneria americana</i> |
| <input type="checkbox"/> <i>Egeria densa</i> | <input type="checkbox"/> <i>Najas guadalupensis</i> | <input type="checkbox"/> <i>Zannichellia palustris</i> |
| <input type="checkbox"/> <i>Heteranthera dubia</i> | <input type="checkbox"/> <i>Elodea canadensis</i> | <input type="checkbox"/> Other |

SAV TWG- Jean Lafitte NPS Sampling Plan
SAV Site Characterization Form #1 [Page 2 of 4]

Quadrat 4:

- | | | |
|--|--|--|
| <input type="checkbox"/> No SAV | <input type="checkbox"/> <u>Check if Quadrat was raked</u> | Area Raked (m ²) _____ |
| <input type="checkbox"/> <i>Cabomba caroliniana</i> | <input type="checkbox"/> <i>Hydrilla verticillata</i> | <input type="checkbox"/> <i>Potamogeton pusillus</i> |
| <input type="checkbox"/> <i>Ceratophyllum demersum</i> | <input type="checkbox"/> <i>Myriophyllum spicatum</i> | <input type="checkbox"/> <i>Vallisneria americana</i> |
| <input type="checkbox"/> <i>Egeria densa</i> | <input type="checkbox"/> <i>Najas guadalupensis</i> | <input type="checkbox"/> <i>Zannichellia palustris</i> |
| <input type="checkbox"/> <i>Heteranthera dubia</i> | <input type="checkbox"/> <i>Elodea canadensis</i> | <input type="checkbox"/> Other |

Comments (flowering shoots, quantity, species etc): _____

SAV, Floating Aquatic, and Emergent Species percent cover: (% cover observed within randomly tossed 0.25m quadrat):

Vegetation Type	Quadrat 1			Quadrat 2			Quadrat 3			Quadrat 4		
	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3
SAV (0.25m ² quadrat)												
SAV- 10 m ² quadrat estimate												
Floating Aquatic Vegetation												
Floating Aquatic Vegetation- 10 m ² quadrat estimate												
<i>Salvinia molesta</i>												
<i>Salvinia molesta</i> - 10 m ² quadrat estimate												
<i>Oxycarium cubensis</i>												
<i>Emergent Vegetation</i>												

Comments: _____

SAV TWG- Jean Lafitte NPS Sampling Plan

SAV Site Characterization Form #1 [Page 3 of 4]

Epiphyte Loading

SAV Species	Quadrat 1 (10m ²)	Quadrat 2 (10m ²)	Quadrat 3 (10m ²)	Quadrat 4 (10m ²)
<i>Cabomba caroliniana</i>				
<i>Ceratophyllum demersum</i>				
<i>Egeria densa</i>				
<i>Heteranthera dubia</i>				
<i>Hydrilla verticillata</i>				
<i>Myriophyllum spicatum</i>				
<i>Najas guadalupensis</i>				
<i>Potamogeton pusillus</i>				
<i>Vallisneria americana</i>				
<i>Zannichellia palustris</i>				
Other				

A= No filamentous algae present;

B= Filamentous algae covers up to 25% of leaves

C= Filamentous algae covers between 25% and 50% of leaves

D= Filamentous algae covers between 50% and 75% of leaves

E= Filamentous algae covers greater than 75% of leaves

Location, time, and date of grab samples:

Sample Type	Latitude	Longitude	Time	Date
Water Chemistry				
Sediment Chemistry				
Chlorophyll <i>a</i>				

SAV TWG- Jean Lafitte NPS Sampling Plan

SAV Site Characterization Form #1 [Page 4 of 4]

Floating/Emergent Vegetation

Quadrat 1:

- | | | | |
|--|---|---|--|
| <input type="checkbox"/> Floating algae | <input type="checkbox"/> <i>Ludwigia peploides</i> | <input type="checkbox"/> <i>Oxycaryum cubensis</i> | <input type="checkbox"/> <i>Alternanthera philox</i> |
| <input type="checkbox"/> <i>Hydrocotyl ranunc.</i> | <input type="checkbox"/> <i>Myriophyllum aquaticum.</i> | <input type="checkbox"/> <i>Nymphaeta sp.</i> | <input type="checkbox"/> <i>Salvinia min.</i> |
| <input type="checkbox"/> <i>Water meal</i> | <input type="checkbox"/> Duckweed sp. | <input type="checkbox"/> <i>Lemna minor</i> | <input type="checkbox"/> <i>Panicum sp.</i> |
| <input type="checkbox"/> <i>Salvinia mol.</i> | <input type="checkbox"/> <i>Utricularia</i> | <input type="checkbox"/> <i>Eichornia crassipes</i> | <input type="checkbox"/> <i>Limnobium spongia</i> |
| <input type="checkbox"/> <i>Schoenoplectus</i> | | | |

Other _____

Quadrat 2:

- | | | | |
|--|---|---|--|
| <input type="checkbox"/> Floating algae | <input type="checkbox"/> <i>Ludwigia peploides</i> | <input type="checkbox"/> <i>Oxycaryum cubensis</i> | <input type="checkbox"/> <i>Alternanthera philox</i> |
| <input type="checkbox"/> <i>Hydrocotyl ranunc.</i> | <input type="checkbox"/> <i>Myriophyllum aquaticum.</i> | <input type="checkbox"/> <i>Nymphaeta sp.</i> | <input type="checkbox"/> <i>Salvinia min.</i> |
| <input type="checkbox"/> <i>Water meal</i> | <input type="checkbox"/> Duckweed sp. | <input type="checkbox"/> <i>Lemna minor</i> | <input type="checkbox"/> <i>Panicum sp.</i> |
| <input type="checkbox"/> <i>Salvinia mol.</i> | <input type="checkbox"/> <i>Utricularia</i> | <input type="checkbox"/> <i>Eichornia crassipes</i> | <input type="checkbox"/> <i>Limnobium spongia</i> |
| <input type="checkbox"/> <i>Schoenoplectus</i> | | | |

Other _____

Quadrat 3:

- | | | | |
|--|---|---|--|
| <input type="checkbox"/> Floating algae | <input type="checkbox"/> <i>Ludwigia peploides</i> | <input type="checkbox"/> <i>Oxycaryum cubensis</i> | <input type="checkbox"/> <i>Alternanthera philox</i> |
| <input type="checkbox"/> <i>Hydrocotyl ranunc.</i> | <input type="checkbox"/> <i>Myriophyllum aquaticum.</i> | <input type="checkbox"/> <i>Nymphaeta sp.</i> | <input type="checkbox"/> <i>Salvinia min.</i> |
| <input type="checkbox"/> <i>Water meal</i> | <input type="checkbox"/> Duckweed sp. | <input type="checkbox"/> <i>Lemna minor</i> | <input type="checkbox"/> <i>Panicum sp.</i> |
| <input type="checkbox"/> <i>Salvinia mol.</i> | <input type="checkbox"/> <i>Utricularia</i> | <input type="checkbox"/> <i>Eichornia crassipes</i> | <input type="checkbox"/> <i>Limnobium spongia</i> |
| <input type="checkbox"/> <i>Schoenoplectus</i> | | | |

Other _____

Quadrat 4:

- | | | | |
|--|---|---|--|
| <input type="checkbox"/> Floating algae | <input type="checkbox"/> <i>Ludwigia peploides</i> | <input type="checkbox"/> <i>Oxycaryum cubensis</i> | <input type="checkbox"/> <i>Alternanthera philox</i> |
| <input type="checkbox"/> <i>Hydrocotyl ranunc.</i> | <input type="checkbox"/> <i>Myriophyllum aquaticum.</i> | <input type="checkbox"/> <i>Nymphaeta sp.</i> | <input type="checkbox"/> <i>Salvinia min.</i> |
| <input type="checkbox"/> <i>Water meal</i> | <input type="checkbox"/> Duckweed sp. | <input type="checkbox"/> <i>Lemna minor</i> | <input type="checkbox"/> <i>Panicum sp.</i> |
| <input type="checkbox"/> <i>Salvinia mol.</i> | <input type="checkbox"/> <i>Utricularia</i> | <input type="checkbox"/> <i>Eichornia crassipes</i> | <input type="checkbox"/> <i>Limnobium spongia</i> |
| <input type="checkbox"/> <i>Schoenoplectus</i> | | | |

Other _____