

Levy Nuclear Plant and Crystal River Energy Complex Combined Discharge Survey and Monitoring Plan

Prepared for

Progress Energy Florida, Inc.

Prepared by



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Acronyms and Abbreviations

CB	Crystal Bay associated monitoring location
CFBC	Cross Florida Barge Canal
cm	centimeter
COC	Condition of Certification
CREC	Crystal River Energy Complex
DMP	Discharge Monitoring Plan
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
ft	foot
FWC	Florida Fish and Wildlife Conservation Commission
GPS	Global Positioning System
LNP	Levy Nuclear Plant Units 1 and 2
LNP 1	Levy Nuclear Plant Unit 1
µg/L	microgram per liter
m ²	square meter
mg/L	milligram per liter
mgd	million gallons per day
NPDES	National Pollutant Discharge Elimination System
PEF	Progress Energy Florida, Inc.
psu	practical salinity units (equivalent to parts per thousand)
QA	quality assurance
QC	quality control
SOP	Standard Operating Procedure
SWFWMD	Southwest Florida Water Management District
TKN	total Kjeldahl nitrogen
TN	total nitrogen
TP	total phosphorus
WITH	Withlacoochee Bay associated monitoring location
YSI	Yellow Springs Instruments

1.0 Introduction

Progress Energy Florida, Inc. (PEF) is proposing to build and operate a nuclear powered electric generating facility, consisting of two generating units, in Levy County, Florida. The proposed facility, known as Levy Nuclear Plant Units 1 and 2 (LNP), will be located east of U.S. Highway 19 and 4 miles north of the Levy County and Citrus County border. The LNP will withdraw cooling water from the Cross Florida Barge Canal (CFBC), which extends west from the Inglis Lock to the Gulf of Mexico. PEF has proposed to route the LNP discharge to the existing Crystal River Energy Complex (CREC) discharge canal, located 9.6 miles southwest of the proposed plant site.

The Florida Governor and Cabinet, sitting as the State of Florida Siting Board, approved the Final Order on Certification for the Progress Energy LNP on August 26, 2009. The Final Order included Conditions of Certification (COCs; Florida Department of Environmental Protection [FDEP], 2009a). The COC that is addressed by this monitoring plan is Condition SECTION B, XXIX.B.2, Levy Nuclear and Crystal River Energy Complex Combined Discharge Survey and Monitoring, which requires the development of a LNP Combined Discharge Survey and Monitoring Plan, referred to as the Discharge Monitoring Plan (DMP).

1.1 Regulatory Requirements

COC SECTION B, XXIX.B.2 requires the submittal of a DMP to the Florida Fish and Wildlife Conservation Commission (FWC) and the FDEP Siting Office for approval by FWC in consultation with FDEP and the Southwest Florida Water Management District (SWFWMD). The requirements of Condition SECTION B, XXIX.B.2 (FDEP, 2009a) as they relate to this DMP are addressed in this DMP, as described below.

SECTION B, XXIX.B 2. Levy Nuclear and Crystal River Energy Complex Combined Discharge Survey and Monitoring

- a. Within 180 days following certification of the Levy County Nuclear Facility, the Licensee will submit to the FWC and the DEP Siting Office a LNP Combined Discharge Survey and Monitoring Plan (Discharge Monitoring Plan). Unless otherwise agreed to by the Licensee and FWC, in consultation with DEP, the Discharge Monitoring Plan shall include, at a minimum, the following components:*
 - i. A broad-based, pre-operational survey and a post-operational monitoring plan, for a period of time to be determined by statistical analysis in coordination between the DEP, FWC and the Licensee, that is available prior to operation of the facility, that includes sites outside of the existing or predicted plume areas to allow for a comparison of the plume area sites to a "control site." This time frame will not exceed the period of time that is available prior to operation of the facility.*

[Described in Sections 2.3, 3.0, 4.0 and 6.0, Tables 3-1 through 3-4 and 6-1, Figures 3-1 and 3-2, and Attachment A of this DMP]

- ii. *Specific survey and monitoring locations, sampling frequencies and methods, and specific parameters to be surveyed and monitored.*

[Described in Sections 3.1 and 4.0, Tables 3-1 through 3-4, 4-1, 4-2, and 6-1; and Figures 3-1 and 3-2 of this DMP]

- iii. *The survey and monitoring will include, at minimum, protocols to monitor seagrass, oyster and hard bottom resources. Monitoring of physical and chemical parameters shall include, at minimum, surface and bottom temperature, salinity, dissolved oxygen (DO), total nitrogen [TN], total phosphate [TP], and water column transparency data collection.*

[Described in Sections 3.1, 3.2, and 4.0, Tables 3-1 through 3-4, 4-1, and 4-2; and Figures 3-1 and 3-2 of this DMP]

- iv. *Intensive survey and monitoring of the central areas of the existing and future predicted plume areas during the first and second summers of the combined discharge. This should include measurements of DO at the surface and at the bottom measured on a regular schedule (quarterly at minimum, monthly if possible), and, within the zone of plume impact, DO at the bottom measured overnight 3 to 4 times during each summer.*

[Described in Sections 3.3 and 6.0, Tables 3-1 and 6-1; and Figure 3-1 of this DMP]

- b. *The Discharge Monitoring Plan and results of monitoring data collected over the course of the previous and current CREC operating period and NPDES permits will be submitted to the DEP and FWC so as to provide a basis for developing the LNP Discharge Mitigation Plan, if needed.*

[Described in Section 5.0 of this DMP.]

- c. *The Licensee will prepare yearly progress reports, including all data and statistical analyses resulting from the survey and monitoring requirements, and a summary report at the end of 5 years after approval of the Discharge Monitoring Plan of the Levy County Nuclear facility and submit the report to the FWC and DEP Siting Office for review. If in the review of the yearly progress reports, the FWC, in consultation with DEP and SWFWMD, determines inadequacies or the need to modify the Discharge Monitoring Plan, FWC will notify the DEP-Siting Office and the Licensee to discuss the findings. At the end of the baseline monitoring period, the Licensee will contact DEP and FWC to discuss the results. At that time, the FWC, in consultation with DEP and SWFWMD, and the Licensee will determine what if any modifications need to be made to the Discharge Monitoring Plan for monitoring once the Plant begins operations.*

[Described in Sections 5.0 and 6.2 of this DMP]

- e. *The Licensee will submit, after initiation of operations at the Levy Plant, a yearly progress report, including all data and statistical analyses from the baseline surveys and monitoring and an analysis comparing the current data to the*

baseline data, to the Agencies. If the FWC, in consultation with DEP and SWFWMD, determines that the preoperational survey and post-operational discharge monitoring data are insufficient to evaluate changes, indicate harm or potential harm to the ecological resources of the waters of the State and/or exceed State water quality standards, then additional measures shall be required to evaluate or to abate such impacts. Additional measures include but are not limited to:

- i. Enhanced monitoring and/or modeling, and mitigative measures;*
- ii. Operational changes in the discharge or water cooling system to reduce any such impacts;*
- iii. Other measures to abate impacts as may be described in the Plan.*

[Described in Section 5.0 of this DMP]

- f. The Licensee will submit a summary report, including all data and statistical analyses from the baseline survey and an analysis comparing the current data to the baseline data to FWC and the DEP Siting Office. The summary report should be submitted a minimum of 6 months before renewal of the NPDES permit.*

[Described in Section 5.0 of this DMP]

2.0 Background and Site Description

This section provides relevant background information on the LNP and the aquatic study area.

2.1 LNP Intake and Discharge Characteristics

The LNP will use a closed-cycle cooling water system that will withdraw cooling tower makeup water from the CFBC. Cooling tower makeup water will be withdrawn from the CFBC using pumps at a flow rate of approximately 122 million gallons per day (mgd).

The LNP will have a combined wastewater discharge comprised of several wastewater streams. The cooling system will utilize mechanical draft cooling towers and will have a blowdown capability that will comprise about 98 percent of the LNP wastewater. The combined LNP wastewater, as proposed by PEF in its pending National Pollutant Discharge Elimination System (NPDES) permit application, will be piped to the CREC and released into the existing CREC discharge canal which flows into the Gulf of Mexico. The maximum flow associated with the LNP, about 88 mgd, is equivalent to 4 to 5 percent of the existing permitted discharge from the CREC.

2.2 Study Area Description

The Gulf of Mexico near the CREC discharge is generally shallow, with depths of 10 feet or less within 3 miles of the shore. Locally, deeper water is found in rivers and dredged canals. Oyster reefs are common in the shallow nearshore environment and are exposed at low tide. During construction of the CFBC, a channel was dredged into the Gulf of Mexico creating a series of spoil islands extending offshore for 5.5 miles along the southern boundary of the channel (see Figure 2-1). This line of spoil islands restricts coastal flow north of the CREC discharge area.

By the CREC, channels and berms border both the intake and discharge canals. The excavated discharge canal extends 1.2 miles west into the Gulf of Mexico with a dike along the southern side. Farther south, two berms border the intake canal, extending 2.7 miles into the Gulf of Mexico. Beyond these berms, a navigational channel extends an additional 3 miles offshore and has a spoil bank along the northern side. The berms along the intake and discharge canals restrict coastal flow south of the CREC discharge area.

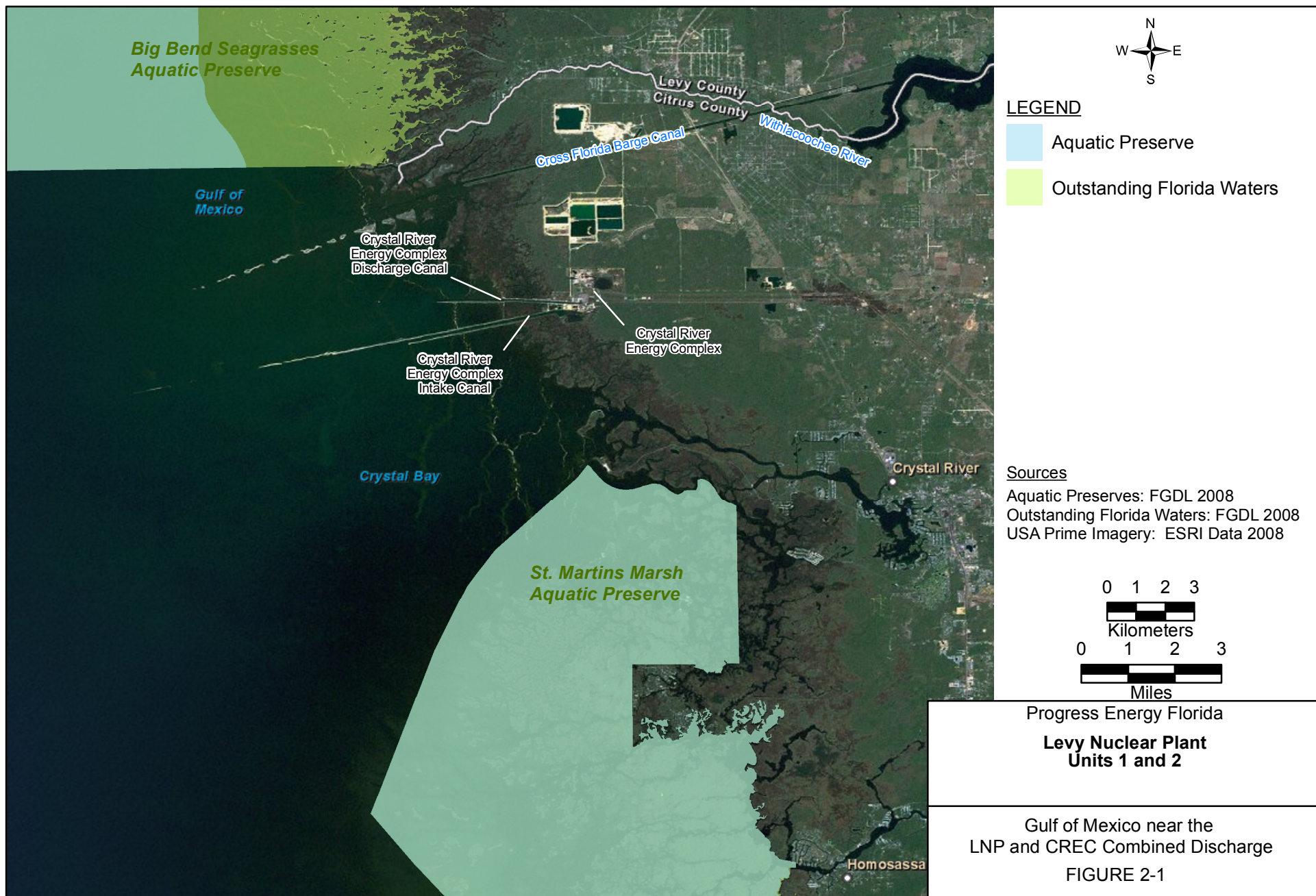
The predicted plume of the CREC discharge was estimated in a 316 analysis (Stone and Webster Engineering Corporation, 1985) for various seasons. This plume did not extend north of the spoil islands or beyond the intake canal berms.

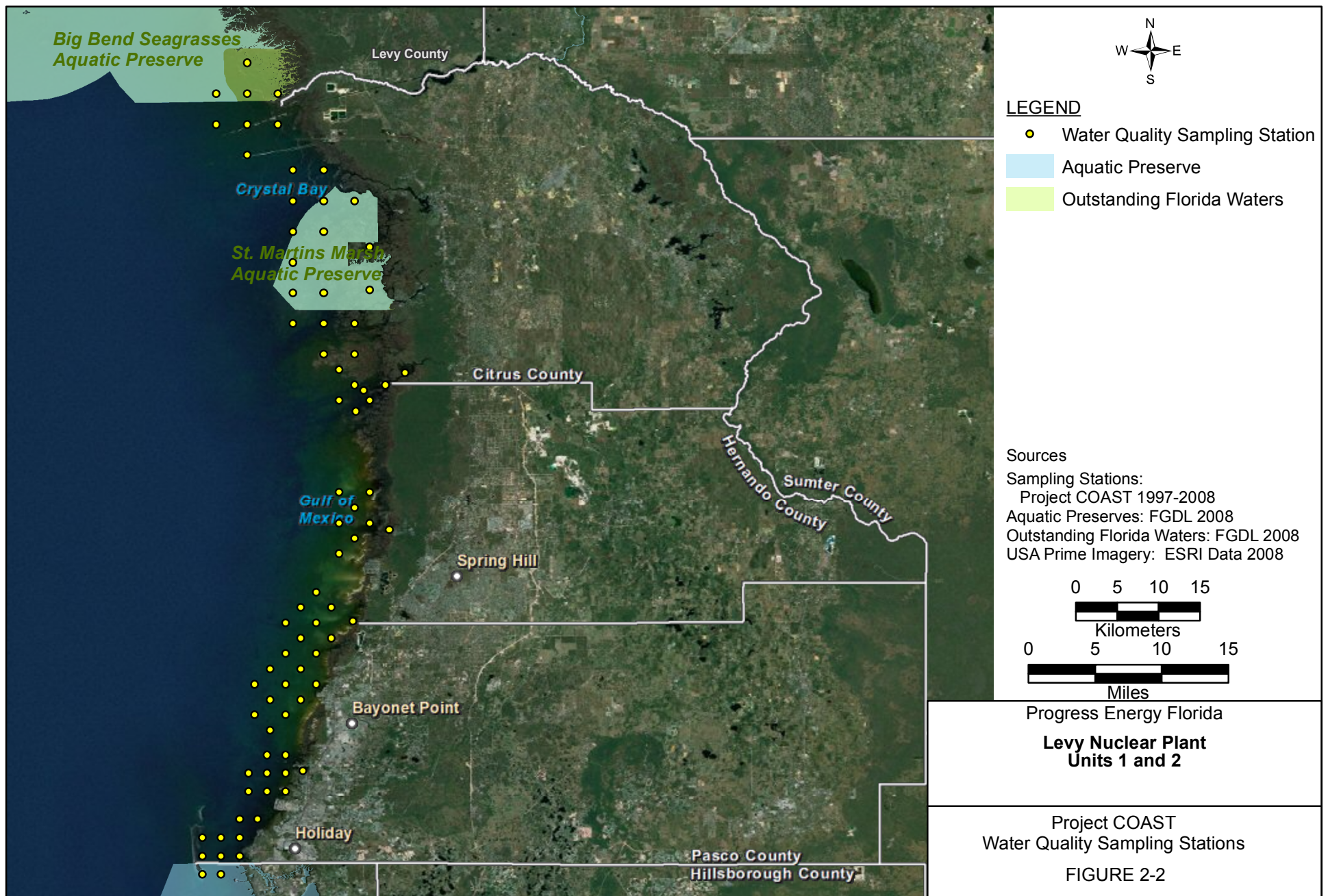
2.3 Historical Data

Water quality sampling is conducted in this part of the Gulf of Mexico under Project COAST by the University of Florida and FDEP staff; the project is funded through SWFWMD's

Surface Water Improvement and Management program and Coastal Rivers Basin Board, and the state's Water Quality Assurance Trust Fund (Frazer et al., 2001). As part of Project COAST, monthly water quality monitoring has been conducted since 1997 at an array of stations along the Gulf of Mexico coast extending from southern Levy County through Citrus, Hernando, and Pasco counties and into northern Pinellas County (see Figure 2-2). The distribution of locations covers nearshore and open water habitats. Water quality results reported for these stations includes Secchi depth, temperature, salinity, DO, pH, TN, TP, chlorophyll, color, and light attenuation coefficient.

The COAST water quality data from January 1997 through June 2008 were obtained from the SWFWMD and evaluated to determine their representativeness to help guide the selection of DMP stations. Stations in proximity to the study area were extracted from the dataset for further analysis (see Attachment A). Relevant statistics for the selected COAST water quality data in the DMP study area are presented in Attachment A and are discussed further in Subsection 3.1.1 with the selection of DMP monitoring locations.





3.0 DMP Monitoring

The purpose of this plan is to monitor for potential adverse changes in surface water quality that may be related to the LNP discharge. In addition, there are requirements to survey seagrass, oyster, and hard bottom resources. Monitoring of physical and chemical parameters, including surface and bottom temperature, salinity, DO, TN, TP, and water column transparency data collection, is also required. The plan also must include survey and monitoring of the plume area during the first and second summers of the combined discharge, including surface and bottom measurements of DO and overnight DO. This section provides an overview of the DMP monitoring locations, parameters to be sampled, and sampling approach. Other sections of this plan discuss quality assurance (QA) sampling and procedures, scheduling, and reporting.

3.1 DMP Water Quality Monitoring

3.1.1 Water Quality Monitoring Locations

Project COAST covers the Gulf of Mexico to the north and south of the combined discharge location. This plan supplements this network to include more stations within the predicted plume. Several of the DMP water quality monitoring locations will be collocated with Project COAST stations. Collocating monitoring points will provide historical information that will allow for the statistical comparison of data over time, providing for both quality control (QC) and data augmentation.

A total of seven locations comprise the DMP water quality network (see Table 3-1 and Figure 3-1); three of these locations are collocated with existing Project COAST stations (see Figure A-1 in Attachment A). Table B-1 in Attachment B provides a list of sampling point latitude/longitude coordinates. The following bulleted list provides an overview of the DMP monitoring location distribution:

- Four DMP locations are in proximity to the LNP combined discharge at the CREC: CREC-3, CREC-4, CREC-7, and WITH-9. Of these, WITH-9 is collocated with an existing Project COAST station, the Withlacoochee Bay station. Three locations, CREC-8, WITH-8, and WITH-10, are established outside of the predicted plume area and will provide background monitoring data. WITH-8 and WITH-10 are collocated with existing Project COAST stations.
- CREC-3 is located at the point of discharge. CREC-4 is located along the main flow path of the dredged discharge canal at the end of the dike. CREC-7 and CREC-8 are located further out beyond the plume but in the same direction of the discharge. These last two stations are located in between other Project COAST stations in the vicinity.

TABLE 3-1
Listing of DMP Water Quality Monitoring Locations

Location Group	Locations
LNP Discharge Vicinity	CREC-3, CREC-4, CREC-7, WITH-9
Outside of Predicted Plume	WITH-8, WITH-10, CREC-8

From the results of the statistical analyses of the Project COAST data presented in Attachment A, the following observations have been made:

- Based on nutrient concentrations, the Project COAST stations can be divided into a northern group located in the Withlacoochee Bay vicinity and a southern group located in the Crystal Bay vicinity. WITH-6 was considered to be an outlier because it was significantly different from all other stations in the vicinity at the 95 percent confidence level (see Table A-1 in Attachment A).
- Most of the Project COAST stations have similar nutrient levels; however, higher levels were observed near the mouth of the Withlacoochee River (WITH-6). Table A-2 in Attachment A provides a summary of Project COAST water quality results for salinity, TN, and TP for the north group, south group, and WITH-6 stations. The DMP monitoring locations are south and west of the Withlacoochee River direct influence.
- The salinity data demonstrate a difference between stations located near freshwater sources (see Figure A-1 in Attachment A). The DMP will not include monitoring stations located near freshwater sources to the study area.
- Some latitudinal differences in TN values exist between Project COAST stations, with TN concentrations generally being slightly higher in the northern portion of the COAST sampling area (see Table A-2 and Figure A-2 in Attachment A). DMP stations generally have similar nutrient levels.

Based on these analyses, it appears that data collected by the Project COAST program are sufficient to define nutrient concentrations in the region and account for differences across the DMP study area.

3.1.2 Water Quality Parameters

Table 3-2 presents a summary of DMP water quality monitoring parameters. Field water quality parameters to be measured at each station include depth profiles (1-meter intervals) of DO, temperature, salinity, and Secchi depth (transparency). Analytical water samples for TN and TP will be collected at a 0.5-meter depth from the water surface. Additional information about water sampling procedures is detailed in Section 4.0.

TABLE 3-2
Summary of Water Quality Monitoring Parameters at DMP Locations

Parameter	Number of Locations	Test Method	Collection Points for Water Quality Parameters
Dissolved Oxygen	7	Field	Depth profile (1-meter intervals)
Temperature	7	Field	Depth profile (1-meter intervals)
Salinity	7	Field	Depth profile (1-meter intervals)
Secchi Disk	7	Field	Visual depth reading
Total Nitrogen	7	Lab	Surface (0.5-meter depth)
Total Phosphorus	7	Lab	Surface (0.5-meter depth)

3.2 Seagrass, Oyster, and Hard Bottom Monitoring

The benthic habitat of the Gulf of Mexico in the vicinity of the CREC discharge will be surveyed by divers during the pre-operational and post-operational periods of the LNP. Diving at predetermined grid points will be performed to characterize the bottom type, percent cover, and species composition relative to the distance from the point of discharge in the discharge plume area. The point observation grid, spaced at 1,000-foot (ft) by 1,000-ft intervals, is provided on Figure 3-2. The specific coordinates for each observation point are listed in Table B-2 in Attachment B.

At each station, percent cover will be estimated at three randomly placed quadrats using a 1-square meter (m²) quadrat frame subdivided into 10-centimeter (cm) by 10-cm (100-square centimeters) squares. Each observation point will be located using Global Positioning System (GPS) and three quadrats dropped from the sampling watercraft. Divers will follow buoy lines to each quadrat to make their survey. Where seagrass is observed, percent cover and species composition will be recorded. Where hard bottom is observed, the maximum vertical relief and percent cover of biota in each 1-m² quadrat will be recorded. Seagrass, macroalgae, octocoral, sponge, or other biota present within each quadrat will be recorded for percent cover using the Braun-Blanquet scale (see Table 3-3). Substrate classifications within each quadrat will be documented using the scale shown in Table 3-4. Notes on the substrate type, water depth, water/current conditions, and visibility will also be recorded by divers. When visibility allows, photographs of each quadrat at each observation point will be taken.

TABLE 3-3
Braun-Blanquet Scale for Benthic Habitat Percent Cover

Score	Description
0	Taxa absent
0.1	Solitary
0.5	Sparse
1	0% to 5% cover
2	5% to 25% cover
3	25% to 50% cover
4	50% to 75% cover
5	75% to 100% cover

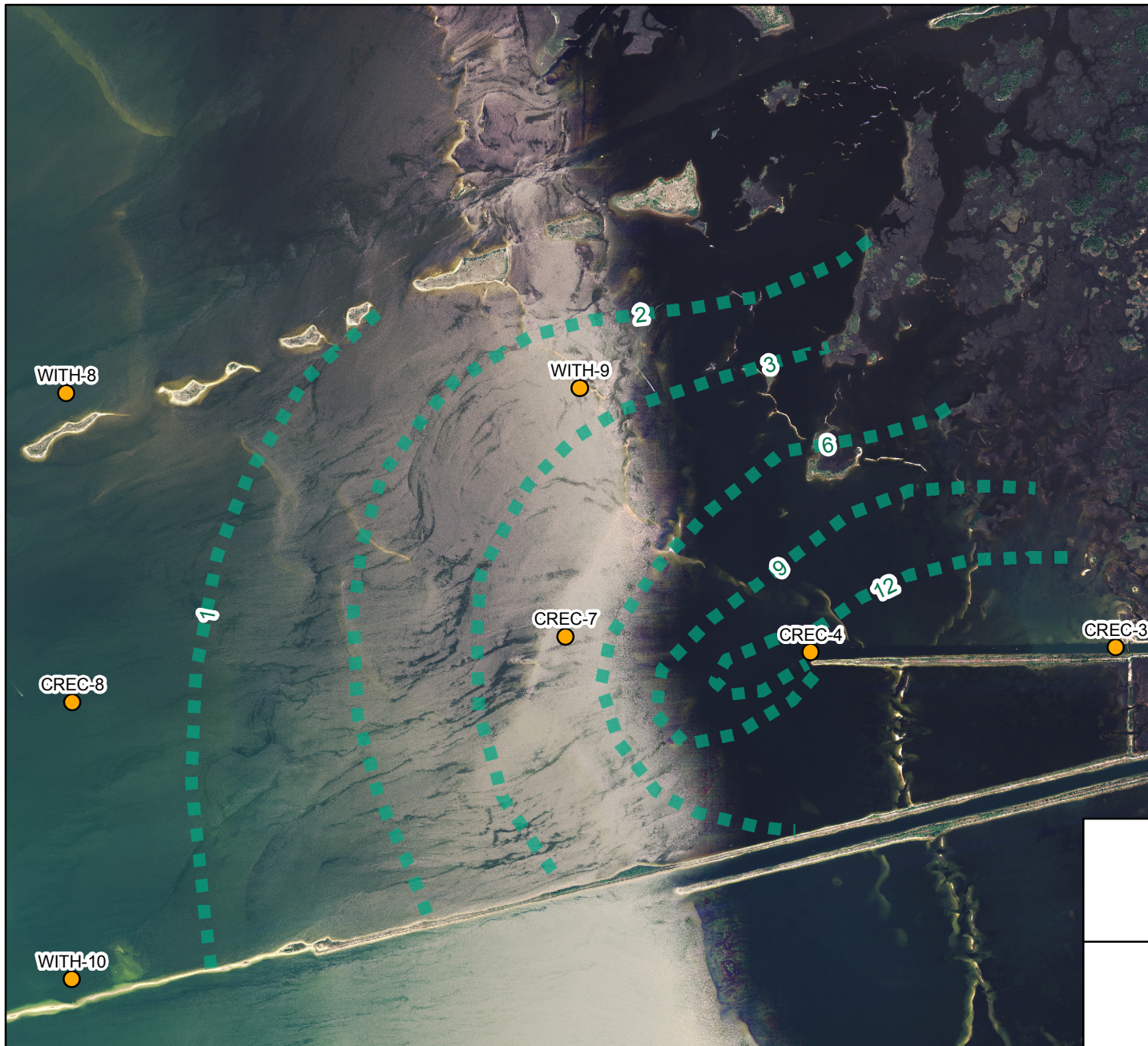
TABLE 3-4
Substrate Classification Scale

Score	Description
1	Silty mud
2	Mud
3	Sandy mud
4	Muddy sand
5	Sand
6	Shell
7	Rubble
8	Rock

3.3 Intensive Dissolved Oxygen Monitoring of Central Plume Area

An intensive DO survey and monitoring of the central area of the predicted combined discharge plume will be conducted during the first and second summers of the LNP operation, per COC SECTION B, XXIX.B.2.iv.

Locations CREC-3, CREC-4, and CREC-7 (see Figure 3-1) are in the area of the predicted thermal plume. Measurements of DO will be collected at these stations on a monthly basis between June and August during the first two LNP post-operational years. DO will be measured at the surface (0.5 meter) and bottom (0.5 meter from the bottom), as well as at 1-meter intervals, depending on total depth at each station. In addition, the DO near the bottom of the water column at CREC-7 will be monitored once per month between June and August from sunset to sunrise (at approximately 15-minute intervals using an automated sonde). CREC-7 represents a central location within the predicted thermal plume.



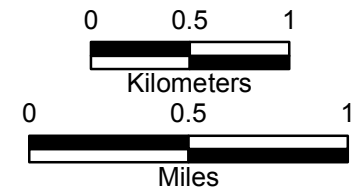
LEGEND

- DMP Monitoring Location
- - - Simulated Temperature Over Winter Ambient Conditions

Note:
Plume isotherms are adapted from
Stone and Webster, 1985.

Sources

DMP Monitoring Location:
CH2M HILL 2009
Simulation: CH2M HILL 2009
Imagery: USGS 2004



Progress Energy Florida

**Levy Nuclear Plant
Units 1 and 2**

Proposed DMP Water Quality
Monitoring Locations

FIGURE 3-1



LEGEND

● Survey Dive Location

Sources

Survey Dive Locations:

CH2M HILL 2009

USA Prime Imagery: ESRI Data 2008

0 0.25 0.5



Kilometers

0 0.25 0.5



Miles

Progress Energy Florida

**Levy Nuclear Plant
Units 1 and 2**

Proposed Seagrass, Oyster and Hard Bottom
Monitoring Locations

FIGURE 3-2

4.0 Quality Assurance and Control

The FDEP maintains Standards Operating Procedures (SOPs) for field data collection (Chapter 62-160, Florida Administrative Code [F.A.C.]). Data collected for this plan will conform to the QA and control measures found in these SOPs (Chapter 62-4.246, F.A.C.). Table 4-1 contains a list of FDEP SOPs that are applicable to the DMP (FDEP, 2009b). A summary of some of the most common elements applicable to this plan are included in this section. In addition to compliance with FDEP protocols, the DMP monitoring team will need to comply with requirements that cover health and safety, vessel operations, and compliance with manatee protection plans.

TABLE 4-1

List of FDEP SOPs Applicable to the DMP

Series	Description
FC 1000	Field Decontamination
FD 1000	Documentation
FM 1000	Field Mobilization
FQ 1000	Quality Control
FS 1000	General Sampling
FS 2000	General Water Sampling
FS 2100	Surface Water Sampling
FT 1000	Field Testing General
FT 1300	Field Salinity
FT 1400	Field Temperature
FT 1500	Field Dissolved Oxygen
FT-1700	Field Light Penetration

Notes:

DMP = Discharge Monitoring Plan

FDEP = Florida Department of Environmental Protection

SOP = standard operating procedure

Source: <http://www.floridadep.org/labs/qa/sops.htm>, accessed 11/04/2009

4.1 Field Team Management

A QA Officer will be assigned to oversee the training and documentation of the project. A QA/QC plan will be developed prior to initiation of work. The field team will maintain its own administrative procedures, which will include company-specific training. Field safety plans will be developed and distributed to field staff during their training. All field

sampling staff will be trained in the proper use of the equipment and SOPs for field sample data collection before field work begins.

Because sampling will be conducted from a watercraft, proper water safety is essential. Two or more staff will be involved for every sampling event; the minimum crew is typically two sampling members and a separate boat operator. The watercraft must be of sufficient size to safely handle the crew and samples (weight and volume). The craft must be able to maintain its position at a site during the collection period.

4.2 Pre-Sampling Event Preparation

Pre-cleaned sample containers of the required size and type will be obtained from the laboratory. Chain-of-custody forms, which are to be maintained with the samples, will be partially filled out before leaving for the sampling event.

Water quality sampling will include inorganic, nonmetallic parameters and physical properties. No volatile substances are involved, so no special trip blanks are required (see Subsection 4.4.1). Sampling equipment will be decontaminated and prepared before the sampling event. The equipment for in-situ samples will be calibrated using standard methods according to FDEP SOPs. Operation of the field monitoring equipment will follow the manufacturer's recommended procedures and standards.

4.3 Sample Collection and Handling

The sampling stations are mapped and locations will be found in the field using standard GPS equipment (see Attachment B). Once the sampling team is at a monitoring point, the team may maintain their position by anchoring or by motor, depending upon conditions during sampling. Minor variation in actual sampling position may occur due to drift and sea conditions.

Field parameters (DO, temperature, and salinity) will be collected using a Yellow Springs Instruments (YSI) or equivalent multi-parameter sonde. Depth profile measurements will be made at 1-meter increments from the water surface to approximately 0.5 meter above the ocean bottom. The sonde will be weighted sufficiently to allow the probe to reach the bottom in strong tidal currents. Water column transparency will be recorded using a Secchi disk. Probe calibrations will be conducted in accordance with FDEP SOPs for each parameter.

Analytical water quality samples will be collected using a peristaltic pump with Teflon tubing at designated sampling depths. Clean sample collection practices will be maintained, but ultra-clean metal sampling is not a requirement of this plan because metals are not being monitored. Samples will be collected near the bow of the watercraft (away from gas engines). The pump tubing will be weighted to keep the end steady at the sample depth. A volume of water sufficient to purge the tubing will be flushed through the tubing prior to sampling. The tubing will not be inserted into the sample containers but held over the container until an adequate volume is obtained. The container will be handled by a "clean hands" crew member who will seal and label each bottle prior to cooling samples on ice.

within 15 minutes of collection. The “clean hands” field team member will use non-talc, latex gloves.

Water quality sample preservation and holding times will conform to FDEP SOPs. Two inorganic, nonmetallic parameters will be monitored: TN and TP. Per FDEP SOP FS 1000, the pH of the samples will be monitored to ensure samples are preserved appropriately. Coolers with ice will also be transported on the sampling watercraft to cool the samples as soon as they are collected and labeled. Extra sample bottles will be transported and used if needed.

FDEP currently has no SOPs for characterization of the seagrasses, oyster, and hard bottom resources. The proposed survey methodology consists primarily of recorded field observations and photographs as is typically done for this type of characterization. Records of field observations will be entered into a project database. Upon return from the field, results obtained in the field will be reviewed for accuracy and the analysis of photographs will be used to determine or verify observations made in the field.

Field data sheets will be used to record the activity at each site, including weather and general observations at each station. Chain-of-custody forms will be completed, kept with the coolers, and shipped to the laboratory. The laboratory will check and record the condition of the samples, including preservation, upon arrival.

4.4 Laboratory Sample Analysis

Water quality samples will be analyzed by a state-certified analytical laboratory using methods approved by the State of Florida. TN is calculated by adding the concentration results of total Kjeldahl nitrogen (TKN) and nitrate plus nitrite together. Analytical methods include the U.S. Environmental Protection Agency (EPA) Method 351.32 (Rev 2.0, 1993) for TKN and EPA Method 353.32 (Rev 2.0, 1993) for nitrate plus nitrite. The analytical method for TP is EPA Method 365.2 (Rev 2.0, 1993). These methods are applicable for fresh and saline waters.

4.4.1 Field Duplicates and Equipment Blanks

Equipment blank and field duplicate samples will be collected for TN and TP parameters as noted in Table 4-2. Trip blanks are not required for inorganic parameters. One equipment blank of the pump and tubing will be collected using de-ionized water at least once per event. FDEP FQ 1000 requires the sampling organization to be responsible for ensuring that blanks, excluding trip blanks, are collected at a minimum of 5 percent of each reported test result/matrix combination for the life of a project. One equipment blank per event will satisfy this requirement. Field blanks are not required if equipment blanks are collected. In addition, one field duplicate will be collected per event at a location to be selected by the field team (anonymously labeled for laboratory analysis) and varied between events.

TABLE 4-2
Quality Assurance Sampling Requirements for the DMP

Sample Type	Analysis	Number of Samples	Matrix
Monitoring Location	TN, TP	7	Receiving Water
Equipment Blank	TN, TP	1	De-ionized water, collected during the day and after first use.
Duplicate	TN, TP	1	Receiving water, vary stations duplicated between sampling events.

Notes:
Each number of samples is per event.
DMP = Discharge Monitoring Plan
TN = total nitrogen
TP = total phosphorus

5.0 Reporting

Data collected during field sampling events will be recorded on standardized field data sheets and electronically using water quality meters and GPS devices. The data sheets will be provided in the QA/QC plan. Field data sheets for each event will be controlled by performing checks before and after entering the information into an electronic database and also by filing the original form into project records. Results from the monitoring activities will be included in the reports described below.

- An annual report of the results of the water quality, intensive DO, and seagrass, oyster, and hard bottom resources survey during pre-operational monitoring for the LNP. This report will include raw data, descriptive statistics of results collected for this condition requirement, a status update, and any deviations or required changes for the past or coming year (COC SECTION B, XXIX.B.2.c). The reports will be submitted by April 1 of each year after the first pre-operational monitoring period.
- A yearly progress report of the post-operational DMP sampling and monitoring activity (COC SECTION B, XXIX.B.2.e). The annual report will include the same information described in the pre-operational report. The progress reports will be submitted by April 1 of each year after the first post-operational monitoring period.
- A 5-Year Discharge Monitoring Summary Report of the water quality monitoring conducted for the DMP (COC SECTION B, XXIX.B.2.c). The report will include an analysis of spatial and temporal differences, as well as tables and figures summarizing the sampling and analytical results. This summary report will be prepared and submitted by July 1 at 5-year intervals following the first submittal.
- COC SECTION B, XXIX.B.2.f requires a summary report that includes the DMP data and statistical analyses comparing the current data to the baseline data to be submitted 6 months prior to the renewal of the LNP NPDES permit. A water quality sampling summary report will be prepared for inclusion with the LNP permit application at a frequency tied to the NPDES permit renewal date. In the event that an LNP NPDES permit renewal occurs prior to completing 5 years of DMP monitoring, available DMP data will be reported.
- COC SECTION B, XXIX.B.2.b requires the DMP results and CREC NPDES permit monitoring results to be submitted to the FDEP and FWC as a basis for developing an LNP Discharge Mitigation Plan, if needed. The FDEP and FWC will receive all of the DMP data through the reports listed in this section. The FDEP already receives CREC data regularly and through the NPDES permit renewal.

6.0 Schedule for DMP Monitoring

6.1 Monitoring Frequency

A summary of the monitoring frequency is provided in Table 6-1. Water quality data will be sampled bi-monthly: February, April, June, July, August, October, and December. The intensive overnight DO monitoring will be conducted in June, July, and August. Dates for the above events will typically be regularly spaced (for example, third week of the month), but may vary as a result of unforeseen delays or weather. The seagrass, oyster, and hard bottom surveys will be conducted once per year near the peak of the growing season (between July and September).

A bi-monthly water quality sampling frequency was selected based on an evaluation of the variance in the COAST water quality monitoring data using the estuarine stations in the area (see Attachment A). The mean nutrient concentrations reported are relatively low; 0.35 milligrams per liter (mg/L) for TN and 0.03 mg/L for TP (see Table A-3 in Attachment A). The coefficient of variation (defined as the standard deviation divided by the mean) for the nutrient levels of TN and TP in the COAST data ranged from 0.4 to 0.6, indicating a moderate amount of natural variability, which is expected, and would make it difficult to demonstrate a significant change in concentration by field monitoring.

A sensitivity analysis was done to see how many samples would be required to estimate a statistically significant change of approximately 0.05 mg/L TN and 0.005 mg/L TP (see Table A-3 in Attachment A). These levels of change were considered sensitive enough because they are small increments, about one-half of the smallest significant digit for reliable readings, and are approximately 15 percent of the mean values of each parameter. Table A-3 in Attachment A indicates that 30 samples are needed to meet the target sensitivity. Post-operational data collected for at least 5 years, with 6 nutrient samples per year at each location yields a total of 30 samples available from each station to estimate an effect from the LNP combined discharge within the plume area for the summary report. Additional data are available for WITH-9 from the COAST program, yielding more than 30 data points inside the plume area for the annual progress report. Similarly, the 4 monitoring locations outside the plume are collocated with Project COAST and they will provide an additional 24 data points annually. Pooling of data from stations located near the discharge and from background areas will yield a sample size well in excess of that required to ascertain change. Bi-monthly sampling will yield sufficient data to allow for the evaluation of significant effects for the annual report.

TABLE 6-1
Summary of Monitoring Frequency

Parameter	Number of Locations	Frequency	
		Pre-Operational	Post-Operational
Dissolved Oxygen	7	Bi-monthly plus July	Bi-monthly plus July
Temperature	7	Bi-monthly	Bi-monthly
Salinity	7	Bi-monthly	Bi-monthly
Secchi Disk	7	Bi-monthly	Bi-monthly
Total Nitrogen	7	Bi-monthly	Bi-monthly
Total Phosphorus	7	Bi-monthly	Bi-monthly
Seagrass, Oyster, and Hard Bottom	141	Annually	Annually
Overnight DO	1	None	Once per month in June, July and August

Bimonthly sampling schedule is to be during February, April, June, August, October, and December.
Pre-operational means before the scheduled start of Levy Nuclear Plant Unit 1 (LNP 1).
Post-operational means after the actual start of wastewater discharge from LNP 1.

6.2 Monitoring Duration

Two years of pre-operational water quality data will be collected within 3 years of LNP 1 scheduled startup (pre-operational). Two annual pre-operational surveys of seagrasses, oyster, and hard bottom resources will be conducted within 3 years of LNP 1 beginning to discharge wastewater.

Water quality and intensive DO sampling will be conducted after LNP 1 begins discharging wastewater to the CREC (post-operational). Annual summer (between July and September) surveys of seagrass, oyster, and hard bottom resources will also be conducted.

At the completion of 5 years of post-operational monitoring as described in this plan, the program data will be summarized and evaluated. In accordance with the COC, if the monitoring demonstrates no impact from the LNP, then PEF may request that the DMP be amended or terminated.

7.0 References

Florida Department of Environmental Protection (FDEP). 2009a. *Levy Nuclear Power Plant Units 1 & 2, Progress Energy Florida Conditions of Certification Plant and Associated Facilities and Transmission Lines*. Certified August 26, 2009.

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Glantz, S.A. 2002. *Primer of Biostatistics*. 5th Ed. McGraw Hill and Co. New York, NY. p. 101.

Stone and Webster Engineering Corporation. 1985. Final Report. *Crystal River 316 Studies*. Prepared for Florida Power Corporation. January 15, 1985.

Summary Statistics for COAST Stations Selected near the LNP and CREC Combined Discharge

TABLE A-1
Tukey Test of Significance between Groups

Individual Results, 0.05 Significance Level	Station	Total Nitrogen Groupings	Station	Total Phosphorous Groupings	Station	Salinity Groupings
	WITH-6	A	WITH-6	A	WITH-10	A
	WITH-9	B	WITH-9	B	WITH-7	AB
	WITH-5	B	WITH-8	BC	WITH-4	ABC
	WITH-8	BC	WITH-5	CD	CB-5	BDC
	WITH-4	BC	WITH-7	ED	WITH-8	EDC
	CB-8	CE	WITH-4	ED	CB-1	ED
	WITH-7	CFE	WITH-10	E	WITH-5	DEF
	WITH-10	FE	CB-2	E	CB-8	EF
	CB-5	FE	CB-1	EF	WITH-9	GF
	CB-1	FE	CB-6	FG	CB-6	G
	CB-6	F	CB-5	FG	CB-2	H
	CB-2	F	CB-8	G	WITH-6	I

Same analysis with only average annual values, demonstrates stability in the data between years

Annual Averages, 0.05 Significance Level	Station	Total Nitrogen Groupings	Station	Total Phosphorous Groupings	Station	Salinity Groupings
	WITH-6	A	WITH-6	A	WITH-10	A
	WITH-9	AB	WITH-9	AB	WITH-7	A
	WITH-5	AB	WITH-8	BC	WITH-4	A
	WITH-8	AB	WITH-5	BC	CB-5	AB
	WITH-4	BD	WITH-4	CD	WITH-8	AB
	CB-8	BED	WITH-7	CD	CB-1	AB
	WITH-7	BED	WITH-10	D	WITH-5	ABC
	WITH-10	ED	CB-2	D	CB-8	ABC
	CB-5	ED	CB-1	DE	WITH-9	BC
	CB-1	E	CB-6	FE	CB-6	CD
	CB-6	E	CB-5	FE	CB-2	D
	CB-2	E	CB-8	F	WITH-6	E

Notes:

Locations that could have their results combined together based on Tukey Test have same letter. Letters are organized by strength of difference (A = most different, I = least different). Comparison made at the alpha = 0.05 level (95% confidence level).

Project COAST stations are labeled by county, watershed, and station number. The data was coded for analysis using the watershed and station number. For example, W6 is Station 6 in the Withlacoochee Bay watershed in Levy County and is equivalent to WITH6. The Withlacoochee Bay spans across Levy and Citrus Counties. C and CB are associated with the Crystal Bay watershed locations in Citrus County.

A Tukey Multiple Comparison test is used to compare groups of means with each other simultaneously. The Tukey statistical test is usually more conservative in estimating significant differences than other alternative tests (Glantz, 2002).

Project COAST data included monthly results from January 1997 through June 2008.

TABLE A-2

Summary Water Quality Statistics for COAST Station Groups used in the Tukey Analysis in the DMP Study Area

North Group: COAST Stations WITH-4, WITH-5, WITH-7, WITH-8, WITH-9, and WITH-10**South Group: COAST Stations WITH-10, CB-1, CB-2, CB-5, CB-6, and CB-8****Outlier: COAST Station WITH-6**

Parameter	Group	Mean (µg/L)	Standard Deviation	Number of Results	Percentiles						
					Min	5th	25th	Median	75th	95th	Max
Salinity	North	24.3	4.91	735	3.0	15.0	21.7	25.0	27.7	30.9	37.0
Salinity	WITH-6	13.4	6.20	147	0.9	2.9	8.4	13.5	17.8	23.0	30.1
Salinity	South	22.7	5.33	881	3.4	12.9	19.8	23.2	26.5	30.6	34.3
Total Nitrogen	North	388	142.81	741	120	220	290	360	460	650	1170
Total Nitrogen	WITH-6	573	265.15	149	200	250	420	530	670	940	2000
Total Nitrogen	South	311	130.44	889	33	150	230	290	360	560	1490
Total Phosphorous	North	35	17.47	741	5	15	22	31	45	68	126
Total Phosphorous	WITH-6	66	45.34	148	17	28	41	54.5	75	128	379
Total Phosphorous	South	20	12.40	889	3	7	12	17	24	42	122

Notes:

µg/L = microgram per liter

Project COAST data included monthly results from January 1997 through June 2008.

TABLE A-3
Sensitivity of Significant Difference with Given Sample Size Estimates

Parameter	Group	Units	Mean	Standard Deviation	Number of Results	Proposed No. of Samples	Sensitivity to Changes in Means (Alpha = 0.05)
Salinity	North	psu	24.3	4.91	735	30	1.8
Salinity	South	psu	22.7	5.33	881	30	1.9
Total Nitrogen	North	µg/L	388	142.81	741	30	51
Total Nitrogen	South	µg/L	311	130.44	889	30	47
Total Phosphorous	North	µg/L	35	17.47	741	30	6
Total Phosphorous	South	µg/L	20	12.40	889	30	4

Notes:

Bi-monthly sampling (Feb., Apr., June, Aug., Oct., Dec.)

Analysis of COAST Data for the following stations and groups:

North = WITH-4, WITH-5, WITH-7, WITH-8, WITH-9, and WITH-10. WITH-6 was handled as an outlier and not included in the statistics.

South = WITH-10, CB-1, CB-2, CB-5, CB-6, and CB-8

psu = practical salinity units

µg/L = micrograms per liter

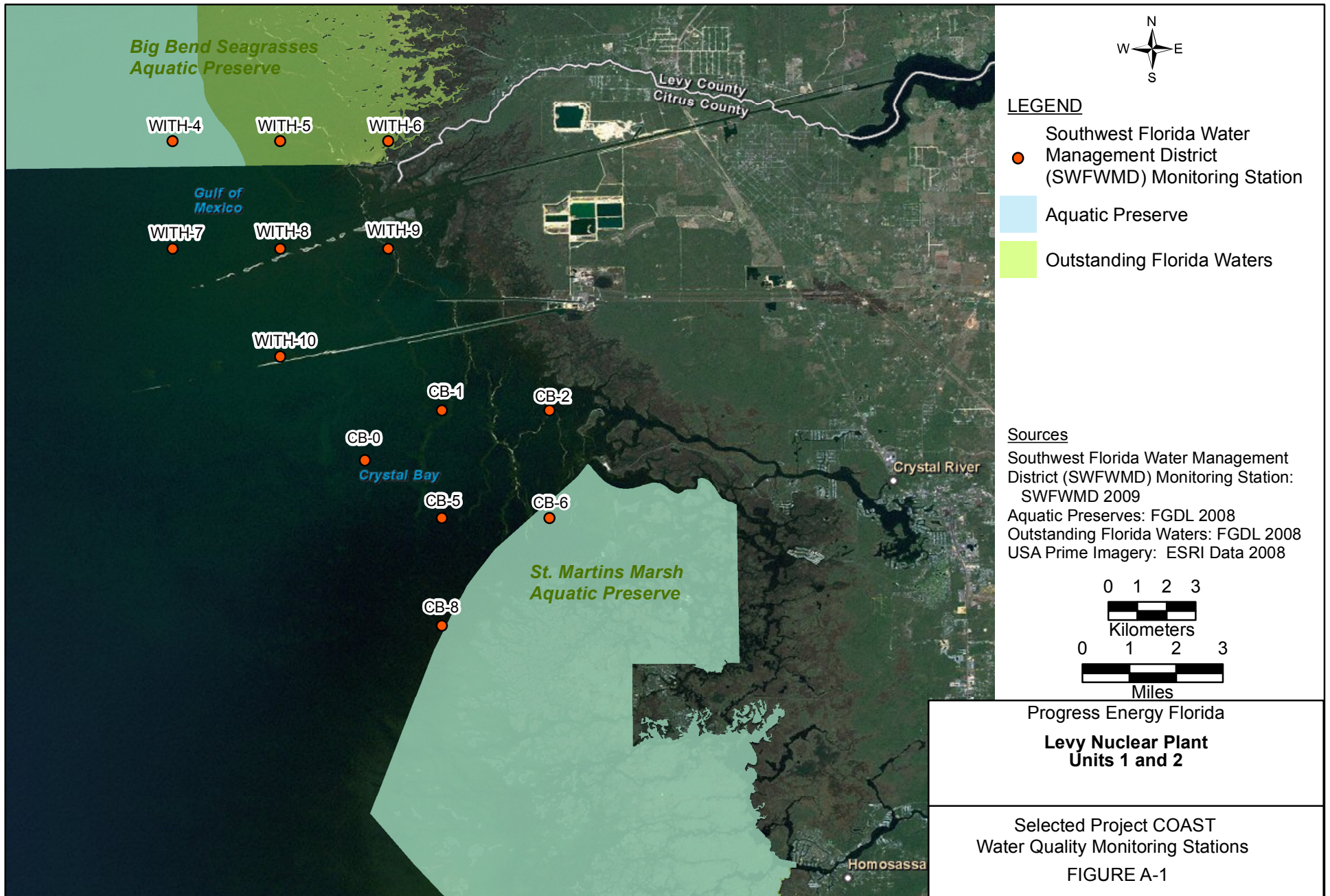


Figure A-2. Box and Whisker Plots for Total Nitrogen by Location and Quarter

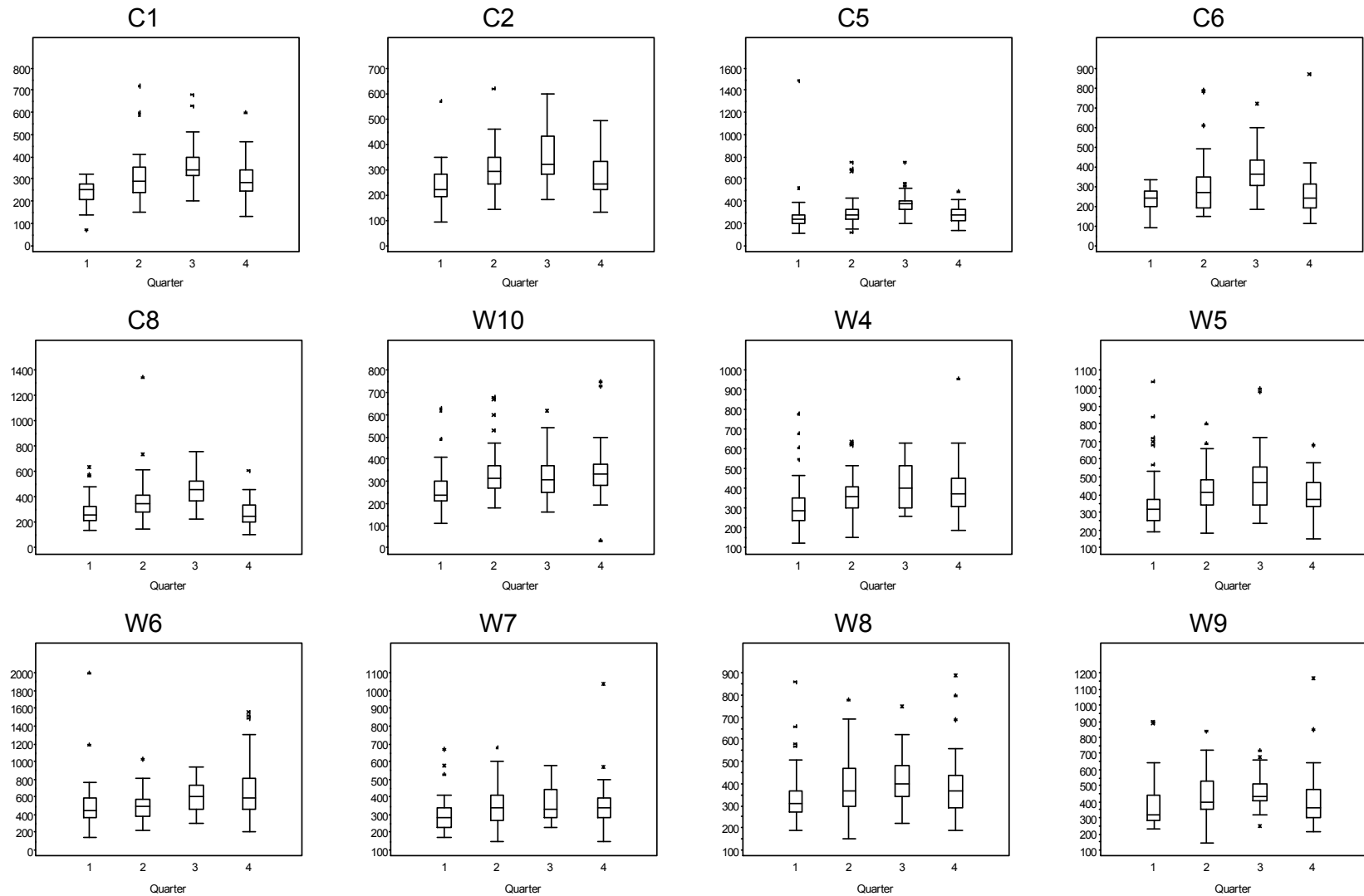


Figure A-3. Box and Whisker Plots for Total Phosphorus by Location and Quarter

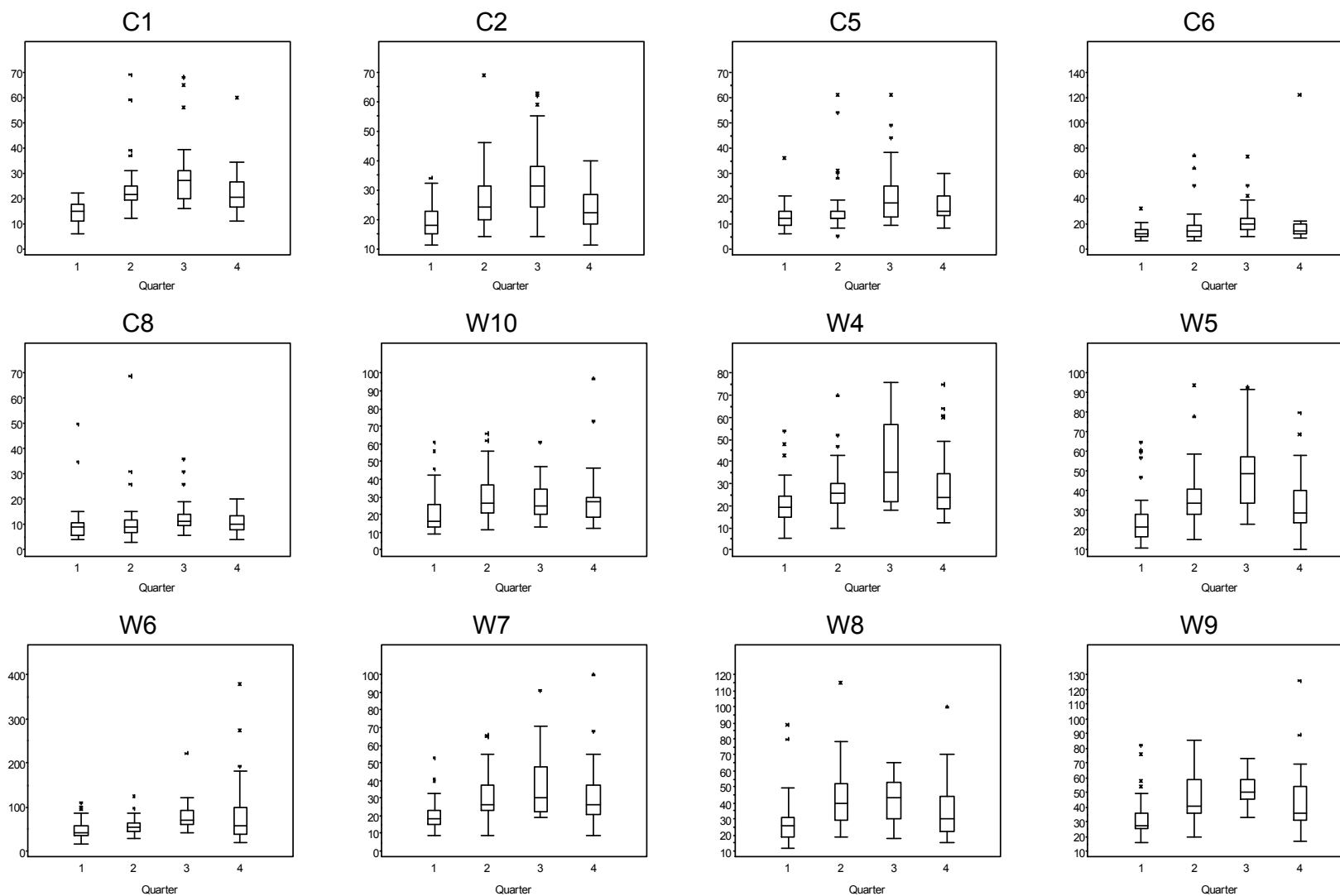
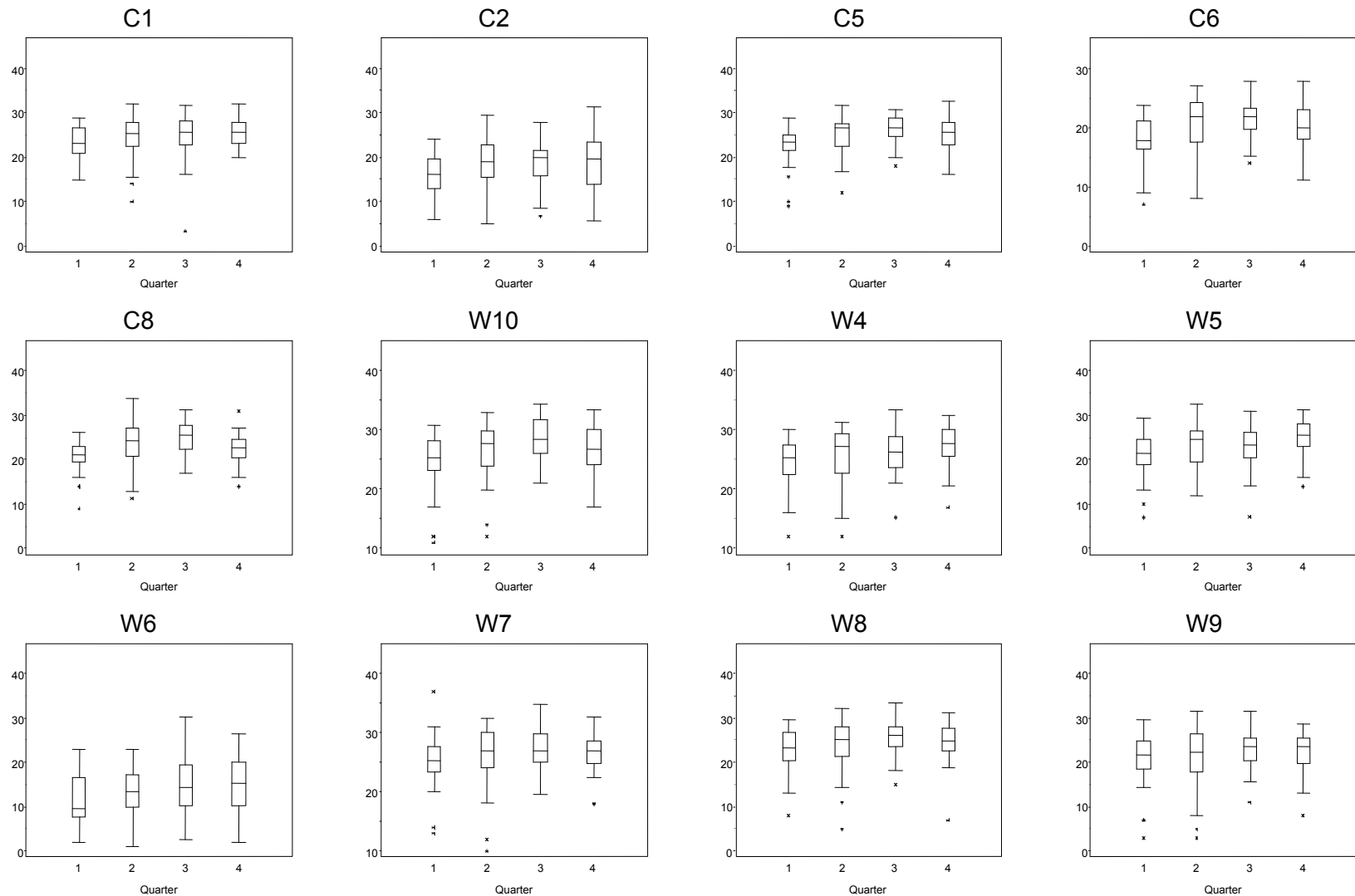


Figure A-4. Box and Whisker Plots for Salinity by Location and Quarter



Station Coordinate Tables

TABLE B-1
DMP Water Quality Monitoring Location Coordinates

Location Name	Latitude	Longitude
CREC-3	28.959941	82.723691
CREC-4	28.959856	82.743489
CREC-7	28.960875	82.759405
CREC-8	28.957422	82.791491
WITH-10	28.941670	82.791670
WITH-8	28.975000	82.791670
WITH-9	28.975000	82.758330

Notes:
CREC = Crystal River Energy Complex associated monitoring location
DMP = Discharge Monitoring Plan
WITH = Withlacoochee Bay associated monitoring location

TABLE B-2
DMP Seagrass, Oyster, and Hard Bottom Monitoring Location Coordinates

Location Name	Latitude	Longitude
1	28.957384	82.774964
2	28.957402	82.771837
3	28.957420	82.768710
4	28.957438	82.765584
5	28.957455	82.762457
6	28.957473	82.759330
7	28.957491	82.756203
8	28.957508	82.753077
9	28.957526	82.749950
10	28.957543	82.746823
11	28.957560	82.743696
12	28.957578	82.740570
13	28.957595	82.737443
14	28.957612	82.734316
15	28.957629	82.731189
16	28.957646	82.728063
17	28.957663	82.724936
18	28.960134	82.774984
19	28.960152	82.771858
20	28.960170	82.768731
21	28.960187	82.765604

TABLE B-2
DMP Seagrass, Oyster, and Hard Bottom Monitoring Location Coordinates

Location Name	Latitude	Longitude
22	28.960205	82.762477
23	28.960223	82.759350
24	28.960241	82.756223
25	28.960258	82.753097
26	28.960276	82.749970
27	28.960293	82.746843
28	28.960310	82.743716
29	28.960327	82.740589
30	28.960345	82.737462
31	28.960362	82.734336
32	28.960379	82.731209
33	28.960396	82.728082
34	28.960413	82.724955
35	28.962884	82.775005
36	28.962902	82.771878
37	28.962920	82.768751
38	28.962937	82.765624
39	28.962955	82.762497
40	28.962973	82.759370
41	28.962990	82.756243
42	28.963008	82.753117
43	28.963025	82.749990
44	28.963043	82.746863
45	28.963060	82.743736
46	28.963077	82.740609
47	28.963095	82.737482
48	28.963112	82.734355
49	28.963129	82.731228
50	28.963146	82.728101
51	28.963163	82.724974
52	28.965634	82.775025
53	28.965652	82.771898
54	28.965670	82.768771
55	28.965687	82.765644
56	28.965705	82.762517

TABLE B-2
DMP Seagrass, Oyster, and Hard Bottom Monitoring Location Coordinates

Location Name	Latitude	Longitude
57	28.965723	82.759390
58	28.965740	82.756263
59	28.965758	82.753136
60	28.965775	82.750009
61	28.965793	82.746882
62	28.965810	82.743755
63	28.965827	82.740628
64	28.965845	82.737501
65	28.965862	82.734374
66	28.965879	82.731247
67	28.965896	82.728120
68	28.968384	82.775046
69	28.968402	82.771919
70	28.968419	82.768792
71	28.968437	82.765665
72	28.968455	82.762538
73	28.968473	82.759411
74	28.968490	82.756283
75	28.968508	82.753156
76	28.968525	82.750029
77	28.968543	82.746902
78	28.968560	82.743775
79	28.968577	82.740648
80	28.968595	82.737521
81	28.968612	82.734394
82	28.971134	82.775066
83	28.971152	82.771939
84	28.971169	82.768812
85	28.971187	82.765685
86	28.971205	82.762558
87	28.971223	82.759431
88	28.971240	82.756303
89	28.971258	82.753176
90	28.971275	82.750049
91	28.971293	82.746922

TABLE B-2
DMP Seagrass, Oyster, and Hard Bottom Monitoring Location Coordinates

Location Name	Latitude	Longitude
92	28.971310	82.743795
93	28.971327	82.740668
94	28.971345	82.737540
95	28.971362	82.734413
96	28.973883	82.775087
97	28.973901	82.771960
98	28.973919	82.768832
99	28.973937	82.765705
100	28.973955	82.762578
101	28.973973	82.759451
102	28.973990	82.756323
103	28.974008	82.753196
104	28.974025	82.750069
105	28.974043	82.746942
106	28.974060	82.743814
107	28.974077	82.740687
108	28.974095	82.737560
109	28.974112	82.734433
110	28.976633	82.775107
111	28.976651	82.771980
112	28.976669	82.768853
113	28.976687	82.765725
114	28.976705	82.762598
115	28.976723	82.759471
116	28.976740	82.756343
117	28.976758	82.753216
118	28.976775	82.750089
119	28.976793	82.746961
120	28.976810	82.743834
121	28.976827	82.740707
122	28.976844	82.737579
123	28.976862	82.734452
124	28.979419	82.768873
125	28.979437	82.765746
126	28.979455	82.762618

TABLE B-2
DMP Seagrass, Oyster, and Hard Bottom Monitoring Location Coordinates

Location Name	Latitude	Longitude
127	28.979473	82.759491
128	28.979490	82.756363
129	28.979508	82.753236
130	28.979525	82.750109
131	28.979543	82.746981
132	28.979560	82.743854
133	28.979577	82.740726
134	28.982205	82.762638
135	28.982223	82.759511
136	28.982240	82.756383
137	28.982258	82.753256
138	28.982275	82.750128
139	28.982293	82.747001
140	28.982310	82.743873
141	28.982327	82.740746

Notes:

DMP = Discharge Monitoring Plan