Compliance Monitoring Plan

For

PICAYUNE STRAND MANATEE MITIGATION MONITORING

(PSMM)

AGENCIES: FDEP, USFWS, FFWC

Document Date: 07/13/2021

Water Quality Monitoring Section
Water Quality Bureau, Water Resources Division
South Florida Water Management District

SFWMD-FIELD-CMP-025-03

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1.0 Project Organization

The following documents define the procedures used by South Florida Water Management District (SFWMD or District) Water Quality Monitoring (WQM) Section personnel to meet the Florida Department of Environmental Protection's (FDEP or Department) Quality Assurance (QA) Rule, Florida Administrative Code (F.A.C.) 62-160, and should be referred to for details on key personnel and relevant responsibilities.

- Overall project organization and responsibilities -
    - SFWMD Water Quality Bureau (WQB) and Applied Sciences Bureau (ASB) Quality Management Plan (QMP).
- Field activity and data validation responsibilities -
    - SFWMD Water Quality Monitoring Section's (WQM) Quality Manual (QM), Field Sampling Manual (FSM), and applicable Standard Operating Procedures (SOP).
- Laboratory analysis and data validation responsibilities –
    - SFWMD Analytical Service's (AS) Chemistry Laboratory Quality Manual (CLQM) and applicable SOPs.

2.0 Project Description

The Picayune Strand Manatee Mitigation monitoring project (PSMM) was initiated in 2014 as part of an agreement among the District, the USFWS, and the USACE (Appendix 1). Samples and data will be collected to satisfy the mandated monitoring requirements in accordance with the permit to which this document is attached and in accordance details outlined in Appendix 1. On July 13, 2021 the Florida Department of Environmental Protection (FDEP) issued concurrence to temporarily suspend isotope monitoring in the Feature's north pool at MMNP, until the Picayune Strand Restoration Project (PSRP) is operational in its entirety, which will occur following the plugging of the Miller, Faka Union, Merritt, Prairie and Stair-step canals and the construction of the Southwest Protection Feature (SWPF) and its associated infrastructure.

This plan details permit mandated monitoring requirements. Modifications to this sampling may be requested in response to any future design changes, and/or changes to project objectives. Monitoring reductions may also be requested to stations, frequencies, and/or analytes if monitoring demonstrates that specific parameters are not present or if found consistently in compliance with regulatory standards. This plan will be reviewed and/or modified as needed to reflect necessary changes. At a minimum, this plan will be reviewed when the permit is renewed.

2.1 Water Quality Performance Measures

Samples will be collected over a three (3) year period to verify the presence of groundwater within the manatee mitigation feature. These data will be compared to historical USGS studies (2009 to 2011) to determine the isotopic signatures within the Port of the Islands (POI) Basin and the unique isotopic signatures of groundwater, the Gulf of Mexico, and the Faka Union canal to determine the presence or absence of a

groundwater connection once the manatee mitigation feature is completed. Monitoring is intended to detect an inverted thermocline/halocline expected to develop following the establishment of a connection to warmer more saline groundwater. Following the initial 3-year monitoring period, the District in consultation with USFWS, FWC and the FDEP, will determine the necessity of continuing and/or changing the monitoring outlined herein.

3.0 Geographic Location

The PSMM project consists of three (3) stations within Collier County (Figure 1). Table 1 provides the station names, GPS coordinates, and a description of each monitoring location. The locations of all monitoring sites are depicted on the map in Figure 1.

Table 1: PSMM Surface Water Monitoring Sites and GPS Coordinates

Station	Latitude (ddmmss.sss)	Longitude (ddmmss.sss)	Description
FAKAUPOI	255721.384	813037.836	Faka Union Canal @ entrance to Port of the Islands marina
MMNP[1]	255644.676	813037.948	Middle of the northern artificial pool
TTI70B	255530.453	255530.453	Faka Union Canal

The standard positional goal for station coordinates is detailed in the Water Quality Monitoring Station Registration SOP (SFWMD-FIELD-SOP-031). Coordinates are relative to NAD83 HARN horizontal datum.

[1]An evaluation of preliminary data did not result in moving monitoring from MMNP.

4.0 Field Activities

4.1 Monitoring Frequencies and Parameters Collected

All monitoring parameters, frequencies of collection and locations are listed in Table 2. Some analytes may be reported by the lab that are not requested by the project.

Table 2: PSMM Station Frequency and Parameter TESTS

Station	Collection Method	Frequency	Parameter TESTS
FAKAUPOI, TTI70B	Grab	Monthly[1] (M)	Ammonia (NH4), Nitrate-Nitrite (NOX), Total Nitrogen (TN), Total Phosphorus (TP)
MMNP	Grab	M[1]	NH4, NOX, TN, TP
	In-Situ Grab	M[1]	Dissolved Oxygen (DO), pH (PH), Specific conductance (SCOND), and Temperature (TEMP)
	Sonde	Continuous[2]	Specific conductance (SCOND), Stage[3] (calculated), and Temperature (TEMP)

[1]Collected only during the Feature's operational period (December 1 to April 1)

[2]Collected at three (3) depths (bottom, mid, surface) at regular intervals (e.g. 60-minute) using near-real time telemetry (SFWMD-FIELD-SOP-013).

[3]Stage will be calculated by relating depth in the pool (a pressure sensor is installed at S489) to stage of the feature measured at the S489 staff gauge.

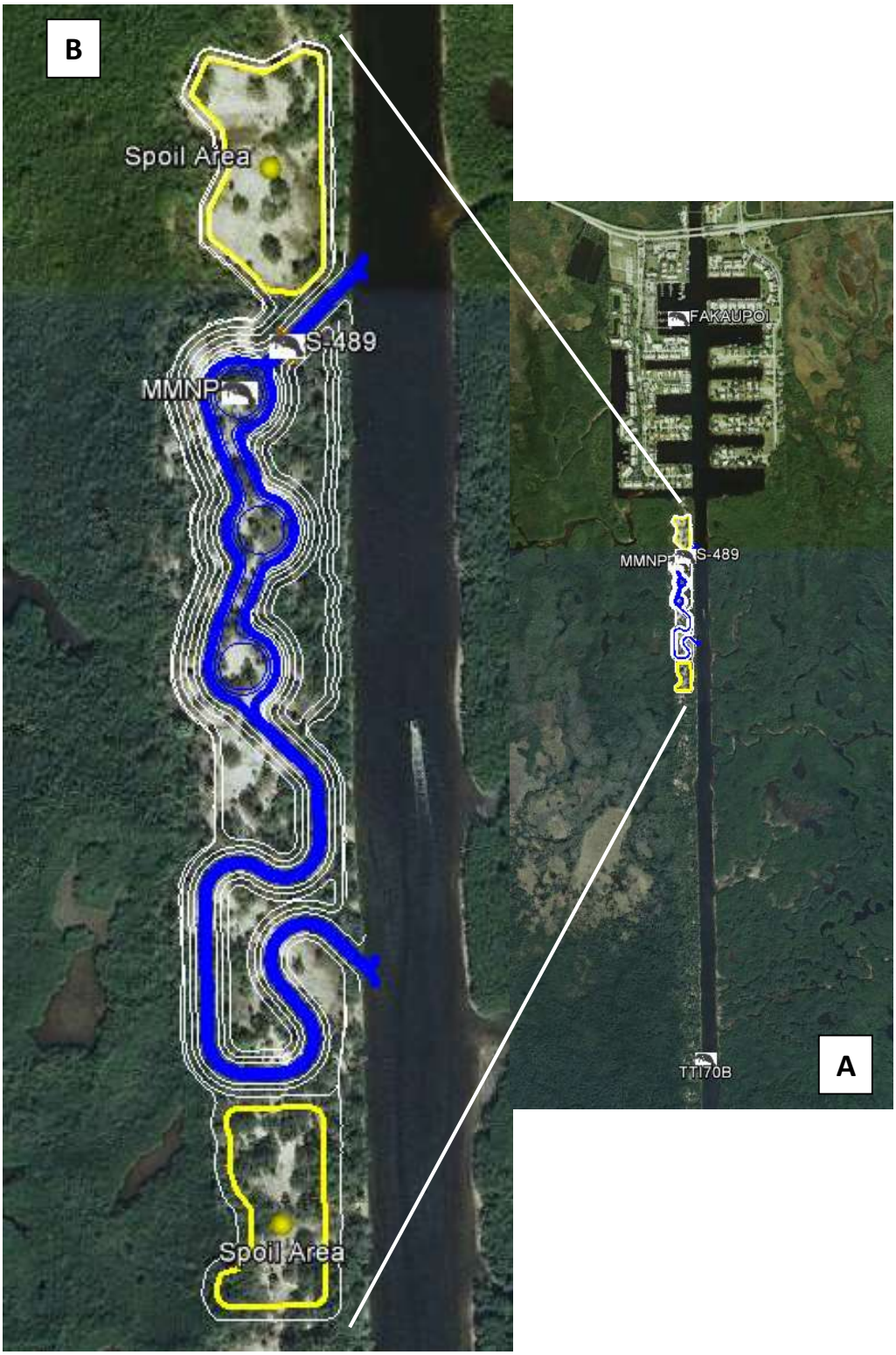

Figure 1: PSMM Site Locations (A). Exploded view (B) detailing the feature

4.2 Project Specific Guidelines

All surface water grab samples are collected on the upstream side of any structure at a depth of 0.5 meters unless collection of a representative sample is inhibited by vegetation and/or other conditions. If an alternative sampling location is required, a consultation with a Science Technician Supervisor and/or the Field Project Manager (FPM) must take place prior to the sampling being collected; this action must be documented in the field notes.

Surface water quality samples will be collected only during those months the project is expected to operate (December 1 through April 1). Field parameters (specific conductance and temperature) will be collected continuously at three (3) depths (bottom, mid, surface) at regular intervals (e.g. 60-minute) with near-real time (telemetry-based) data available from MMNP with station names corresponding to depth (i.e., MMNP-B, MMNP-M and MMNP-S).

Three vertical temperature strata will be continuously monitored (60-minute intervals) during the winter season from December 1 through April 1 in accordance with the WQM *Sonde Deployment and Data Retrieval* SOP (SFWMD-FIELD-SOP-013), for three (3) full operational seasons following the plugging the Faka Union and Miller Canals and the construction of the SWPF.

Isotope sampling was suspended with concurrence of the FDEP (see Section 2.0).

When collecting a surface water sample, field staff will also record water depth to the nearest 10 cm at the S489 staff gauge and will also record the time of the reading.

4.3 Grab Sampling Procedures

Sample collection for this project follows the procedures and requirements found in the *Grab Sampling Protocol* section of the WQM FSM. Project-specific deviations are detailed in Section 4.2.

4.4 Field Parameters

The collection of field parameters follows the procedures and requirements outlined in the *Instrument Calibration and Field Measurements* section of the WQM FSM. Project-specific deviations are detailed in Section 4.2.

4.5 Field Quality Control Requirements

Field quality control requirements shall follow the procedures found in the *Field Quality Control Measurements and Requirements* section of the WQM FSM. Project-specific deviations are detailed in Section 4.2.

4.6 Autosampler Collection

There is no requirement for the use of autosamplers for this project.

4.7 Sample Submission

If the District laboratory is to be used, samples are transported to the laboratory and submitted for analyses in accordance with the requirements specified in the WQM FSM. Samples are submitted to the laboratory on the same day as collection or via courier the following day. Sample acceptance criteria are detailed in Section 6 of the CLQM. If samples are submitted to another laboratory, it must meet the contract laboratory requirements as specified in Section 5.2 below.

5.0 Data Quality Objectives (DQOs)

5.1 Data Usage

The data from this project are compiled and are summarized in an annual report in accordance with the conditions outlined in the associated mandate.

5.2 Data Quality

All monitoring described herein meet the requirements conveyed in the FDEP's QA Rule, 62-160 F.A.C. The District has adopted a uniform set of DQOs following criteria detailed within the *Analytical Methods and Default QA/QC Targets* table of the CLQM.

Field parameter DQOs are described in the *Field Instrument Minimum Accuracy Requirements* table found in the *Instrument Calibration and Field Measurements* section of the FSM. The most recent version of the FSM details the specific field testing DQOs at the time of sample collection.

Samples are analyzed according to the provisions within the FDEP QA Rule, 62-160 F.A.C. and the CLQM. The most recent version of the CLQM details DQOs at the time of sample collection for each specific laboratory analysis. Data are qualified in accordance with the FSM, CLQM and applicable data validation SOPs.

Contract laboratories must be certified through the National Environmental Laboratory Accreditation Program (NELAP) for the submitted samples' analyses, and the DQOs for those analyses must meet or exceed the District laboratory's DQOs (*sensu* CLQM). Analyses performed by contract laboratories must comply with DQOs derived with the assistance of the District Laboratory Manager and/or Data Validation Unit Section Leader and specified in this monitoring plan.

5.3 Completeness Target

The completeness target (i.e., the number of samples successfully collected and analyzed, as a percentage of those that were planned) has been set at 95% annually for this project. Sampling attempts shall be included in the completeness target. At times samples will not be able to be collected due to no flow or low water conditions, unsafe station conditions, equipment malfunction, site maintenance, tropical storms/hurricanes or other unforeseen problems that might affect sample collection and/or quality. If samples cannot be collected on an attempt, collectors shall document the sample as a "NOB" to

indicate an attempt was made and/or the sample could not be collected for the documented reasons.

6.0 Data and Records Management

The District evaluates data in accordance with the data quality objectives stated in the District's FSM and CLQM. All data submittals shall conform to existing District guidelines. Contract laboratory data shall be submitted to the District in the ADaPT format or another format as requested by the District.

6.1 Contract Deliverables

Contract laboratory and/or field data and documentation are submitted to the District in the ADaPT format and/or another format as requested by the District. The Contract laboratory shall evaluate the data in accordance with the DQOs defined in the FSM and/or CLQM. All contract field and laboratory data and documentation submittals shall conform to existing FSM, CLQM, applicable SOPs and/or other formats as requested by the District.

6.2 Data and Record Storage

After the data validation process, all data and records are maintained so that end users can retrieve and review information relative to a sampling event. Field records are maintained in accordance with the *Archive Records Storage and Retention* SOP (SFWMD-FIELD-SOP-022). All analytical data and specified metadata are sent to the DBHYDRO database for long-term storage and retrieval.

The District shall maintain master copies of field and laboratory generated records. It is the responsibility of the District to maintain both records of current and historical methodologies and operating procedures so that at any given time the conditions that were applied to a sampling event can be evaluated.

Field records storage protocols are outlined in the *Archive Records Storage and Retention* (SFWMD-FIELD-SOP-022). Corrections of field data or records must follow the applicable WQM *Correction of Field Records SOP* (SFWMD-FIELD-SOP-032) and the FSM. Corrections to data in DBHYDRO must follow *Data Investigations and Corrections* (SFWMD-DVS-SOP-010).

7.0 References

FDEP (Florida Department of Environmental Protection). Quality Assurance Rule, 62-160 Florida Administrative Code (F.A.C.). April 16, 2018.

SFWMD (South Florida Water Management District). *Archive Records Storage and Retention*, SFWMD-FIELD-SOP-022, Water Quality Monitoring Section

SFWMD (South Florida Water Management District). *Chemistry Laboratory Quality Manual (CLQM)*, SFWMD-LAB-QM-2021-001 or most current effective version. Analytical Services Section.

SFWMD (South Florida Water Management District). *Correction of Field Records*, SFWMD-FIELD-SOP-032, Water Quality Monitoring Section

SFWMD (South Florida Water Management District). *Field Sampling Manual (FSM)*, SFWMD-FIELD-FSM-001, Water Quality Monitoring Section.

SFWMD (South Florida Water Management District). *Field Quality Manual (QM)*, SFWMD-FIELD-QM-001, Water Quality Monitoring Section.

SFWMD (South Florida Water Management District). *Data Investigations and Corrections*, SFWMD-DVS-SOP-010, Data Validation Services Unit.

SFWMD (South Florida Water Management District). *Sampling Flow-Related Stations*, SFWMD-FIELD-SOP-027, Water Quality Monitoring Section.

SFWMD (South Florida Water Management District). *Sonde Deployment and Data Retrieval*, SFWMD-FIELD-SOP-013, Water Quality Monitoring Section

SFWMD (South Florida Water Management District). *Station Registration*, SFWMD-FIELD-SOP-031, Water Quality Monitoring Section

SFWMD (South Florida Water Management District). *Water Quality and Applied Sciences Bureaus Quality Management Plan (QMP)*, SFWMD-QS-QM-001. Applied Sciences and Water Quality Bureaus.

8.0 Revisions and Modifications

Version	Date	Section	Notes
00	12/12/2014	All	Original CMP
01	12/27/2015	Section 4.0; Tables 1 & 2; Figure 1	Clarified language stating the deployed sondes would only measure specific conductance and temperature. Added the name of the gated structure (S-489) and the changed the "proposed sampling location" name to MMNP (Manatee Mitigation north pool)
02	02/11/2016	Table 2	Modified to reflect agreement between District and FDEP staff to eliminate Stage and Flow from the project. Depth will be used for a stage calculation and be available from the deployed sondes.
03	07/13/2021	All	Included language suspending the collection of isotope samples with FDEP concurrence (7/13/21) until after all PSRP canals are plugged and construction of the SWPF is completed; updated format and boiler plate language to match most recent CMP template; some project-specific language was updated for clarification and accuracy. Eliminated Appendix 2 because there is not Hg or other toxicant sampling associated with this project.

Appendix 1: Picayune Strand Restoration Project Manatee Monitoring Plan

Evaluation of Effects of Backfilling Merritt Canal on Flows to Port Of the Islands BASIN

When the north-south portion of Merritt Canal is plugged, the east-west portion of the canal at the southern end of the Picayune Strand Restoration Project (PSRP) will remain open and continue to capture flows moving to the south. Thus, the current level of flow into the Port of the Islands (POI) Basin should remain essentially the same after the north-south section of Merritt Canal down to 126th Avenue is plugged. However, monitoring will be conducted to ensure that plugging the Merritt Canal does not cause significant changes to the conditions in the POI Basin.

South Florida Water Management District (SFWMD) currently monitors flows over Faka Union Weir #1 and three rainfall stations SGGEWX (NW), Collier Seminole State Park (SW) and Dan House Prairie (SE) within or near the PSRP. The data are stored within SFWMD's DBHydro database. An equation developed by the United States Geological Survey (USGS) uses these four datasets to correlate canal flows from the lower Faka Union Canal into POI Basin with rainfall within the upstream watershed.

The USGS equation described above will be used to assess whether the monthly flow-rainfall relationship has been significantly altered by filling the north-south portion of Merritt Canal. This relationship will be evaluated for one winter season (December 1 to April 1) following the start of Merritt Canal plugging. If canal plugging begins between December 1 and April 1, monitoring will occur through April 1 of that dry season and be repeated the next winter season from December 1 through April 1. If canal plugging begins between April 1 and November 30, monitoring will occur during the next winter season from December 1 through April 1. The actual plugging of the canals will take approximately three to four months. If no significant changes to flows are observed, the evaluations will be discontinued after one full winter season (December 1 to April 1); however, if a significant change is observed using the equation developed by USGS, as a function of plugging Merritt Canal, the U.S. Army Corps of Engineers (Corps) and SFWMD will consult with U.S. Fish and Wildlife Service (USFWS) and Florida Fish and Wildlife Conservation Commission (FWC) to determine if any additional action(s) are needed or required. Information will be analyzed and reported on a monthly basis.

Additionally, 2006 Comprehensive Everglades Restoration Plan (CERP) Manatee Construction Guidelines (CERP Interagency Manatee Task Force 2006) will be implemented for all construction phases while working in canals accessible to manatees.

Post-construction Manatee Monitoring

Post-construction manatee monitoring for the PSRP will begin with the plugging of all canals within the project. The Faka Union Canal conveys the largest amount of water to POI Basin; therefore, plugging the Faka Union Canal will likely alter freshwater flows into POI Basin more significantly than plugging of the Merritt or Miller canals. Therefore, if the Faka Union Canal is plugged prior to the Miller Canal, post-construction monitoring will begin following the

construction of the first Faka Union Canal plug. As freshwater flows into POI Basin are reduced, the manatee refugium at POI Basin will likely be altered.

The Faka Union and Miller Canals will not be plugged until Endangered Species Act (ESA) consultation on the West Indian Manatee is complete and a manatee mitigation feature has been implemented in the POI Basin to compensate for the reduction in freshwater flows into POI Basin. The project is phased so that each pump station will begin operations when complete, with the Miller pump station completed last. When all pump stations are completed, the manatee mitigation feature and western protection features are functional, and all canals are plugged, the project can begin to achieve estuarine benefits. One goal of PSRP was to redistribute freshwater flows to the estuaries and reduce the point discharge from the Faka Union Canal. It is this point source discharge from the Faka Union Canal that is responsible for the current manatee refugium within the POI Basin. As a result of restoration, this artificial refugium will be altered, thus the need for the manatee mitigation feature. As natural freshwater flows are reestablished in the estuaries south of Picayune Strand, it is anticipated that manatees will begin to utilize these natural areas once again. The PSRP acknowledges that manatees have become reliant upon the POI Basin refugium; therefore monitoring will be conducted in the POI Basin beginning the first winter season from December 1 through April 1 as identified in Table D-1. Manatee observations as described in Table D-1 will be conducted by a qualified marine species observer as outlined within the 2006 Guidelines for Manatee Conservation during Comprehensive Everglades Restoration Plan Implementation (CERP Interagency Task Force 2006). Post-construction seagrass surveys are included in the overall PSRP Monitoring Plan and will be included in results of manatee monitoring.

Table D-1: Proposed Picayune Strand Restoration Project Manatee Monitoring Plan

FEATURE	OBJECTIVE	TASK	DURATION	TARGET
Merritt Canal (begin monitoring with construction of first plug)				
Begin evaluating flows at Faka Union-1 (FU-1) and rainfall after the start of Merritt canal plugging.	Determine if significant changes occur to flows at FU-1 at times when rainfall would historically maintain the manatee refugium at POI.	Evaluate stage and rainfall at FU-1 using DBHydro and rainfall (SGGEWX [NW]; Collier Seminole State Park [SW] and Dan House Prairie [SE]) monthly using equation developed by USGS (Sloan et al., 2013) to determine if significant changes occur. Assumption: Headwater stages above 2.34 feet NAVD88 at FU-1 would result in halocline formation and resultant thermal refuge.	If the canal plugging begins between December 1 and April 1, monitoring will occur through April 1 of that winter season and be repeated the next winter season from December 1 through April 1. OR If canal plugging begins between April 1 and November 30, monitoring will be conducted for one full winter season from December 1 through April 1.	Maintain stage/rainfall correlation within 95% confidence limits of prediction based on 7 years of winter rainfall data for first full winter season following canal plugging. If stage/rainfall correlations met after one year (December 1-April 1 time period), determine no effect. If stage/rainfall correlations not met after one year, identify if rainfall patterns were outside of original model period of record (2003-2004 to 2009-2010). If yes, repeat analysis for one more year. If no, initiate consultation with FWS/FWC on manatee effects due to Merritt and potential additional effects from Miller and Faka Union canal plugging.

FEATURE	OBJECTIVE	TASK	DURATION	TARGET
Post-Construction Monitoring (all canals plugged – Prairie, Merritt, Miller, Faka Union)				
If construction of the manatee mitigation feature is completed between April 1 through November 30 monitoring will start the following December 1. OR If construction of the manatee mitigation feature is completed from December 1 through April 1 monitoring will start immediately through April 1 and restart the next winter season (December 1 to April 1).	Determine success of the manatee mitigation feature following the completion of the PSRP at times when rainfall would historically maintain the manatee refugium at POI.	1. Monitoring of vertical temperature strata using data loggers. Vertical temperature strata to include bottom, middle, and upper depths. These depths will be determined during mitigation feature design. At least one temperature logger would be telemetry-based for real time transmission of data to determine cold events. 2. Isotope analysis – collect water isotopes to determine 18O/16O and 2H/1H ratios. Monthly (December 1 to April 1) The bottom depth would be determined during mitigation feature design.	1. Collect and evaluate temperature data monthly during winter season (15 to 30 minute intervals with data loggers) collected and evaluated monthly from December 1 to April 1. Monitor for 3 years then re-evaluate in consultation with USFWS and FWC using decision matrix with options to continue or discontinue monitoring. Isotope data would be collected monthly (December 1 to April 1) and during moderate to severe cold weather events. 2. First test performed immediately following completion of construction of the manatee mitigation feature (construction contract). Duration: Monthly (December 1 to April 1) for 3 years at the beginning of winter season. Re-evaluate after 3 years in	1. Maintain vertical temperature strata with bottom layer at least 20°C during moderate to severe cold weather events at times when rainfall would historically maintain the manatee refugium at POI. 2. Confirm presence of groundwater isotopes and trend in bottom layer. Moderate to severe whether events occurred: a. If groundwater isotopes are confirmed within mitigation refugium area and bottom temperatures remain at or above 20 degrees Celsius during moderate or severe cold weather events for 3 full winter seasons - monitoring will be discontinued. b. If isotopes are confirmed but temperature threshold is exceeded, monitor for additional 3 years and reevaluate. c. If isotopes are not confirmed, evaluate rainfall/stage equation to determine if halocline formation would have likely formed. If no, continue monitoring for additional 3

FEATURE	OBJECTIVE	TASK	DURATION	TARGET
			consultation with USFWS and FWC.	years. If yes, initiate consultation with USFWS and FWC on potential manatee effects. d. If no moderate to severe whether events occur, continue monitoring for 3 more years.
Manatee Observations	Determine if manatees are using the manatee mitigation feature.	Manatee use*: 1. Manatee mitigation feature and; 2. POI Basin *: Manatee Observation protocol will be developed in conjunction with USFWS and FWC.	Winter season for up to 10 years following completion of the manatee mitigation feature within: 1. Manatee mitigation feature area beginning the next day following a cold event (water temperature below 20°C) for 2 days. Based upon information provided from data loggers described in post-construction monitoring. 2. POI Basin area for 2 days beginning the next day following a cold event (water temperature below 20°C) **and** when FU-1 stage is below 2.34 feet NAVD88. The PSRP Monitoring and Assessment Group (MAG)	Determine presence and number of manatees within: 1. <u>Manatee mitigation feature</u> Confirm presence of manatees within the feature for 3 cold weather events (2 moderate and 1 severe) during the period between December 1 to April 1. 2. <u>POI Basin</u> Confirm presence of manatees within the POI Basin for 3 cold weather events (2 moderate and 1 severe) during the period between December 1 to April 1. Discontinue task if target (letter a below) reached. a. If manatees are present in manatee mitigation feature during 3 cold events and the feature is working (hydrology/temperature criteria), then discontinue monitoring.

FEATURE	OBJECTIVE	TASK	DURATION	TARGET
			will meet annually to assess monitoring data. After three cold events (two moderate and one severe), the PSRP MAG will reassess need for further manatee observation monitoring requirements.	b. If moderate to severe cold events occur and manatee mitigation feature is not working (hydrology/temperature criteria) and halocline would not have formed based on USGS equation analysis of rainfall and stage, then continue monitoring for additional 3 years. c. If manatees are not present in manatee mitigation feature during cold events and mitigation feature is working (hydrology/temperature criteria), then coordinate with FWC/USFWS to evaluate potential manatee effects. d. If manatees are not present in manatee mitigation feature during cold events and mitigation feature is not working (hydrology and temperature criteria), and halocline would have formed based on USGS equation analysis of rainfall and stage; then coordinate with FWC/USFWS.

*A moderate cold event is described as ambient water temperatures fall below 20^{o}C for a period of 14 days. A severe cold event is defined as ambient water temperatures (as indicated by monitoring well located at mouth of Faka Union Canal) fall below 20^{o}C for 25 days or fall below 15^{o}C for a period of 14 days.

Additional Monitoring

The following monitoring data is included in this monitoring plan solely per request of FWC and USFWS. All data are collected and funded by FWC/USFWS and will be considered in determining manatee use in area. These data are not considered as factors in determining the success of the manatee mitigation feature. Any data that are available and determined to be of use by FWC/USFWS will be coordinated with the Corps/SFWMD.

1. Boat Strike Data: FWC and USFWS boat strike data may be used to assess post-construction manatee distribution changes in POI Basin area. Data will be provided to Corps and SFWMD for review, if available and produced by FWC/FWS. Data will be assessed until manatee mitigation feature success criteria are met.
2. Mortality/Morbidity Data: FWC/FWS data regarding manatee mortality and morbidity related to regional cold stress data may be used to assess post-construction cold stress effects on manatees in the POI Basin area. Data will be provided to Corps and SFWMD for review, if available and produced by FWC/FWS. Data will be assessed until manatee mitigation feature success criteria are met.

Vertical Temperature Strata

Three vertical temperature strata will be continuously monitored, as defined in Table D-1, during the winter season from December 1 through April 1 for three full winter seasons following the beginning of plugging the Faka Union and Miller Canals to determine the temperature in the water column within the manatee mitigation feature. Vertical temperature strata will include bottom, middle, and upper depths. These depths will be determined during mitigation feature design. Prolonged water temperatures below 20 degrees Celsius can lead to cold stress syndrome in manatees (Bossart et al. 2003). The current refugium in the POI Basin functions as a temperature inverted thermocline/halocline; it is expected that the manatee mitigation feature will serve as a manatee refugium by establishing a connection with warmer saline groundwater. It is important to monitor the vertical temperature strata to determine whether the manatee mitigation feature serves as a refugium in light of the post-construction reduction in point source discharge of freshwater inflows to POI Basin.

Isotope Analysis

Isotope analyses will be conducted following resumption of sampling after all PSRP canals are plugged and the SWPF is completed, on the bottom water layer of the manatee mitigation feature monthly (December 1 to April 1) for three years to verify the presence of groundwater within the manatee mitigation feature. USGS conducted studies from 2009 to 2011 of the isotope signatures in the POI Basin and determined that there is currently no groundwater connection in the relatively shallow POI basin; furthermore, they identified the unique isotope signatures of groundwater, water from the Gulf of Mexico, and freshwater from the

Faka Union canal. These data can be used to determine the presence or absence of a groundwater connection once the manatee mitigation feature is completed.

Evaluation of Boat Strike and Mortality/morbidity Data

Boat strike and mortality/morbidity data collected by the USFWS and FWC will be evaluated to observe patterns of changes in distribution and occurrence of cold stress in manatees within the POI basin. Collection of these data will not be funded by SFWMD or USACE; however, SFWMD and USACE biologists can utilize these already available data to help evaluate possible post-construction changes in manatee boat strikes and mortality/morbidity patterns

Manatee Observations

Manatee observations will be performed within the POI Basin and manatee mitigation feature to determine if manatees are using the new refugium. Observations will be conducted once a day within the manatee mitigation feature the next day following a cold event where the ambient water temperature reaches 20°C or less for two days following the cold event. Observations will be conducted in the POI Basin under the same temperature condition and duration with the additional requirement that the stage at the FU-1 is less than 2.34 feet NAVD88 as determined critical by the USGS trigger analysis. Manatee observations as described in Table D-1 will be conducted by a qualified marine species observer as outlined within the 2006 Guidelines for Manatee Conservation during Comprehensive Everglades Restoration Plan Implementation (CERP Interagency Task Force 2006).

References

Bossart, G.D., Mesiner, S.A., Ghim, S-J, Jenson, A.B. 2003. Pathological features of the Florida manatee cold stress syndrome. *Aquatic Mammals* 29 (1): 9-17.

CERP Interagency Task Force, 2006. Guidelines for Manatee Conservation during Comprehensive Everglades Restoration Plan Implementation. CERP Interagency Task Force, U.S. Fish and Wildlife Service, South Florida Ecological Services Office, Vero Beach, Florida, USA.

Slone, D.H., Reid, J.P., Stith, B.M., Langtimm, C.A., Butler, S.M., Swain, E.D., Wolfert, M.A., Renken, R.A., Decker, J.D, Pantino, E. 2008. Assessing PSRP effects on the Florida manatee, Scope of work, 23 pages (unpublished)

Slone, D. H., J. P. Reid, B. M. Stith, S.M. Butler, T. W. Green, E. Patino, and L. Soderqvist. 2009. Hydrological Monitoring and Analysis to Assess Effects of the Picayune Strand Restoration Project on the Florida Manatee. U.S. Geological Survey Technical Report Series XXXX-XXXX. Appendix 3: Prediction of Stage and Flow over the FAKA-1 Weir at Port of the Islands, Collier County Florida USA.