Appendix D: STA Water Quality Monitoring Plans

Operational Project Monitoring Plan

For

Eastern Flow-Way
Stormwater Treatment Area 1 East

(STA1E)

01/08/2013

This monitoring plan is adaptive and therefore subject to change based on operational needs. It will be reviewed and/or modified at a minimum, on an annual basis.

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

SFWMD-FIELD-MP-046-03

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1.0 Glossary

ACF	Autosampler collection based upon flow trigger
CLQM	Clinical Laboratory Quality Manual
DBHYDRO	South Florida Water Management District Environmental Database
DQOs	Data Quality Objectives
ECP	Everglades Construction Project
EFA	Everglades Forever Act
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FSQM	Field Sampling Quality Manual
GPS	Global Positioning System
LIMS	Laboratory Information Management System
NPDES	National Pollutant Discharge Elimination System
PSTA	Periphyton-based Stormwater Treatment Area
SFWMD	South Florida Water Management District
STA1E	Stormwater Treatment Area 1 East
USACE	United States Army Corps of Engineers
WCA-1	Water Conservation Area 1

2.0 Project Organization

Overall project organization and responsibilities are detailed in the South Florida Water Management District (SFWMD or District) Applied Sciences (ASB) and Water Quality Bureau (WQB) Quality Management Plan (QMP). Field activity responsibilities are detailed in the District's Field Sampling Quality Manual (FSQM). Laboratory analysis and data validation responsibilities are detailed in the District's Chemistry Laboratory Quality Manual (CLQM). These documents define the procedures used by SFWMD personnel to meet the Florida Department of Environmental Protection's (FDEP) Quality Assurance (QA) Rule, Florida Administrative Code (F.A.C.) 62-160. Refer to these documents for details on key personnel and relevant responsibilities.

3.0 Project Description

3.1 Introduction and Background

This document serves as a reference for surface water quality monitoring for Stormwater Treatment Area 1 East (STA1E). The operational plan for this project contains detailed structure specifications including brief descriptions of the mandate and/or permit required monitoring at each station. Current project status, schematics and the project operational plan can be viewed at the District's STA status page.

Surface water monitoring at STA1E began in 2004, as part of the Everglades Construction Project (ECP). STA1E's mandated stations consist of the STA1E inflows at G-311, S-319 and S-361; STA1E outflow station S-362 and diversion stations G-300. The construction, operation and maintenance of this Everglades Construction Project are required by the Everglades Forever Act (EFA) to restore the Everglades ecosystem. The guidance contained in this document will assist in maintaining consistency in sampling locations, parameter lists, and frequencies as well as providing documentation of the project scope and an ongoing historical perspective.

3.2 Mandates and Permits

Station locations, sampling frequencies, and parameters to be sampled are dictated by the mandate and/or permits governing this project (see Appendix 1 for details). In addition, a mercury and toxicants monitoring program required by Everglades Forever Act Permit (0311207) is included as Appendix 2.

As part of the Eastern Flow-way for the Everglades Construction Project, STA1E is subject to both the Everglades Forever Act Permit #0311207 and the National Pollutant Discharge Elimination System Industrial Wastewater Facility (NPDES) Permit FL0778451, both issued on September 10, 2012 and expiring on September 09, 2017. These permits dictate the types and frequencies of monitoring to be done, and the parameters to be analyzed, and can be viewed at:

- Everglades Forever Act Permit
  http://www.dep.state.fl.us/water/wqssp/everglades/docs/ecp-sta/draft-watershed-efa-permit.pdf
- NPDES Permit

http://www.dep.state.fl.us/secretary/news/2012/06/npdes_watershed_permit_consent_order.pdf

Additional stations, parameters and frequencies are required as part of operational monitoring are detailed in Appendix 1.

3.3 Project Objectives

The primary objectives of this monitoring project are:

1. Assess compliance with applicable water quality standards and phosphorus discharge limits;
2. Aid in determining the nutrient concentrations to quantify the tons of nutrients removed by the STA annually;
3. Guide mid and long term resource management decisions for nutrient removal capabilities of the STA.

3.4 Duration

3.4.1 Initiation Conditions

The monitoring for this project was initiated at S-319 on September 30, 2004, in response to start-up phase of this project.

3.4.2 Modification or Termination Conditions

The mandated monitoring described in this document will be ongoing as required by the EFA 0311207 and NPDES FL0778451 permits, which are renewed once every 5 years. Conditions for modification or termination of the project are detailed in the permit(s) that specify the conditions of the project. Monitoring for operations will continue indefinitely in support of the project goals and objectives. Monitoring may increase or decrease over time, depending upon individual cell operations, data results, end user needs and permit requirements. Short-term changes to collection events may be made as a result of an extreme weather conditions (i.e., droughts and tropical storms/hurricanes), other safety concerns, or construction activities.

4.0 Geographic Location

4.1 Regional Area

The locations of all monitoring stations are depicted on the map in Figure 1.

4.2 Sampling Locations

The locations of all monitoring stations are depicted in Figure 1 with exact locations described in Table 1.

4.3 Access and Authority

The gates on roadways into STA1E are secured with a District Palm Beach County “W” lock. The lock requires a “W” key which can be obtained through a request made through the FPM and/or Field Supervisor. Access to STA1E is from either SR80 just east of the

1st entrance to S5A pump station; the two main access points are along the eastern STA1E border (off Flying Cow Road) and along the western border. Samples are collected on the upstream side of structures/culverts.

Table 1: Surface Water Sites, GPS Coordinates and Descriptions

Station Name	Latitude	Longitude	Description
G300	264038.3	802146.99	Gated structure on western edge of ST1E receiving water from S5A Inflow & Distribution Basin and diverting it to the L-40 Canal.
G311	264045.921	802148.812	Inflow gated structure into western distribution cell from I & D basin
S319	264054.935	801934.035	Primary inflow pump station – C51 canal into eastern distribution cell
S361	263854.913	801857.858	Seepage return flow pump station into cell 4S.
S362	263733.001	801903.378	Primary outflow pump station into L-40 canal
S363C	264036.357	801816.797	Cell 1 East inflow (start)
S364A	263948.334	801844.934	Cell 1 west outflow/cell 2 inflow (interior)
S364C	263948.235	801808.547	Cell 1 west outflow/cell 2 inflow (interior)
S365A	263901.257	801841.894	Cell 2 west outflow (end)
S365B	263901.268	801814.611	PSTA/cell 2 east outflow (end)
S366B	264035.799	801934.561	Cell 3 west inflow (start)
S366D	264035.736	801913.657	Cell 3 east inflow (start)
S367B	263948.481	801935.814	Cell 3 west outflow/cell 4N inflow (interior)
S367D	263948.434	801912.64	Cell 3 east outflow/cell 4N inflow (interior)
S368B	263856.055	801938.781	Cell 4N west outflow/cell 4S inflow (interior)
S368D	263856.009	801917.364	Cell 4N east outflow/cell 4S inflow (interior)
S369B	263752.508	801933.491	Cell 4S west outflow (end)
S369C	263744.6	801920.132	Cell 4S east outflow (end)
S370A	264035.95	802039.098	Cell 5 west inflow (start)
S370C	264035.861	802001.915	Cell 5 east inflow (start)
S371A	263948.787	802042.717	Cell 5 west outflow/cell 6 inflow (interior)
S371C	263948.689	802004.159	Cell 5 east outflow/cell 6 inflow (interior)
S372B	263835.157	802025.762	Cell 6 west outflow (end)
S372D	263814.51	802005.169	Cell 6 east outflow (end)
S373A	264037.348	802133.86	Cell 7 west inflow (start)
S373B	264036	802102.77	Cell 7 east inflow (start)
S374A	263948.67	802113.836	Cell 7 west outflow/cell 6 inflow (interior)
S374C	263948.641	802056.292	Cell 7 east outflow/cell 6 inflow (interior)

The standard positional goal for site coordinates is ±1 meter. This standard can be obtained with a professional grade DGPS system. The coordinates are relative to NAD83 HARN horizontal datum.

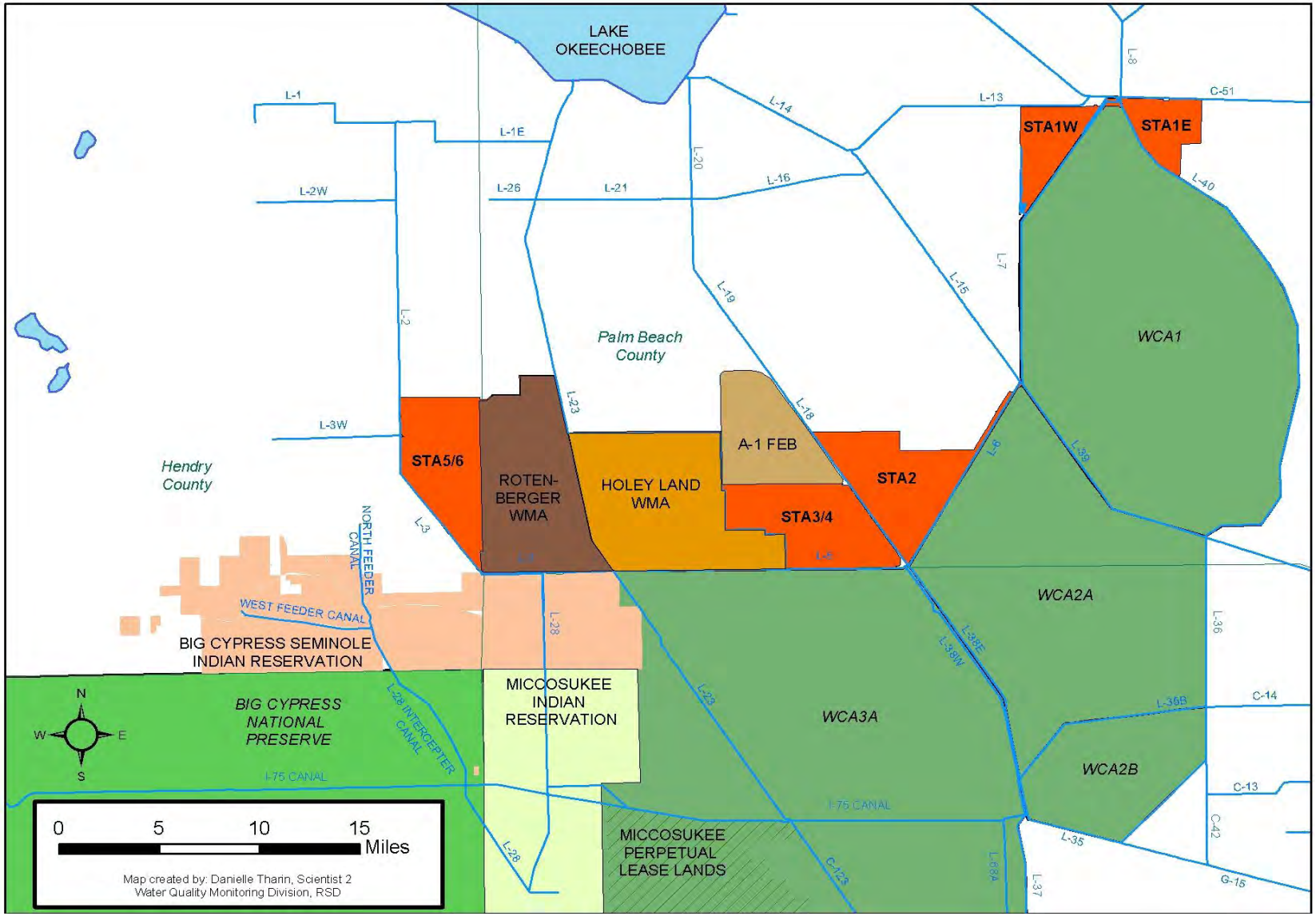
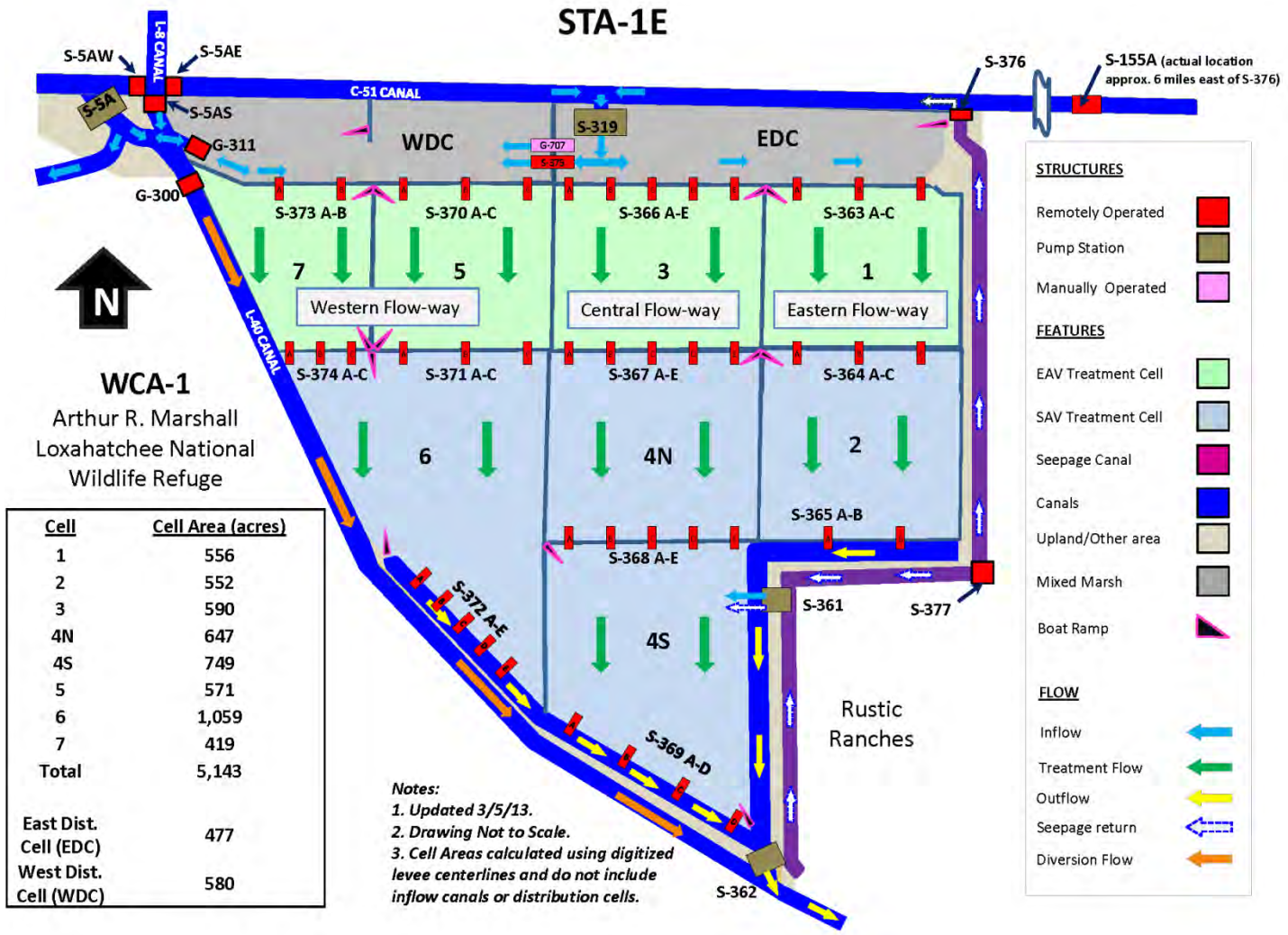


Figure 1: Stormwater Treatment Areas



Cell	Cell Area (acres)
1	556
2	552
3	590
4N	647
4S	749
5	571
6	1,059
7	419
Total	5,143
East Dist. Cell (EDC)	477
West Dist. Cell (WDC)	580

Figure 2: STA1E Layout Map

5.0 Field Activities

5.1 Monitoring Frequencies by Site and Parameters

All samples required for collection are depicted in Table 2. As of August 1, 2011, the STA Operation sites will be monitored according to weekly, biweekly or monthly recorded flow with autosamplers disabled at these sites as of September 2011. Some stations within the monitoring network are collected based on whether flow has been recorded. Specifically, structure operation activity is determined within a specified timeframe through the review of electronic data. If no flow (i.e., no operations) has been recorded, the sample is considered a No Bottle sample (NOB) and the structure is not visited. Conversely, if flow has been recorded during the specified timeframe, a sample is collected.

5.2 Project Specific Guidelines

All surface water samples shall be collected on the upstream side of any structure at a depth of 0.5 m unless vegetation and/or other conditions inhibit the collection of a representative sample upstream. Prior to sampling an alternative site, a consultation with a Field Technician Supervisor and/or the FPM must take place; this action must be documented in the field notes.

Backup grab samples will accompany the autosampler collection based upon flow trigger (ACF) samples collected on a weekly basis. In addition, in situ readings (i.e., Temperature, pH, DO and Specific Conductance) are measured as the grab samples are being collected. Samples are collected are on the upstream side of structures or culverts.

5.3 Grab Sampling Procedures

Sample collection for this project shall follow the procedures and requirements found in the Field Sample Collection Procedures Section of the District's FSQM.

Table 2: STA1E Grab/Autosampler Sample Frequency and Parameters

Station	Collection Method	Frequency	Parameter ACODES
Outflow Station			
S362	Grab	Weekly	OPO_4, TPO_4, DO, pH, Scond, Temp
		Biweekly	ALKA, Ca, Cl, NH_4, NOx, SO_4, $TDPO_4$, TKN, TSS
	ACF	Weekly	TPO_4
Inflow Stations			
G311 S319 S361	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
		Weekly Recorded Flow	ALKA, Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
		Quarterly	DOC
	ACF	Weekly	TPO_4
Diversion Station			
G300	Grab	Weekly	OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
		Biweekly	ALKA, NOx, SO_4, TKN

Station	Collection Method	Frequency	Parameter ACODES
Flow Way Start Stations			
S363C **S366B** **S366D** **S370A** **S370C** **S373A** **S373B**	Grab	Biweekly Recorded Flow	Ca, TPO_4, DO, pH, Scond, Temp
Flow Way Interior Stations			
S364A **S364C** **S367B** **S367D** **S368B** **S368D** **S371A** **S371C** **S374A** **S374C**	Grab	Monthly Recorded Flow	Ca, OPO_4, $TDPO_4$,TPO_4, DO, pH, Scond, Temp
Flow Way End Stations			
S365A **S365B** **S369B** **S369C** **S372B** **S372D**	Grab	Weekly Recorded Flow	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
		Quarterly	DOC

5.4 Field Testing Procedures

Field testing procedures shall follow the procedures and requirements found in the District's FSQM. Table 3 below describes the field parameters collected for this project. The table shows only the most commonly used parameters.

Table 3: Field Analytical Parameters Collected

Parameter	Resolution	Accuracy
Dissolved Oxygen	0.01 mg/L	0-20 mg/L, $\pm$ 0.2 mg/L
Specific Conductance	0.001 mS/cm	$\pm$ 0.5% of reading $\pm$0.001 mS/cm
Temperature	0.01^{o} C	$\pm$ 0.2^{o}C
pH	0.01 unit	$\pm$ 0.2 unit

5.5 Field Quality Control Requirements

Field quality control requirements shall follow the procedures found in the Quality Control Section of the District's FSQM.

5.6 Autosamplers

Samples are collected under flow-proportional (ACF) conditions at the stations identified in Table 2. Frequency for ACF collections is determined by a "trigger volume" established through the protocols established by Abtew and Powell (2004). Discrete

bottles within each autosampler are pre-acidified and composited on a weekly basis and analyzed for total phosphorus (TPO_4).

5.7 Sample Submission

Following completion of sample collection for each day, the samples are transported in coolers with wet ice at $\leq 6^oC$ to the laboratory for analysis. Samples are submitted to the laboratory on the same day as collection or via courier the following day. Samples are submitted according to the requirements outlined in the District's FSQM. If samples are submitted to other than the District's in house laboratory, the laboratory must be a District approved laboratory.

6.0 Data Quality Objectives

6.1 Data Uses

The data from STA1E are compiled and reported in accordance with the conditions outlined in the permit or mandate specified in Section 3.2. Typically the data are reported in the District's Annual South Florida Environmental Report (SFER), or in some cases is reported in a standalone mandated report, such as the quarterly Everglades Settlement Agreement Report. The SFER can be found at www.sfwmd.gov/sfer/.

6.2 Data Quality

All monitoring described herein shall meet the indicators conveyed in the FDEP's Quality Assurance Rule, 62-160 F.A.C. The District has adopted a uniform set of Data Quality Objectives (DQOs) following criteria detailed within the "Analytical Methods and Default QA/QC Targets" table of the CLQM.

The DQOs of the field testing parameters for this project are covered by the table entitled Field Quality Assurance Objectives found in the field testing section of the FSQM. This manual is updated regularly, and therefore, the most recent version of the District's FSQM details the specific field testing DQOs for this project at the time of sample collection.

Samples are analyzed according to the provisions within the FDEP Rule 62-160 F.A.C. and the District's CLQM. This manual is updated regularly, and therefore, the most recent version of the District's CLQM details DQOs for this project at the time of sample collection for each specific laboratory analysis. Data are qualified in accordance with the FSQM, CLQM and applicable data validation SOPs.

6.3 Completeness Targets

The completeness target (i.e., the number of samples successfully collected and analyzed) shall be 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 on an attempt due to no flow or low water conditions, unsafe station conditions, equipment malfunction, site maintenance, or other unforeseen problems that might affect sample collection and/or quality. If samples cannot be collected on an attempt, collectors shall document "no bottle" (NOB) to indicate and attempt was made and/or the sample could not be collected

for the documented reasons. Attempted collection (NOB) of samples will be considered a collected sample when calculating completeness targets.

7.0 Data and Records Management

The laboratory shall evaluate the data in accordance with the data quality objectives stated in the FSQM and CLQM. All data submittals shall conform to existing District guidelines.

7.1 Contract Deliverables

There are no contract deliverables for this project.

7.2 Data and Record Storage

After the data validation process, all data and records are maintained so that end users can retrieve and review all information relative to a sampling event. Field records are maintained in NuGenesis by scanning actual field note pages records directly into NuGenesis (See SFWMD-FIELD-SOP-022). All analytical data and specified metadata are sent to a database (DBHYDRO) 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 current and historical method and operating procedures so that at any given time the conditions that were applied to a sampling event can be evaluated. At least quarterly, any contractor performing work for the project shall provide all original field records to the District's WQB for permanent archival.

Records shall be maintained for the life of the project and a minimum of five years thereafter, in a manner that will protect the physical condition and/or integrity of the records. Storage shall follow the SOP for Archive Records Storage and Retention (SFWMD-FIELD-SOP-022). Corrections of data or records shall follow the applicable District SOPs and FSQM.

8.0 Revisions and Modifications

Date	Section	Page(s)	Change From	Change To	Reason
01/01/2013	All	All			Monitoring plan modified to conform to requirements of EFA Permit # 0311207, NPDES Permit # FL0778451, and their associated Consent Orders as well as STA Operational considerations.

References:

Abtew, Wossenu & Powell, B. Water Quality Sampling Schemes for Variable Flow Canals at Remote Sites. Journal of the American Water Resources Association. October, 2007. Pp 1197 – 1204.

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

South Florida Water Management District, Chemistry Laboratory Quality Manual (CLQM), Version 1.0, October 2011 or a newer version if available. http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/analytical%20services/tab2/tab5/2011%20quality%20manual.pdf

South Florida Water Management District, Field Sampling Quality Manual (FSQM), Version 7.0, December 2011 or a newer version if available. http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/water%20quality%20monitoring%20division/subtab%20-%20wqm%20-%20qa/tab24442257/fsqm_sfwmd-field-qm-001-07.pdf

South Florida Water Management District, Field Sampling Quality Management Plan (QMP), Version 3.0, June 2011 or a newer version if available.
http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/subtab%20-%20qaqc/tab21630104/rsd_qmp_v3_0.pdf

Signature Page

Monitoring Plan

For

Eastern Flow-Way
Stormwater Treatment Area One East
(STA1E)

Linda Crean, Water Quality Monitoring Section Administrator	**Date**
David Struve, Analytical Services Section Administrator	**Date**
Julianne LaRock, Compliance Assessment and Reporting Section Administrator	**Date**
Ming Chen, Quality Assurance Administrator	**Date**

Appendix 1: Site Requirements by Mandate

Station Name	Mandate	Collection Method	Frequency	Analytical Parameters
Outflow Station				
S362	National Pollution Discharge Elimination System [NPDES]	Grab	Weekly Recorded Flow (WRF)	Total Phosphorus (TPO_4), pH
		ACF	Weekly (W)	TPO_4
	Everglades Forever Act [EFA]	Grab	See Specific Condition 21	Turbidity (TURB)
			WRF	TPO_4, Dissolved Oxygen (DO), pH, Specific conductance (Scond), Temperature (Temp)
			Biweekly Recorded Flow (BWRF)	Alkalinity (ALKA), Nitrite-Nitrate (NOx), Sulfate (SO_4), Total Nitrogen (TN^1)
		ACF	W	TPO_4
	Settlement Agreement	Grab	W	Orthophosphorus (OPO_4), TPO_4
			Biweekly (BW)	ALKA, Calcium (Ca), Chloride (Cl), NOx, Sulfate (SO_4), Total Dissolved Phosphorus ($TDPO_4$), Total Kjeldahl Nitrogen (TKN), Total Suspended Solids (TSS)
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, Scond, Temp
			BW	ALKA, Ca, Cl, NOx, NH_4, OPO_4, SO_4, $TDPO_4$, TKN, TSS
		ACF	W	TPO_4
Inflow Stations				
G311 S319 S361	NPDES	Grab	WRF	TPO_4
		ACF	W	TPO_4
	EFA	Grab	WRF	TPO_4, pH, Scond, Temp
			BWRF	ALKA, NOx, SO_4, TN^1
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, Scond, Temp
			WRF	ALKA, Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
			Quarterly (Q)	DOC
		ACF	W	TPO_4
Diversion Station				
G300	EFA	Grab	WRF	TPO_4
	Settlement Agreement	Grab	W	OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
			BW	ALKA, NOx, SO_4, TKN
		ACF	W	TPO_4
	STA Operations	Grab	WRF	TPO_4
Flow Way Start Stations				
S363C S366B S366D S370A S370C	STA Operations	Grab	BWRF	Ca, TPO_4, DO, pH, Scond, Temp

Station Name	Mandate	Collection Method	Frequency	Analytical Parameters
S373A **S373B**				
Flow Way Interior Stations				
S364A **S364C** **S367B** **S367D** **S368B** **S368D** **S371A** **S371C** **S374A** **S374C**	STA Operations	Grab	Monthly recorded flow (MRF)	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
Flow Way End Stations				
S365A **S365B** **S369B** **S369C** **S372B** **S372D**	STA Operations	Grab	WRF	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
			Q	DOC

[1]TN is calculated as the sum of TKN and NOx

Appendix 2: Mercury and Other Toxicants Monitoring Plan

Flow-Path: Eastern
Stormwater Treatment Area 1E
EFA Permit No. 0311207

Monitoring of water-column concentrations of total mercury (THg) and methylmercury (MeHg) began in January 2005 at STA1E. Both the central flow-way (Cells 3-4N-4S) and the western flow-way (Cells 5-6-7) met the mercury startup criteria, as specified in Exhibit "C" of EFA Permit No. 0195030-001-GL, in August 2005 (see data summary provided in correspondence from R. Bearzotti, SFWMD dated September 9, 2005). The U.S. Army Corps of Engineers completed construction of a PSTA Demonstration Project in the eastern flow-way (Cells 1 and 2) of STA1E in February 2007. The eastern flow-way met mercury startup criteria, as specified in Exhibit "F" of EFA permit 0279449-001-EM, in August 2007. February 29, 2012 the Florida Department of Environmental Protection (Department) approved transfer of STA1E mercury monitoring from Phase 2 – Tier 1: Routine Monitoring during Stabilization Period to Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9 for all flow ways (Western, Central and Eastern) which include cells 1, 2, 3, 4N, 4S, 5, 6 and 7 of STA1E.

Based on the, initial performance of the three flow-ways and the guidance contained in "*A Protocol for Monitoring Mercury and Other Toxicants"* (dated April 2011; hereafter referred to as the *Protocol*), the District shall conduct Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9 as follows:

3.0 Phase 3 - Operational Monitoring

3.1 Phase 3 - Tier 1: Routine Operational Monitoring from Year 4 to Year 9

3.1.1 Fish Tissues

Semiannually, mosquitofish will be collected from multiple locations within each flow-way and physically composited into one spatially-averaged sample (to total at least 100 fish) per flow-way (i.e., eastern flow-way comprised of Cells 1 and 2; central flow-way comprised of Cells 3, 4N, and 4S; and the western flow-way comprised of Cells 5, 6, and 7) for THg analysis (note, a single aliquot will be analyzed per composite). Additionally, mosquitofish (to total at least 100 fish) will be collected from a single site located in the receiving waters immediately downstream from the project (site STA1ELX) and analyzed for THg.

As reported in previous annual reports (see 2010 South Florida Environmental Report and references therein), mercury levels tend to be statistically higher in resident fish from Cell 2A as compared to the other cells. Accordingly, to assess "worst case" conditions, large-bodied fish will be collected only from Cell 2A and the downstream station STA1ELX once every three years beginning in 2011. This limited spatial sampling of large-bodied fish within the STA is to revert back to include formerly sampled stations in Cells 4 and 6 (i.e., STA1EC4SA and STA1EC6A), if Tier 2 is triggered or if mosquitofish demonstrate significantly altered spatial patterns in mercury biomagnification.

Specifically, sunfish (n should be greater than or equal to 5) should be collected from each station and individually analyzed as whole-fish. At the same time, largemouth bass (*Micropterus salmoides*; n should be greater than or equal to 5) should be collected from each station and individually analyzed (fillets) for THg. To reduce variance (i.e., due to species differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections will target bluegill (*Lepomis microchirus*) ranging in size from 102 to 178 mm (i.e., 4 to 7 inches) and largemouth bass ranging in size from 307 to 385 mm (i.e., 12 to 15 inches); however, other lepomids (due to similar trophic status, first priority being given to spotted sunfish (*L. punctatus*) or sizes will be collected if efforts fail to locate targeted fish.

These data will then be used to track the following:

- THg levels in individual mosquitofish composite;
- Annual average THg levels in mosquitofish;
- THg levels in large-bodied fish

Table 1: Phase 3 - Tier 1: Routine Operational Monitoring from Year 4 to Year 9

Matrix	Location	Collection Method	Frequency	Parameter
Mosquitofish	Each Flow-way & STA1ELX	Net or Trap	Semiannually	THg
Sunfish and Bass (n=5 each)	Cell 2A & STA1ELX	Electrofish or Hook & Line	Triennially	THg

3.2 Phase 3 - Tier 2: Expanded Monitoring and Risk Assessment

Tier 2 monitoring and assessment is triggered if one of the following action levels is exceeded during operation:

- If annual average THg levels in mosquitofish progressively increased over time (i.e., two or more years) or any (semi-annual) mosquitofish composite exceeds the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceeds the 75th percentile concentration for the period of record for all basins; or
- If triennial monitoring of large-bodied fish reveal tissue Hg levels in fishes have statistically increased progressively over time or have become elevated to the point of exceeding the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceeded the 75th percentile concentration for the period of record for all basins.

The following steps will be taken if any action level in Tier 2 is triggered:

Step 1: Notify the Department;

Step 2: Resample fish species that triggered Tier 2;

If results of Step 2 (i.e., re-sampling) demonstrate that the anomalous condition was an isolated event, the Department will be notified that the project will revert back and continue with Tier 1

monitoring. Alternatively, if results of Step 2 reveal the anomalous condition was not an isolated event, proceed to Step 3.

Step 3: Expanding monitoring program as follows:

- Increase frequency of mosquitofish collection from semiannually to monthly.
- If Tier 2 was triggered by THg levels in fish at the downstream site, possibly due to excessive loading from the STA outflow, then quarterly water-column sampling at the outflow station will begin. If necessary (i.e., if loading uncertainty is high), increase frequency of surface water collection to monthly (reducing temporal interpolation), or as appropriate for hydraulic retention time (HRT).
- If Tier 2 was triggered by THg levels in fish within only one of the treatment trains, further define spatial extent of problem by collecting multiple mosquitofish composites from within the treatment train exhibiting anomalous conditions.
- If Tier 2 was triggered by tissue THg levels in large-bodied fish, increase sample size of large-bodied fish to n = 20, i.e., 20 each of sunfish (collect various species and sizes) and/or bass (collect various sizes and extract otolith from bass for age determination).
- To evaluate possible trends in methylation rates in sediments (i.e., to determine if methylation rates are increasing or decreasing), replicate sediment cores (0-4 cm) can be collected from the suspected methylation "hot spot" and reference locations within the component (for THg, MeHg, moisture content, total organic carbon (TOC), total sulfur (TS), and total iron (TFe)) over a given period of time (i.e., 2 to 4 months). At these same locations and collection times, collect pore water samples and analyze for THg, MeHg, and sulfides, or if no acceptable pore water protocol has been developed, then acid-volatile sulfide (AVS) on solids shall be completed.

Projects shown to have (spatially) large or multiple MeHg "hotspots" should consider use of the Everglades Mercury Cycling Model (E-MCM) or comparable model as an assessment tool (i.e., to synthesize results of expanded monitoring).

Step 3 will also include the notification of the Department that anomalous conditions are continuing. The Department and the District may then develop an adaptive management plan using the data generated from the expanded monitoring program. This plan will evaluate the potential risks from continued operation under existing conditions (i.e., through a risk assessment for appropriate ecological receptors). If risk under existing operational conditions is deemed acceptable, then project monitoring would continue under a modified Tier 2 scheme to monitor exposure. On the other hand, if risk under existing operational conditions is deemed unacceptable, then the adaptive management plan would then proceed to determine potential remedial actions to (1) reduce exposure and risk (e.g., signage for human health concerns[1], reduce fish populations, reduce forage habitat suitability)) and (2) affect mercury biogeochemistry to reduce net methylation (e.g., modify hydroperiod or stage, water quality).

In developing this adaptive management plan, the Department may conduct a publicly noticed workshop to solicit comments from the District, the U.S. Army Corps of Engineers, the U.S.

[1] Note that assessment of potential human health impacts and corrective actions (i.e., signage) will require the involvement of the Florida Department of Health.

Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Park Service, the Florida Fish and Wildlife Conservation Commission, and other interested persons.

The next step would then be to carry out such remedial or corrective action. If the remedial or corrective action is demonstrated to be successful, then the project would revert back to Tier 1 monitoring. Alternatively, if monitoring data indicate that the remedial action was unsuccessful in reducing fish tissue concentrations or downstream loading, the Department and the District would then initiate a peer-reviewed, scientific assessment of the benefits and risks of the project.

3.3 Phase 3 - Tier 3: Termination of Monitoring After Year 9

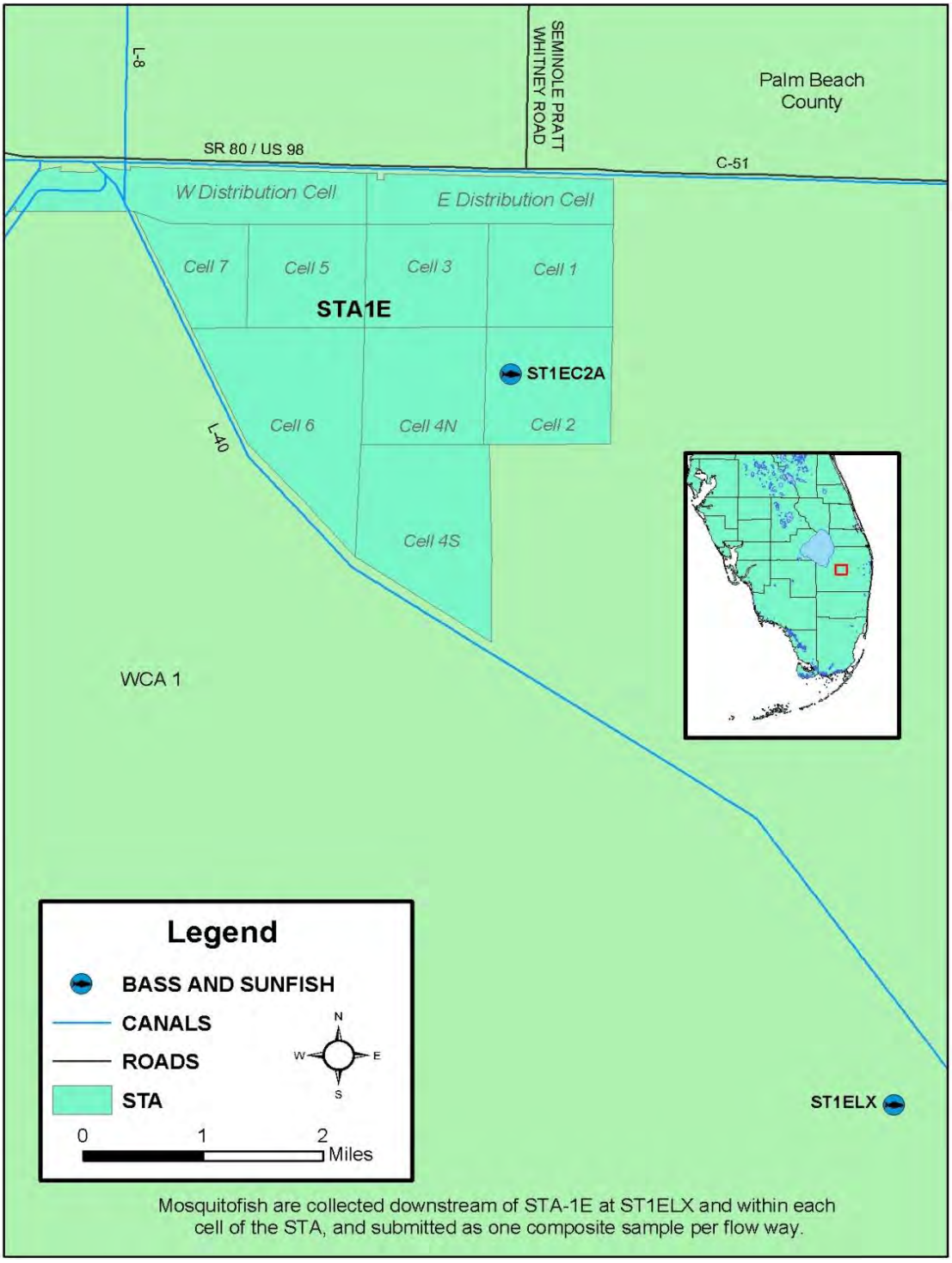
If fish collected under Tier 1 have not exceeded action levels by year 9, project-specific monitoring would be discontinued; future assessments would be based on regional monitoring.

4.0 Annual Mercury Monitoring Report

The District shall notify the Department immediately if monitoring data indicate that any of the action levels are exceeded. In addition, the District shall submit an annual report to be incorporated into the South Florida Environmental Report (SFER) and submitted to the Department no later than March 1st of each year. The annual report shall summarize the most recent results of the monitoring as defined above and compares them with the cumulative results from previous years. This report shall also evaluate assessment performance measures (i.e., action levels) outlined above.

5.0 Adaptive Management Strategy

It is the intent that this monitoring plan will be carried out within the context of an adaptive management strategy that will allow for appropriate changes based on new, better understanding of mercury cycling, fate and transport as conveyed in the guidance contained in the *Protocol*.



STA1E Mercury and other Toxicants Monitoring Locations

Operational Project Monitoring Plan

For

Eastern Flow-Way
Stormwater Treatment Area 1 West

(STA1W)

01/07/2013

This monitoring plan is adaptive and therefore subject to change based on operational needs. It will be reviewed and/or modified at a minimum, on an annual basis.

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

SFWMD-FIELD-MP-047-03

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Appendices

1.0 Glossary

ACF	Autosampler collection based upon flow trigger
CLQM	Clinical Laboratory Quality Manual
DBHYDRO	South Florida Water Management District Environmental Database
District	South Florida Water Management District
DO	Dissolved Oxygen
DQOs	Data Quality Objectives
EAA	Everglades Agricultural Area
ECP	Everglades Construction Project
EFA	Everglades Forever Act
ENR	Everglades Nutrient Removal
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FSQM	Field Sampling Quality Manual
GPS	Global Positioning System
LIMS	Laboratory Information Management System
NPDES	National Pollutant Discharge Elimination System
SFER	South Florida Environmental Report
SFWMD	South Florida Water Management District
STA1W	Stormwater Treatment Area 1 West
WCA-1	Water Conservation Area 1

2.0 Project Organization

Overall project organization and responsibilities are detailed in the South Florida Water Management District (SFWMD or District) Applied Sciences (ASB) and Water Quality Bureau (WQB) Quality Management Plan (QMP). Field activity responsibilities are detailed in the District's Field Sampling Quality Manual (FSQM). Laboratory analysis and data validation responsibilities are detailed in the District's Chemistry Laboratory Quality Manual (CLQM). These documents define the procedures used by SFWMD personnel to meet the Florida Department of Environmental Protection's (FDEP) Quality Assurance (QA) Rule, Florida Administrative Code (F.A.C.) 62-160. Refer to these documents for details on key personnel and relevant responsibilities.

3.0 Project Description

3.1 Introduction and Background

This document serves as a reference for surface water quality monitoring for STA1W. The operational plan for this project contains detailed structure specifications including brief descriptions of the mandate and/or permit required monitoring at each station. Current project status, schematics and the project operational plan can be viewed at the District's STA status page.

Surface water monitoring at STA1W began in June 2000, as part of the Everglades Construction Project (ECP). STA1W's mandated stations consist of the inflows at G-302; outflow station S-310 and G-251and diversion stations G-301. The construction, operation and maintenance of this Everglades Construction Project are required by the Everglades Forever Act (EFA) to restore the Everglades ecosystem. The guidance contained in this document will assist in maintaining consistency in sampling locations, parameter lists, and frequencies as well as providing documentation of the project scope and an ongoing historical perspective.

3.2 Mandates and Permits

Station locations, sampling frequencies, and parameters to be sampled are dictated by the mandate and/or permits governing this project (see Appendix 1 for details). In addition, a mercury and toxicants monitoring program required by Everglades Forever Act Permit (0311207) is included as Appendix 2.

As part of the Eastern Flow-way for the Everglades Construction Project, STA1W is subject to both the Everglades Forever Act Permit #0311207 and the National Pollutant Discharge Elimination System Industrial Wastewater Facility (NPDES) Permit FL0778451, both issued on September 10, 2012 and expiring on September 09, 2017. These permits dictate the types and frequencies of monitoring to be done, and the parameters to be analyzed, and can be viewed at:

- Everglades Forever Act Permit
  http://www.dep.state.fl.us/water/wqssp/everglades/docs/ecp-sta/draft-watershed-efa-permit.pdf
- NPDES Permit

http://www.dep.state.fl.us/secretary/news/2012/06/npdes_watershed_permit_consent_order.pdf

Additional stations, parameters and frequencies are required as part of operational monitoring are detailed in Appendix 1.

3.3 Project Objectives

The primary objective of this monitoring project is to:

1. Assess compliance with applicable water quality standards and phosphorus discharge limits;
2. Aid in determining the nutrient concentrations to quantify the tons of nutrients removed by the STA annually;
3. Guide mid and long term resource management decisions for nutrient removal capabilities of the STA.

3.4 Duration

3.4.1 Initiation Conditions

The monitoring for this project was initiated during June, 2000. Prior monitoring for Cells 1 through 4 was conducted as part of the Everglades Nutrient Removal (ENR) Project.

3.4.2 Modification or Termination Conditions

The mandated monitoring described in this document will be ongoing as required by the EFA 0311207 and NPDES FL0778451 permits, which are renewed once every 5 years. Conditions for modification or termination of the project are detailed in the permit(s) that specify the conditions of the project. Monitoring for operations will continue indefinitely in support of the project goals and objectives. Monitoring may increase or decrease over time, depending upon individual cell operations, data results, end user needs and permit requirements. Short-term changes to collection events may be made as a result of an extreme weather conditions (i.e., droughts and tropical storms/hurricanes), other safety concerns, or construction activities.

4.0 Geographic Location

4.1 Regional Area

The STA1W project consists of 19 monitoring stations in Palm Beach County (Figure 1). Table 1 provides the station names, global positioning system (GPS) coordinates, and a description of each monitoring station. The locations of all monitoring stations are depicted on the map in Figure 1.

4.2 Sampling Locations

The locations of all monitoring stations are depicted in Figure 1 with exact locations described in Table 1.

4.3 Access and Authority

The gates on roadways into STA1W are secured with a District Palm Beach County "W" lock. The lock requires a "W" key which can be obtained through a request made through the FPM and/or Field Supervisor. Samples are collected on the upstream side of structures/culverts.

Table 1: STA1W Surface Water Monitoring Sites, GPS Coordinates and Descriptions

Station Name	Latitude	Longitude	Description
G251 (ENR012)	263552.244	802633.18	Immediately upstream (west) of G251. Cell 3 outflow pump station (seepage)
G250S (ENR002)	263552.244	802633.18	Immediately upstream (north) of G250. Cell 1A inflow pump station
G310	263553.57	802644	Primary outflow pump station
G301	264032.33	802248.99	Gated structure in NE corner on L-7 canal (diversion)
G302	264035.213	802250.99	Primary inflow gated structure - NE corner
G327B	264037.448	802635.695	Pump structure on SW corner of cell 5B in STA1W (seepage)
G309	263739.122	802640	North cell 4 outflow gated structure (end)
G308	263645.943	802641.5	North cell 3 outflow gated structure (end)
G307	263712.301	802642.247	South cell 4 outflow gated structure (end)
G306G	263932.69	802639.9	7th outflow gated structure (from north) for cell 5B (end)
G306C	264011.732	802639.911	3rd outflow gated structure (from north) for cell 5B (end)
G305N	264000.942	802420.3	14th inflow open culvert (from north) for cell 5B (interior)
G305G	264019.811	802405.8	7th inflow open culvert (from north) for cell 5B (interior)
G259	263556.243	802646.18	South cell 3 outflow culvert (end)
G255	263929.234	802445.177	Inflow gated structure for cell 2A (start)
G254D	263805.238	802604.179	7th inflow culvert (from west) for cell 4 (interior)
G254B	263805.238	802625.18	3rd inflow culvert (from west) for cell 4 (interior)
G249D	263831.012	802609.408	4th inflow culvert (from west) for cell 2B (interior)
G248B	263830.708	802509.540	2nd inflow culvert (from west) for cell 1B (interior)

*The standard positional goal for site coordinates is ±1 meter. This standard can be obtained with a professional grade DGPS system. The coordinates are relative to NAD83 HARN horizontal datum.

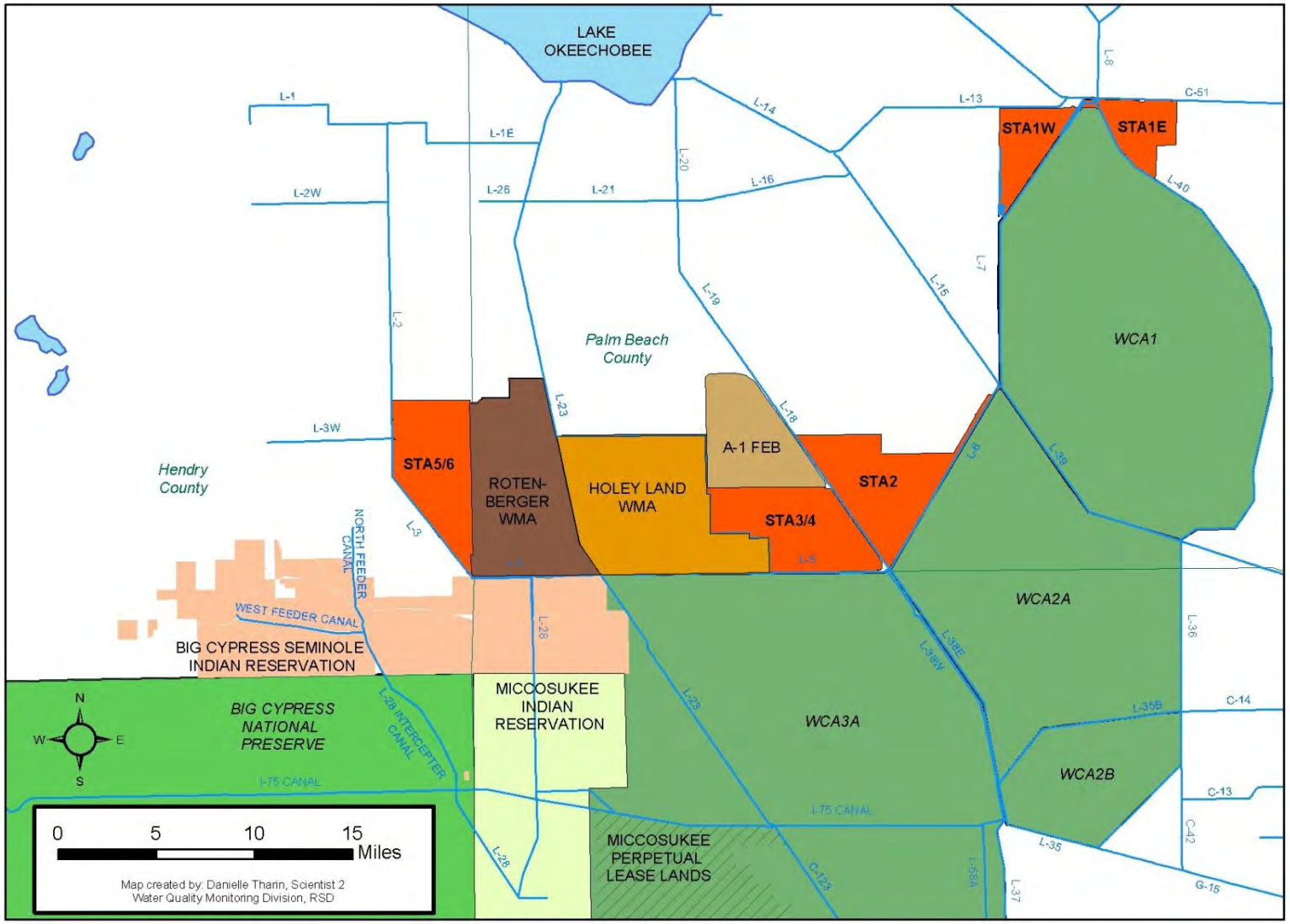

Figure 1: Regional Area Map

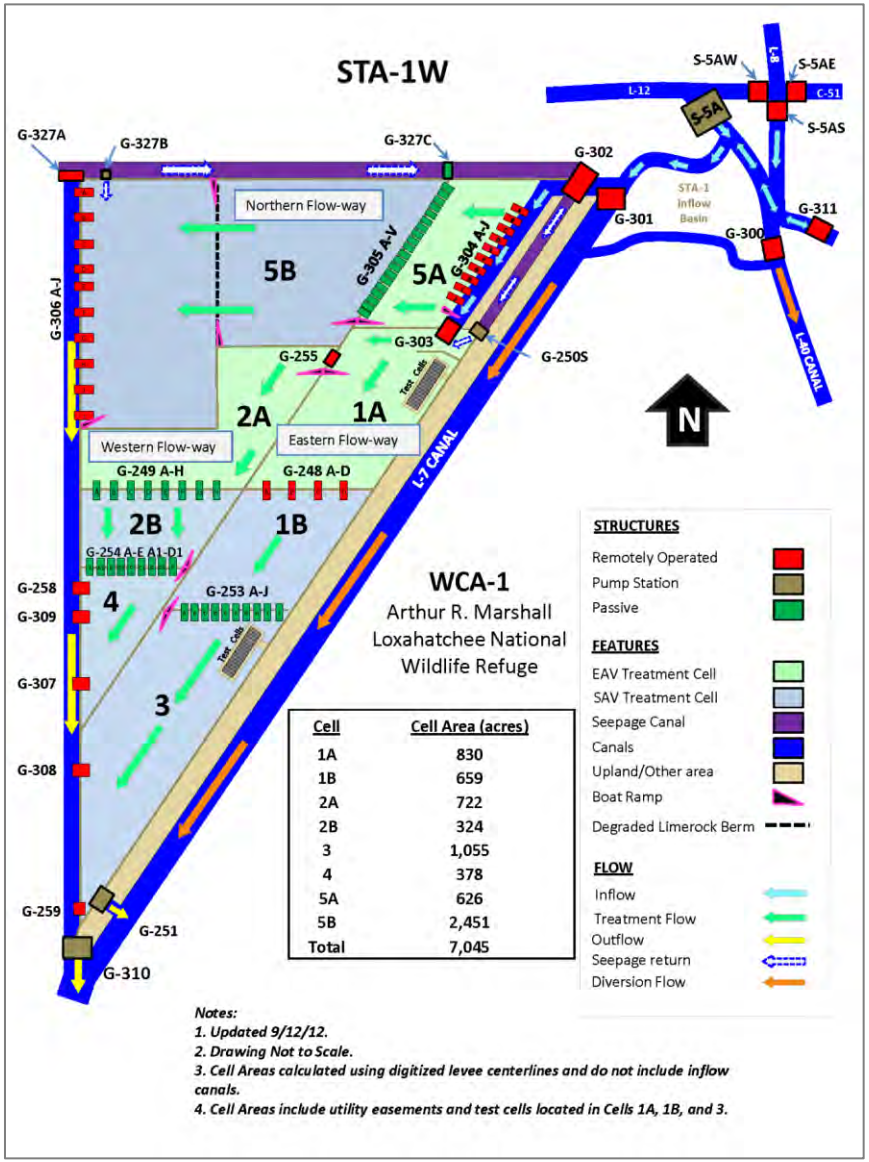

Figure 2: STA1W Layout

5.0 Field Activities

5.1 Monitoring Frequencies by Site and Parameters (ACODES)

All samples required for collection are depicted in Table 2. Some stations within the monitoring network are collected based on whether flow has been recorded. Specifically, structure operation activity is determined within a specified timeframe through the review of electronic data. If no flow (i.e., no operations) has been recorded, the sample is considered a No Bottle sample (NOB) and the structure is not visited. Conversely, if flow has been recorded during the specified timeframe, a sample is collected.

5.2 Project Specific Guidelines

All surface water samples shall be collected on the upstream side of any structure at a depth of 0.5 m unless vegetation and/or other conditions inhibit the collection of a representative sample upstream. Prior to sampling an alternative site, a consultation with a Field Technician Supervisor and/or the FPM must take place; this action must be documented in the field notes.

Backup grab samples will accompany the autosampler collection based upon flow trigger (ACF) samples collected on a weekly basis. In addition, in situ readings (i.e., Temperature, pH, DO and Specific Conductance) are measured as the grab samples are being collected. Samples collected are on the upstream side of structures/culverts.

5.3 Grab Sampling Guidelines

Sample collection for this project shall follow the procedures and requirements found in the Field Sample Collection Procedures Section of the District's FSQM.

Table 2: STA1W Grab/Autosampler Collection Frequency and Parameters

Station Name	Collection Method	Frequency	Parameter ACODES
Outflow Station			
G310	Grab	Weekly	OPO_4, TPO_4, DO, pH, Scond, Temp
		Biweekly	ALKA, Ca, Cl, NH_4, NOx, SO_4, $TDPO_4$, TKN, TSS
	ACF	Weekly	TPO_4
Outflow and End Station			
G251 (ENR012)	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
		Weekly Recorded Flow else Biweekly	ALKA, Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
	ACF	Weekly	TPO_4
Inflow Station			
G302	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
		Weekly Recorded Flow	ALKA, Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
		Quarterly	DOC
	ACF	Weekly	TPO_4
Diversion Station			
G301	Grab	Weekly	OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
		Biweekly	ALKA, NOx, SO_4, TKN
Flow Way Start Station			

Station Name	Collection Method	Frequency	Parameter ACODES
G255	Grab	Biweekly Recorded Flow	Ca, TPO_4, DO, pH, Scond, Temp
Flow Way Interior Stations			
G248B G249D G254B G254D G305G G305N	Grab	Monthly Recorded Flow	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
Flow Way End Stations			
G259 G306C G306G G307 G308 G309	Grab	Weekly Recorded Flow	Ca, OPO_4, TDPO4, TPO_4, DO, pH, Scond, Temp
		Quarterly	DOC
Divides and Seepage Structures			
G250S (ENR002) G327B	Grab	Monthly Recorded Flow	TPO_4, DO, pH, Scond, Temp

5.4 Field Testing Procedures

Field testing procedures shall follow the procedures and requirements found in the District's FSQM. Table 3 below describes the field parameters collected for this project. The table shows only the most commonly used parameters.

Table 3: Field Analytical Parameters Collected

Parameter	Resolution	Accuracy
Dissolved Oxygen	0.01 mg/L	0-20 mg/L, $\pm$ 0.2 mg/L
Specific Conductance	0.001 mS/cm	$\pm$ 0.5% of reading +0.001 mS/cm
Temperature	0.01° C	$\pm$ 0.15°C
pH	0.01 unit	$\pm$ 0.2 unit

5.5 Field Quality Control Requirements

Field quality control requirements shall follow the procedures found in the Field Quality Control Section of the District's FSQM.

5.6 Autosampler Collection

Samples are collected with flow-proportional (ACF) at the stations identified in Table 2. Frequency for ACF collections is determined by a "trigger volume" established through the protocols established by Abtew and Powell (2004). The frequency of ADT collection is set by the FPM following discussions with the data end user(s). Discrete bottles within each autosampler are pre-acidified and composited on a weekly basis and analyzed for total phosphorus (TPO_4).

5.7 Sample Submission

Following completion of sample collection for each day, the samples are placed in ice and transported in coolers at $\leq 6^{o}C$ to the laboratory for analysis. Samples are submitted to the laboratory on the same day as collection or via courier the following day. Samples are submitted according to the requirements outlined in the District's FSQM. If samples are submitted to other than the District's laboratory, the laboratory must be a District approved laboratory.

6.0 Data Quality Objectives

6.1 Data Uses

The data from STA1W are compiled and reported in accordance with the conditions outlined in the permit or mandate specified in Section 3.2. Typically the data are reported in the District's annual South Florida Environmental Report (SFER), or in some cases is reported in a standalone mandated report, such as the quarterly Everglades Settlement Agreement Report. The SFER can be found at www.sfwmd.gov/sfer/.

6.2 Data Quality

All monitoring described herein shall meet the indicators conveyed in the FDEP's Quality Assurance Rule, 62-160 F.A.C. The District has adopted a uniform set of Data Quality Objectives (DQOs) following criteria detailed within the "Analytical Methods and Default QA/QC Targets" table of the CLQM.

The DQOs of the field testing parameters for this project are covered by the table entitled Field Quality Assurance Objectives found in the field testing section of the FSQM. This manual is updated regularly, and therefore, the most recent version of the District's FSQM details the specific field testing DQOs for this project at the time of sample collection.

Samples are analyzed according to the provisions within the FDEP Rule 62-160 F.A.C. and the District's CLQM. This manual is updated regularly, and therefore, the most recent version of the District's CLQM details DQOs for this project at the time of sample collection for each specific laboratory analysis. Data are qualified in accordance with the FSQM, CLQM and applicable data validation SOPs.

6.3 Completeness Targets

The completeness target (i.e., the number of samples successfully collected and analyzed) shall be 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 on an attempt due to no flow or low water conditions, unsafe station conditions, equipment malfunction, site maintenance, or other unforeseen problems that might affect sample collection and/or quality. If samples cannot be collected on an attempt, collectors shall document "no bottle" (NOB) to indicate and attempt was made and/or the sample could not be collected for the documented reasons. Attempted collection (NOB) of samples will be considered a collected sample when calculating completeness targets.

7.0 Data and Records Management

The laboratory shall evaluate the data in accordance with the data quality objectives stated in the FSQM and CLQM. All data submittals shall conform to existing District guidelines.

7.1 Contract Deliverables

There are no contract deliverables for this project.

7.2 Data and Record Storage

After the data validation process, all data and records are maintained so that end users can retrieve and review all information relative to a sampling event. Field records are maintained in NuGenesis by scanning actual field note pages records directly into NuGenesis (See SFWMD-FIELD-SOP-022). All analytical data and specified metadata are sent to a database (DBHYDRO) 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 current and historical method and operating procedures so that at any given time the conditions that were applied to a sampling event can be evaluated. At least quarterly, any contractor performing work for the project shall provide all original field records to the District's WQB for permanent archival.

Records shall be maintained for the life of the project and a minimum of five years thereafter, in a manner that will protect the physical condition and/or integrity of the records. Storage shall follow the SOP for Archive Records Storage and Retention (SFWMD-FIELD-SOP-022). Corrections of data or records shall follow the applicable District SOPs and FSQM.

8.0 Revisions and Modifications

Date	Section	Page Number(s)	Change From	Change To	Reason
01/01/2013	All	All			Monitoring plan modified to conform to requirements of EFA Permit # 0311207, NPDES Permit # FL0778451, and their associated Consent Orders as well as STA Operational considerations.

References

Abtew, Wossenu & Powell, B. Water Quality Sampling Schemes for Variable Flow Canals at Remote Sites. Journal of the American Water Resources Association. October, 2007. Pp 1197 – 1204.

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

South Florida Water Management District, Chemistry Laboratory Quality Manual (CLQM), Version 1.0, October 2011 or a newer version if available.

http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/analytical%20services/tab2/tab5/2011%20quality%20manual.pdf

South Florida Water Management District, Field Sampling Quality Manual (FSQM), Version 7.0, December 2011 or a newer version if available.

http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/water%20quality%20monitoring%20division/subtab%20-%20wqm%20-%20qa/tab24442257/fsqm_sfwmd-field-qm-001-07.pdf

South Florida Water Management District, Field Sampling Quality Management Plan (QMP), Version 3.0, June 2011 or a newer version if available.

http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/subtab%20-%20qaqc/tab21630104/rsd_qmp_v3_0.pdf

Signature Page

Operational Monitoring Plan

For

Eastern Flow-Way
Stormwater Treatment Area One West
(STA1W)

Linda Crean, Water Quality Monitoring Section Administrator	**Date**
David Struve, Analytical Services Section Administrator	**Date**
Julianne LaRock, Compliance Assessment and Reporting Section Administrator	**Date**
Ming Chen, Quality Assurance Administrator	**Date**

Appendix 1: Site Requirements by Mandate

Station Name	Mandate	Collection Method	Frequency	Analytical Parameters
Outflow Station				
G310	National Pollution Discharge Elimination System [NPDES]	Grab	Weekly Recorded Flow (WRF)	Total Phosphorus (TPO_4), pH
		ACF	Weekly (W)	TPO_4
	Everglades Forever Act [EFA]	Grab	See Specific Condition 21	Turbidity (TURB)
			WRF	TPO_4, Dissolved Oxygen (DO), pH, Specific conductance (Scond), Temperature (Temp)
			Biweekly Recorded Flow (BWRF)	Alkalinity (ALKA), Nitrite-Nitrate (NOx), Sulfate (SO_4), Total Nitrogen (TN^1)
		ACF	W	TPO_4
	Settlement Agreement	Grab	W	Orthophosphorus (OPO_4), TPO_4
			Biweekly (BW)	ALKA, Calcium (Ca), Chloride (Cl), NOx, Sulfate (SO_4), Total Dissolved Phosphorus ($TDPO_4$), Total Kjeldahl Nitrogen (TKN), Total Suspended Solids (TSS)
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, Scond, Temp
			BW	ALKA, Ca, Cl, NOx, Ammonia (NH_4), SO_4, OPO_4, $TDPO_4$, TKN, TSS
		ACF	W	TPO_4
Outflow and Flow Way End Station				
G-251 (ENR012)	National Pollution Discharge Elimination System [NPDES]	Grab	WRF	TPO_4, pH
		ACF	W	TPO_4
	Everglades Forever Act [EFA]	Grab	See Specific Condition 21	TURB
			WRF	TPO_4, DO, pH, Scond, Temp
			BWRF	ALKA, NOx, SO_4, TN^1
		ACF	W	TPO_4
	Settlement Agreement	Grab	W	TPO_4
			BW	ALKA, Ca, Cl, NOx, SO_4, $TDPO_4$, TKN, TSS
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, Scond, Temp
			WRF	ALKA, Ca, Cl, NOx, NH_4, OPO_4, SO_4,

Station Name	Mandate	Collection Method	Frequency	Analytical Parameters
				$TDPO_4$, TKN, TSS
		ACF	W	TPO_4
Inflow Stations				
G302	NPDES	Grab	WRF	TPO_4
		ACF	W	TPO_4
	EFA	Grab	WRF	TPO_4, pH, Scond, Temp
			BWRF	ALKA, NOx, SO_4, TN[1]
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, Scond, Temp
			WRF	ALKA, Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
			Quarterly (Q)	DOC
		ACF	W	TPO_4
Seepage and Diversion Stations				
G-250S (ENR002) G327B	STA Operations	Grab	Monthly Recorded Flow (MRF)	TPO_4, DO, Scond, pH, Temp
G301	EFA	Grab	WRF	TPO_4
	Settlement Agreement	Grab	W	OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
			BW	ALKA, NOx, SO_4, TKN
		ACF	W	TPO_4
	STA Operations	Grab	WRF	TPO_4
Flow Way Start Station				
G255	STA Operations	Grab	BWRF	Ca, TPO_4, DO, pH, Scond, Temp
Flow Way Interior Stations				
G248B G249D G254B G254D G305G G305N	STA Operations	Grab	MRF	Ca, OPO_4, TDP [redacted] PO_4, DO, pH, Scond, Temp
Flow Way End Stations				
G259 G306C G306G G307 G308 G309	STA Operations	Grab	WRF	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
			Q	DOC

[1]TN is calculated as the sum of TKN and NOx

Appendix 2: Project STA1W Mercury and other Toxicants Monitoring Plan

Eastern Flow-Way
Stormwater Treatment Area 1W
EFA Permit No. 0311207

The Florida Department of Environmental Protection (Department) issued minor permit modification 0279449-009 August 21, 2009, approving transfer of STA-1W mercury monitoring from Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9 to Phase 3 – Tier 3: Routine Operational Monitoring After Year 9. This implemented the termination of all site specific mercury monitoring at STA-1W.

Operational Project Monitoring Plan

For

Central Flow-Way

Stormwater Treatment Area 2

(STA2)

01/07/2013

This monitoring plan is adaptive and therefore subject to change based on operational needs. It will be reviewed and/or modified at a minimum, on an annual basis.

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

SFWMD-FIELD-MP-073-02

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Appendices

1.0 Glossary

ACF	Autosampler collection based upon flow trigger
ADaPT	Automated Data Processing Tool (a software application that processes data validation based on the Florida DEP QA Rule).
CAMB	Conservation Area Mass Balance Project
CLQM	District's Chemistry Laboratory Quality Manual
DBHYDRO	SFWMD hydrometeorologic, water quality and hydrogeologic data storage and retrieval system
DGPS	Differential Global Positioning System
DQOs	Data Quality Objectives
EAA	Everglades Agricultural Area
EFA	Everglades Forever Act
ESA	Environmental Site Assessment
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FSQM	Field Sampling Quality Manual
GPS	Global Positioning System
NAD83 HARN	North American Datum of 1983 High Accuracy Reference Network
NPDES	National Pollutant Discharge Elimination System
NCB	North Compartment B Flow Way
NPDES	National Pollutant Discharge Elimination System
QA/QC	Quality Assurance/Quality Control
SFER	South Florida Environmental Report
SFWMD	South Florida Water Management District
SCB	South Compartment B Flow Way
SQAG	Sediment Quality Assessment Guidelines
STA2	Stormwater Treatment Area 2
WCA	Water Conservation Area
WQB	Water Quality Bureau

2.0 Project Organization

Overall project organization and responsibilities are detailed in the South Florida Water Management District (SFWMD or District) Water Quality Bureau (WQB) Quality Management Plan (QMP). Field activity responsibilities are detailed in the District's Field Sampling Quality Manual (FSQM). Laboratory analysis and data validation responsibilities are detailed in the District's Chemistry Laboratory Quality Manual (CLQM). These documents define the procedures used by SFWMD personnel to meet the Florida Department of Environmental Protection's (FDEP) Quality Assurance Rule, Florida Administrative Code (F.A.C.) 62-160. Refer to these documents for details on key personnel and relevant responsibilities.

3.0 Project Description

3.1 Project Introduction and Background

The Central Flow Way consists of Stormwater Treatment Area Two (STA2) and Stormwater Treatment Area 3/4 (ST34). This document serves as a reference for surface water quality monitoring for Stormwater Treatment Area Two (STA2) and the Compartment B Build-out Project (Compartment B). This integrated operational plan for this project contains detailed structure specifications including brief descriptions of the mandate and/or permit required monitoring at each station. Current project status, schematics and the project operations plan can be viewed at the District's STA status web page.

There are three main flow ways in the STA2 and Compartment B Project. These are: 1) the original STA2, 2) the North Compartment B (NCB) and 3) the South Compartment B (SCB). The total effective treatment area for all three flow ways is 14,919 acres and is divided as detailed in Table 1.

- The original STA2 began operations in 1997 and accepts inflow from the Hillsboro canal through S6 or from privately owned lands through G328. Water is directed into three cells through gated culverts. Cell 1 has four inflow culverts G329A-D, Cell 2 has seven inflow culverts G331A-G, and Cell 3 has five inflow culverts G333A-E. Water flows out of the Cell 1 through five gated culverts G330A-E, from Cells 2 and Cell 3 through gated spillways (G332 and G334, respectively) to a common discharge canal. The G337 seepage pump station directs perimeter seepage back into the STA2 supply canal.
- North Compartment B began operations in November 2012 and accepts water from the North New River Canal through G434 and flows into gated culverts for Cells 5 (G438A-E) and 6 (G438F-J). Cell 5 has three outflow culverts G367D-F and Cell 6 has three outflow culverts G367A-C which flow into Cell 4. Cell 4 discharges to the common discharge canal through a gated spillway G368. There is a seepage pump at the G434 pump station to redirect seepage back into the NCB inflow.
- G337A now acts a divide structure allowing inflow from S6 or G328 to enter North Compartment B or allows water from G434 to enter the original STA2.

- South Compartment B began startup testing in November 2012 and accepts water from the North New River canal through G435; this water flows into Cell 7 through six gated culverts G440A-F. The water then flows out of Cell 7 and into Cell 8 through three gated culverts G442A-C. Water leaves Cell 8 through two gated culverts G441A-B to a common discharge canal. G445 is a seepage pump station located near the inflow of Cell 8, and pulls seepage from the FPL right of way located between Cell 8 and the L6 canal. Currently, this flow way is offline for regular monitoring.
- Water for all three flow ways is collected into a common discharge canal and is discharged to the L6 canal to Western WCA2A through either G335 or G436.

This document serves as a reference for surface water quality monitoring for STA2. The operational plan for this project contains detailed structure specifications including brief descriptions of the mandate and/or permit required monitoring at each station. Current project status, schematics and the project operational plan can be viewed at the District's STA status page.

3.2 Mandates and Permits

Station locations, sampling frequencies, and parameters to be sampled are dictated by the mandate and/or permits governing this project (see below). In addition, the mercury and toxicants monitoring program required by the Everglades Forever Act is included as Appendix 2.

As part of the Central Flow-way for the Everglades Construction Project, STA2 and Compartment B are subject to both the Everglades Forever Act Permit #0311207 and the National Pollutant Discharge Elimination System Industrial Wastewater Facility (NPDES) Permit FL0778451, both issued on September 10, 2012 and expiring on September 09, 2017. Adherence to these permits is paramount to the success of this project. These permits dictate the types and frequencies of monitoring to be done, and the parameters to be analyzed, and can be viewed at:

- Everglades Forever Act Permit
  http://www.dep.state.fl.us/water/wqssp/everglades/docs/ecp-sta/draft-watershed-efa-permit.pdf
- NPDES Permit
  http://www.dep.state.fl.us/secretary/news/2012/06/npdes_watershed_permit_consent_order.pdf

Additional stations, parameters and frequencies are required as part of operational monitoring are detailed in Appendix 1.

3.3 Project Objectives

The primary objectives of this monitoring project are to evaluate water quality status and trends within the STA. The water quality data obtained under this program will be used to;

1. Assess compliance with applicable water quality standards and phosphorus discharge limits;
2. Aid in determining the nutrient concentrations to quantify the tons of nutrients removed by the STA annually;
3. Guide mid and long term resource management decisions for nutrient removal capabilities of the STA

3.4 Duration

3.4.1 Initiation Conditions

The monitoring for this project was initiated on 04/07/1997 with monitoring of Compartment B initiated on 11/01/2012 for the purpose of evaluating water quality status and trends within the STA.

One station, S6, is being monitored as part of two projects (i.e., STA2 and Compartment B and the Conservation Area Mass Balance (CAMB) Project) for supplementary mandates. These mandates are the Settlement Agreement and the Everglades Agricultural Area (EAA Rule) Chapter 40E-63 (Appendix 1).

3.4.2 Modification or Termination Conditions

The mandated monitoring described in this document will be ongoing as required by the EFA 0311207 and NPDES FL0778451 permits, which are renewed once every 5 years. Conditions for modification or termination of the project are detailed in the permit(s) that specify the conditions of the project. Monitoring for operations will continue indefinitely in support of the project goals and objectives. Monitoring may increase or decrease over time, depending upon individual cell operations, data results, end user needs and permit requirements. Short-term changes to collection events may be made as a result of an extreme weather conditions (i.e., droughts and tropical storms/hurricanes), other safety concerns, or construction activities.

4.0 Geographic Location

4.1 Regional Area

The STA2 project consists of twenty four (24) monitoring stations in western Palm Beach County (Figure 1). Table 1 provides the station names, global positioning system (GPS) coordinates, and a description of each monitoring station. The locations of all monitoring stations are depicted on the map in Figure 1.

4.2 Sampling Locations

The locations of all monitoring stations are depicted on the map in Figure 2 with exact locations described in Table 1.

4.3 Access and Authority

The gates on roadways into STA 2 are secured with a District “1W” lock. The lock requires a “1MK” key which can be obtained through a request made through the FPM

and/or Field Supervisor. Samples are collected on the upstream side of structures/culverts.

Table 1: STA2 Surface Water Monitoring Sites and GPS Coordinates

Station	Latitude	Longitude	Description
S6	262820.263	802644.181	STA2 primary inflow pump station located on the Hillsboro Canal.
G328	262702.535	802757.727	Pump station discharging EAA water into the Supply Canal for inflow into STA2; approximately 2 miles southwest of S6. Also can pump water from STA2 for irrigation.
G335	262244.772	803045.658	Outflow pump station discharging into the L-6 canal from STA2 and Comp B
G436	262237.378	803054.244	Outflow pump station discharging into the L-6 canal from STA2 and Comp B
G330D	262246.04	803123.691	Five gated culverts labeled G330A to G330E discharge water from Cell 1. G330D is an outflow culvert from Cell 1 of STA2.
G332	262248.031	803138.478	Outflow spillway from Cell 2 STA2
G334	262245.632	803141.361	Outflow spillway from Cell 3 STA2
G329B	262514.421	802923.765	Four gated culverts labeled G329A to G329D accept inflow to Cell 1 of STA2. G329B is the monitored inflow culvert to Cell 1.
G331D	262514.353	803103.218	Seven gated culverts labeled G331A to G331G accept inflow to Cell 2 of STA2. G331D is the monitored inflow culvert to Cell 2.
G333C	262513.999	803242.359	Five gated culverts labeled G333A to G333E accept inflow to Cell 3 of STA2. G333C is the monitored inflow culvert to Cell 3.
G337	262522.902	802900.109	Seepage return pump station for STA2
G337A	262514.703	803317.112	Optional North Build Out Inflow from the Hillsboro Canal through S6 and G328. This structure can also supply STA2 with inflow water from the North New River Canal.
G434	262605.757	803640.031	North Build Out primary inflow pump station located on the North New River Canal.
G438D	262605.924	803502.679	Five gated culverts labeled G438A to G438E accept inflow to Cell 5 of Compartment B North Build Out. G438D is the monitored inflow culvert to Cell 5.
G438I	262606.592	803310.458	Five gated culverts labeled G438F to G438J accept inflow to Cell 6 Compartment B North Build Out. G438I is the monitored inflow culvert to Cell 6.
G367C	262422.664	803413.581	Three gated culverts labeled G367A to G367C accept inflow to Cell 5 Compartment B North Build Out. G367C is the monitored culvert from Cell 6 to Cell 4.
G367E	262422.512	803455.374	Three gated culverts labeled G367D to G367E accept inflow to Cell 5 of Compartment B North Build Out. G367E is the monitored culvert from Cell 5 to Cell 4.
G368	262241.105	803320.409	Compartment B North Build Out outflow from Cell 4 to G335 or G436.
G-435	262237.684	803400.175	Compartment B South Build Out Inflow Pump Station located on the North New River Canal
G440D	262238.448	803243.556	Six gated culverts labeled G440A to G440F accept inflow to Cell 7 of Compartment B South Build Out. G440D is the monitored inflow culvert to Cell 8.
G442	262105.271	804752.416	Gated culvert passing water from Compartment B South Build Out cell 7 to cell 8.

Station	Latitude	Longitude	Description
G-441	262239.339	803113.462	Compartment B South Build Out outflow gated culvert from Cell 8 to G335 or G436
G338	262812.147	802643.261	Gated spillway structure located in the Hillsboro Canal downstream of the S6 pump station. This structure can divert water to and from WCA1 through S6.
G339	262750.946	802707.353	Gated spillway structure located at the confluence of the STA2 inflow canal and the L6 borrow canal. This structure is intended to move water from the S6 and G328 pump stations to the L6 borrow canal.

*The standard positional goal for site coordinates is ±1 meter. This standard can be obtained with a professional grade DGPS system. The coordinates are relative to NAD83 HARN horizontal datum.

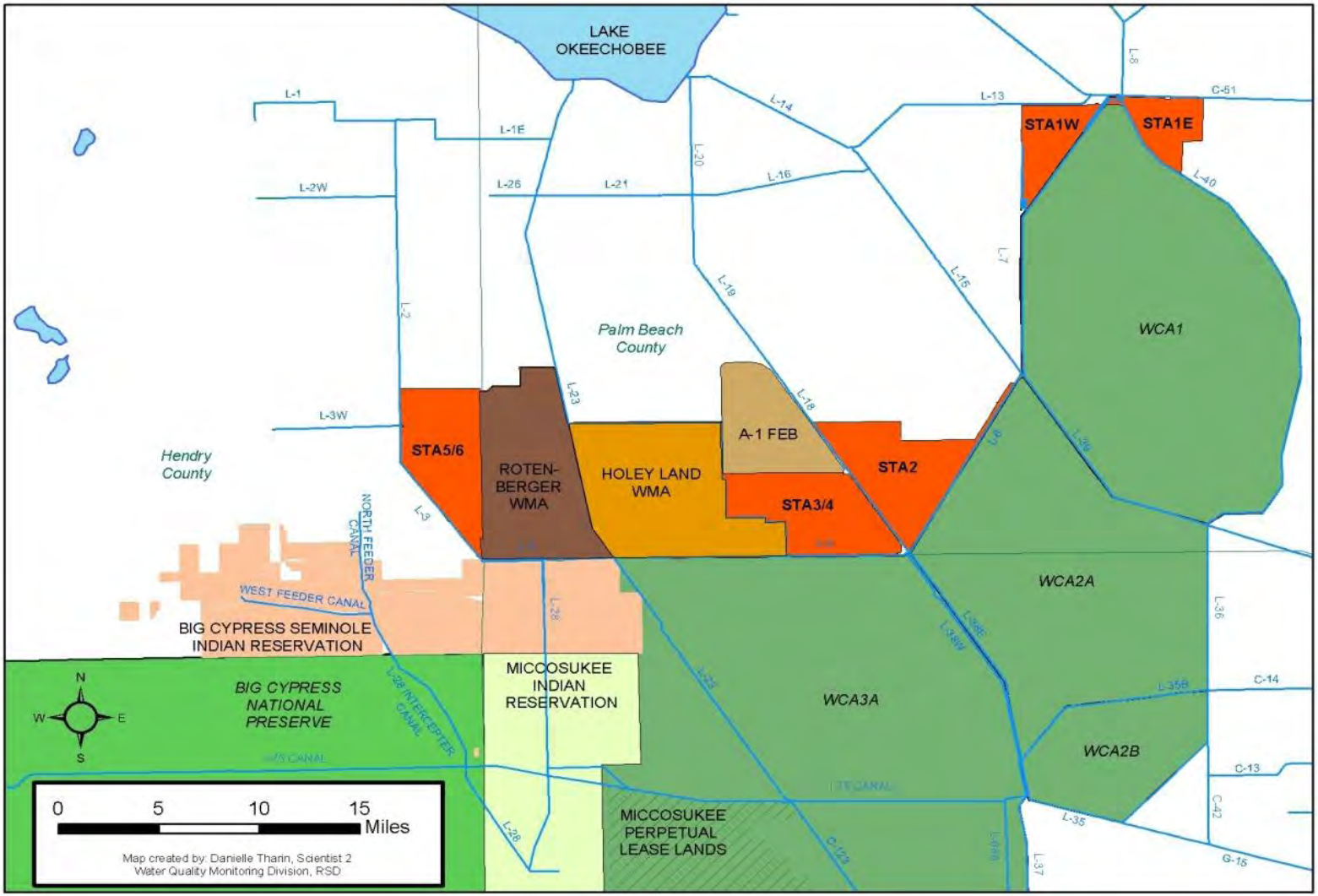


Figure 1: Regional Map including STA2

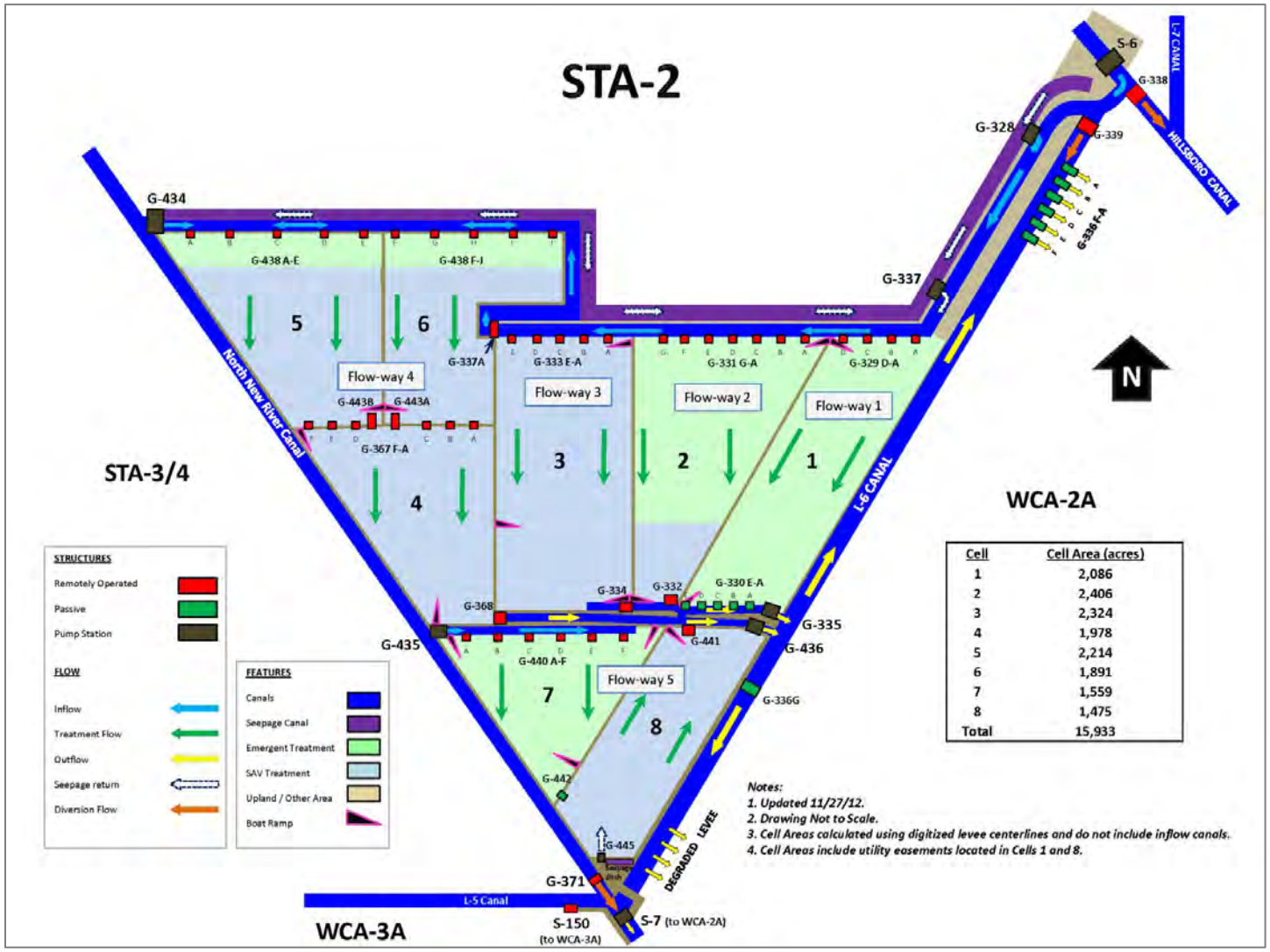


Figure 2: STA2 Site Location Map

Table 2: STA-2 Grab/Autosampler Station, Frequency and Parameter ACODES

Station Name	Method	Frequency	Parameter ACODES
Outflow Stations			
G335, G436	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
		Biweekly Recorded Flow	$TDPO_4$, OPO_4, TKN, NOx, NH_4, SO_4, Cl, Ca, TSS
		Quarterly	DOC
	ACF	Weekly	TPO_4
Inflow Stations			
S6	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
		Weekly Recorded Flow	ALKA, Ca, Cl, DOC, K, Mg, Na, NH_4, NOx, OPO_4, SiO_2, SO_4, TDKN, $TDPO_4$, TKN, TOC, TSS
		Quarterly	Fe
	ACF	Weekly	NOx, TKN, TPO_4
G328, G434, G435*	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
		Weekly Recorded Flow	Ca, Cl, OPO_4, NH_4, NOx, SO_4, $TDPO_4$, TKN, TSS
		Quarterly	DOC
	ACF	Weekly	TPO_4
Diversion Stations			
G338, G339	Grab	Weekly Recorded Flow	TPO_4, DO, pH, Scond, Temp
Flow Way Starts, Ends and Interior Stations			
G329B, G331D, G333C, G438D, G438I, G440D*	Grab	Biweekly Recorded Flow	Ca, TPO_4, DO, pH, Scond, Temp
G330D, G332, G334, G368, G441*	Grab	Weekly Recorded Flow	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
		Quarterly	DOC
G367C, G367E, G442*	Grab	Monthly Recorded Flow	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
Divides and Seepage Structures			
G337A	Grab	Monthly Recorded Flow	TPO_4 DO, pH, Scond, Temp
G337	Grab	Monthly Recorded Flow	TPO_4 DO, pH, Scond, Temp

*Site currently in startup and not being monitored according to this plan.

5.0 Field Activities

5.1 Monitoring Frequencies by Station and Parameters (ACODES)

All samples required for collection by grab sampling are depicted in Table 2. Some stations within the monitoring network are collected based on whether flow has been recorded. Specifically, structure operation activity is determined within a specified timeframe through the review of electronic data. If no flow (i.e., no operations) has been recorded, the sample is considered a No Bottle sample (NOB) and the structure is not visited. Conversely, if flow has been recorded during the specified timeframe, a sample is collected.

5.2 Project Specific Guidelines

All surface water samples shall be collected on the upstream side of any structure at a depth of 0.5 m unless vegetation and/or other conditions inhibit the collection of a representative sample upstream. Prior to sampling an alternative site, a consultation with a Field Technician Supervisor and/or the FPM must take place; this action must be documented in the field notes.

Backup grab samples will accompany the autosampler collection based upon flow trigger (ACF) samples collected on a weekly basis. In addition, in situ readings (i.e., Temperature, pH, DO and Specific Conductance) are measured as the grab samples are being collected. Samples collected on upstream side of structures/culverts. G337A is a divide structure and flow may occur in both directions. Flow originating from S6 shall be considered the upstream location for the purposes of this monitoring plan and flows originating from G434 will be considered as reverse flow for this structure.

5.3 Grab Sampling Procedures

Sample collection for this project shall follow the procedures and requirements found in the Field Sample Collection Procedures Section of the District's FSQM.

5.4 Field Testing Procedures

Field testing procedures shall follow the procedures and requirements found in the District's FSQM. Table 3 below describes the field parameters collected for this project. The table shows only the most commonly used parameters. Refer to the FSQM for guidance on other parameters that may be measured by field testing, (i.e. Salinity, Turbidity, PAR, ORP, depth, Secchi).

Table 3: Field Analytical Parameters Collected

Parameter	Resolution	Accuracy
DO	0.01 mg/l	0-20 mg/l, $\pm$ 0.2 mg/l
Specific conductance	0.001 mS/cm	$\pm$ 0.5% of reading $\pm$ 0.001 mS/cm
Temp	0.01^{o} C	$\pm$ 0.15^{o}C
pH	0.01 unit	$\pm$ 0.2 unit

5.5 Field Quality Control Requirements

Field quality control requirements shall follow the procedures found in the Quality Control Section of the District's FSQM.

5.6 Autosampler Collection

Samples are collected with flow-proportional (ACF) at the inflow pump stations (S6, G328, G434 and G435) and the outflow pump stations (G335 and G436) as identified in Table 2. Frequency for ACF collections is determined by a "trigger volume" established through the protocols established by Abtew and Powell (2004). Discrete bottles within each autosampler are pre-acidified and composited on a weekly basis and analyzed for total phosphorus (TPO_4).

In addition, flow proportional samples for TKN and NOx are collected at S6 for the CAMB Project. This autosampler is refrigerated; therefore, it collects samples in a composite format. On January 8, 2013, the following autosamplers were decommissioned and these sites are now sampled by grab only: G332, G334, G330D, G337A, G368, G329B, G331D, G333C, and G337. Until startup is complete, the autosampler at G441 remains on flow to capture discharges related to seepage and rainfall.

5.7 Sample Submission

Following completion of sample collection for each day, the samples are placed in ice and transported in coolers at $\leq 6^{o}C$ to the laboratory for analysis. Samples are submitted to the laboratory on the same day as collection or via courier the following day. Samples are submitted according to the requirements outlined in the District's FSQM. If samples are submitted to other than the District's laboratory, the laboratory must be a District approved laboratory.

6.0 Data Quality Objectives

6.1 Data Usage

The data from STA2 are compiled and reported in accordance with the conditions outlined in the permit or mandate specified in Section 3.2. Typically the data are reported in the District's Annual South Florida Environmental Report (SFER), or for S6, data are reported in a standalone mandated report and the quarterly Everglades Settlement Agreement Report. The SFER can be found at www.sfwmd.gov/sfer/.

6.2 Data Quality

All monitoring described herein shall meet the indicators conveyed in the FDEP's Quality Assurance Rule, 62-160 F.A.C. The District has adopted a uniform set of Data Quality Objectives (DQOs) following criteria detailed within the "Analytical Methods and Default QA/QC Targets" table of the CLQM.

The DQOs of the field testing parameters for this project are covered by the table entitled Field Quality Assurance Objectives found in the field testing section of the FSQM. This

manual is updated regularly, and therefore, the most recent version of the District's FSQM details the specific field testing DQOs for this project at the time of sample collection.

Samples are analyzed according to the provisions within the FDEP Rule 62-160 F.A.C. and the District's CLQM. This manual is updated regularly, and therefore, the most recent version of the District's CLQM details DQOs for this project at the time of sample collection for each specific laboratory analysis. Data are qualified in accordance with the FSQM, CLQM and applicable data validation SOPs.

6.3 Completeness Targets

The completeness target (i.e., the number of samples successfully collected and analyzed) shall be 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 on an attempt due to no flow or low water conditions, unsafe station conditions, equipment malfunction, site maintenance, or other unforeseen problems that might affect sample collection and/or quality. If samples cannot be collected on an attempt, collectors shall document "no bottle" (NOB) to indicate and attempt was made and/or the sample could not be collected for the documented reasons. Attempted collection (NOB) of samples will be considered a collected sample when calculating completeness targets.

7.0 Data and Records Management

The laboratory shall evaluate the data in accordance with the data quality objectives stated in the FSQM and CLQM. All data submittals shall conform to existing District guidelines. Contract laboratory data for mercury or pesticide analysis shall be submitted to the District in the ADaPT format or other format as requested by the District.

7.1 Data Deliverables

There are no contract deliverables for this project.

7.2 Data Storage

After the data validation process, all data and records are maintained so that end users can retrieve and review all information relative to a sampling event. Field records are maintained in NuGenesis by scanning actual field note pages records directly into NuGenesis (See SFWMD-FIELD-SOP-022). All analytical data and specified metadata are sent to a database (DBHYDRO) 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 current and historical method and operating procedures so that at any given time the conditions that were applied to a sampling event can be evaluated. At least quarterly, any contractor performing work for the project shall provide all original field records to the District's WQB for permanent archival.

Records shall be maintained for the life of the project and a minimum of five years thereafter, in a manner that will protect the physical condition and/or integrity of the records. Storage shall follow the SOP for Archive Records Storage and Retention (SFWMD-FIELD-SOP-022). Corrections of data or records shall follow the applicable District SOPs and FSQM.

8.0 Revisions and Modifications

[This section is left for future changes as they are made and should be referenced throughout the document as revisions occur. Sections should be added chronologically. As revisions are made a note should be made in the corresponding section of the plan.]

Date	Section	Page Number(s)	Change From	Change To	Reason
01/01/2013	All	All			Monitoring plan modified to conform to requirements of EFA Permit # 0311207, NPDES Permit # FL0778451, and their associated Consent Orders as well as STA Operational considerations.

References:

Abtew, Wossenu & Powell, B. Water Quality Sampling Schemes for Variable Flow Canals at Remote Sites. Journal of the American Water Resources Association. October, 2007. Pp 1197 – 1204.

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

South Florida Water Management District, Chemistry Laboratory Quality Manual (CLQM),

http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/analytical%20services/tab2/tab5/2011%20quality%20manual.pdf

South Florida Water Management District, Field Sampling Quality Manual (FSQM), SFWMD-FIELD-QM-001.

http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/water%20quality%20monitoring%20division/subtab%20-%20wqm%20-%20qa/tab24442257/fsqm_sfwmd-field-qm-001-07.pdf

South Florida Water Management District, Field Sampling Quality Management Plan (QMP),

http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/subtab%20-%20qaqc/tab21630104/rsd_qmp_v3_0.pdf

Signature Page

Monitoring Plan

For

Central Flow-Way

Stormwater Treatment Area 2
(STA2)

Linda Crean, Water Quality Monitoring Section Administrator	Date
David Struve, Analytical Services Section Administrator	Date
Julianne LaRock, Compliance Assessment and Reporting Section Administrator	Date
Ming Chen, Quality Assurance Administrator	Date

Appendix 1: Site Requirements by Mandate

Station Name	Mandate	Collection Method	Frequency	Analytical Parameters
Outflow Stations				
G335 G436	National Pollution Discharge Elimination System (NPDES)	Grab	Weekly Recorded Flow (WRF)	Total Phosphorus (TPO_4), pH
		ACF	Weekly (W)	TPO_4
	Everglades Forever Act (EFA)	Grab	See Specific Condition 21	Turbidity (TURB)
		Grab	WRF	TPO_4, Dissolved Oxygen (DO), pH, Specific Conductance (SCond) Temperature (Temp)
		Grab	Biweekly Recorded Flow (BWRF)	Total Nitrogen (TN[1]), Nitrate-Nitrite (NOx), Sulfate (SO_4)
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, SCond, Temp
		Grab	BWRF	Calcium (Ca), Chloride (Cl), Ammonia (NH_4), NOx, Ortho-Phosphorus (OPO_4), SO_4, Total Dissolved Phosphorus ($TDPO_4$), Total Kjeldahl Nitrogen (TKN), Total Suspended Solids (TSS)
		Grab	Quarterly (Q)	DOC
		ACF	W	TPO_4
Inflow Stations				
S6	NPDES	Grab	WRF	TPO_4
		ACF	W	TPO_4
	EFA	Grab	WRF	TPO_4, pH SCond, Temp
		Grab	BWRF	TN, NOx, SO_4
		ACF	W	TPO_4
	EAA Rule	Grab	W	TPO_4
		ACF	W	TPO_4
	Settlement Agreement	Grab	WRF	Alkalinity, Ca, Cl, Dissolved Organic Carbon (DOC), Magnesium (MG), NH_4, NOx, OPO_4, Potassium (K), Silica (SiO_2), Sodium (Na), SO_4,TDKN, $TDPO_4$, TKN, Total Organic Carbon (TOC), TPO_4, TSS, DO, pH, SCond, Temp
		Grab	Q	Total Iron (FE)
		ACF	W	NOx, TKN, TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, SCond, Temp
		Grab	WRF	Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
		Grab	Q	DOC
		ACF	W	TPO_4

Station Name	Mandate	Collection Method	Frequency	Analytical Parameters
Inflow Stations				
G328	NPDES	Grab	WRF	TPO_4
		ACF	W	TPO_4
	EFA	Grab	WRF	TPO_4, pH, SCond, Temp
		Grab	BWRF	TN, NOx, SO_4
		ACF	W	TPO_4
	Everglades Agricultural Area Chapter Rule 40E-63 (EAA Rule)	Grab	W	TPO_4
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, SCond, Temp
		Grab	WRF	Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
		Grab	Q	DOC
		ACF	W	TPO_4
G434 G435	NPDES	Grab	WRF	TPO_4
		ACF	W	TPO_4
	EFA	Grab	WRF	TPO_4, pH, SCond, Temp
		Grab	BWRF	TN, NOx, SO_4
		ACF	W	TPO_4
	EAA Rule	Grab	W	TPO_4
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, SCond, Temp
		Grab	WRF	Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
		Grab	Q	DOC
		ACF	W	TPO_4
Seepage, Divide, and Diversion Stations				
G337 G337A	STA Operations	Grab	Monthly Recorded Flow (MRF)	TPO_4, DO, pH, SCond, Temp
G338	EFA	Grab	WRF	TPO_4
G339	STA Operations	Grab	WRF	TPO_4, DO, pH, SCond, Temp
Flow Way Start Stations				
G329B G331D G333C G438D G438I G440D	STA Operations	Grab	BWRF	Ca, TPO_4, DO, pH, SCond, Temp,
Flow Way Interior Stations				
G367C G367E G442	STA Operations	Grab	MRF	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, SCond, Temp

Station Name	Mandate	Collection Method	Frequency	Analytical Parameters
Flow Way End Stations				
G334 **G330D** **G332** **G368** **G441**	STA Operations	Grab	WRF	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, SCond, Temp
			Q	DOC

[1]TN is calculated as the sum of TKN and NOx

Appendix 2: STA-2 and Comp. B Mercury and Other Toxicants Monitoring Plan

Central Flow-Way
Stormwater Treatment Area 2
EFA Permit No. 0311207

Monitoring of water-column concentrations of total mercury (THg) and methylmercury (MeHg) began in the summer of 2000 at STA-2. STA-2 Cells 2 and 3 met mercury (Hg) startup criteria, as specified in Exhibit "D" of EFA Permit No.0126704, in September 2000 and November 2000, respectively. In August 2001, flow-though operation of Cell 1 was authorized under an EFA permit modification; Cell 1 met startup criteria in November 2002 (for review, see 2003 and 2004 Everglades Consolidated Reports and the 2005 South Florida Environmental Report [SFER]).

In January 2007, the District completed construction of a new flow-way in STA-2, known as Cell 4. STA-2 Cell 4 met the mercury start up criteria as specified in Exhibit "D" of EFA Permit No. 0126704-005-EM in September 2007. Routine monitoring of mercury in Cell 4 was initiated October 2007. In addition, Cell 4 met conditions contained in "*A Protocol for Monitoring Mercury and Other Toxicants"* (dated April 2011; hereafter referred to as the *Protocol*) to terminate atrazine monitoring in June 2008 (see data summary provided in correspondence from H. Andreotta, SFWMD dated January 6, 2012). The Florida Department of Environmental Protection (Department) approved termination of atrazine monitoring January 30, 2012. February 29, 2012, the Department approved transfer of STA-2 mercury monitoring from Phase 2 - Tier 1: Routine Monitoring during Stabilization Period for Cells 1, 2 and 3 of STA-2 to Phase 3 – Tier 3: Routine Operational Monitoring After Year 9 and Phase 3 – Tier 1: Routine Operational Monitoring From Year 4 to Year 9 for Cell 4 of STA-2. Phase 3 – Tier 3 implemented the termination of all site specific mercury monitoring at STA-2 Cells 1, 2, and 3.

As of the date of this updated monitoring plan, the District has constructed two new flow-ways in STA-2, known as EAA Compartment B Buildout Project (Compartment B). These new flow-ways consist of the North Buildout (NBO), which includes Cells 4, 5, and 6 and the South Build-out (SBO), which includes Cells 7 and 8. Compartment B incorporates the existing Cell 4.

Based on the current status of Compartment B, initial performance of Cells 1, 2, and 3, and the guidance contained in the *Protocol*, the District shall initiate Phase 1 – Tier 2: Field Sampling for Initial Startup Monitoring Prior to Discharge for Compartment B (Cells 4, 5, 6, 7 and 8) and implement Phase 3 – Tier 3: Routine Operational Monitoring After Year 9, which terminates mercury monitoring, for Cells 1, 2, and 3 and as follows:

1.0 Phase 1: Baseline Collection and Assessment

1.2 Phase 1 - Tier 2: Field Sampling for Initial Startup Monitoring Prior to Discharge

1.2.1 Mosquitofish

i) When construction of the Compartment B is completed, the District shall notify the Department and within one month of initial flooding collect mosquitofish from multiple locations within the two new flow-ways known as NBO and SBO (to total at least 100 fish; see Figure 2 for map). Samples shall be physically composited into one (spatially-averaged) sample per flow-way and analyzed for total mercury (THg), cis-chlordane, trans-chlordane, o,p'-DDD, p,p-DDD, o,p'DDE, p,p'-DDE, o,p'-DDT, p,p'-DDT, cis-nonachlor, trans-nonchlor, and toxaphene analysis (note, a single aliquot should be analyzed per composite).

ii) The District shall provide the Department with the results of the first collection of mosquitofish as well as the appropriate action levels for comparison (90% upper confidence level of the basin-wide average or the 75th percentile concentration for the period of record for all basins). If tissue concentrations from Compartment B are below the 90% upper confidence level of the basin-wide average or below the 75th percentile concentration for the period of record for all basins (if basin-specific data are lacking) after concurrence from the Department, the District may initiate flow-through operation and routine monitoring for the Compartment B.

However, if Hg or other toxicant concentrations in the mosquitofish composite exceed one of the above-referenced action levels, the District shall immediately (within 14 days of receiving quality-assured data from the laboratory) collect a sample(s) to confirm the exceedance(s). In addition, the District shall consult with the Department to determine the most appropriate course of action and obtain authorization to initiate flow-through operation. At a minimum, the course of action will include implementation of Tier 2 Expanded Monitoring and Risk Assessment by the District during initial flow-through operations (e.g., collection of monthly mosquitofish within the STA and at one station downstream of the STA at a minimum), additional details on expanded monitoring are provided in the *Protocol*). The recommended course of action may also include additional measures as determined to be appropriate. When results of expanded monitoring demonstrate concentration of Hg in mosquitofish from the Compartment B has decreased to acceptable levels (below action levels referenced above) and the concentrations at the downstream site are not significantly elevated above baseline levels, the District shall notify the Department and request that the monitoring revert back to Tier 1 routine monitoring.

1.2.2 Soil

After the soils have been flooded and saturated for some period of time (i.e., in excess of a month) and prior to discharge, sediment cores will be collected from five representative locations within both the NBO and SBO. Downstream startup sediment was already collected for Cell 4 startup in December 2007. Efforts will be made to co-locate sediment sites with mosquitofish collection sites.

At each location or site, a minimum of three cores (number of cores in excess of three will be determined by amount of sediment required for analysis) from the 0 to 4 cm horizon are to be collected and composited as a single sediment sample.

To serve as baseline for future comparison, if future conditions warrant follow-up sampling of sediments (i.e., if Tier 2 were triggered), sediment samples will be analyzed for THg, MeHg,

moisture content, total organic carbon (TOC), total sulfur (TS), and total iron (TFe). Additionally, these sediment samples will be analyzed and assessed for toxicants other than mercury as discussed below.

1.3 Water

Although mercury will be monitored and assessed prior to discharge based on tissue concentrations, because of the concern for potential acute toxicity, water will be collected from immediately upstream of the STA-2 and Compartment B inflow pump stations (G-328, S-6, G434, and G-435) and outflow pump stations (G-335 and G-436) and analyzed for toxicants other than mercury as discussed below.

Selection of Toxicants Other Than Mercury

The following information sources have been reviewed for data regarding this project: URS Corporation, Environmental Site Assessment (ESA) for Acceler8 Projects (Woerner South Farm and Okeelanta Property). Based on this review, samples will be collected and analyzed for the parameters identified in Table 1 for each of the specified matrices.

Table 1: Parameter list of toxicants other than mercury that will be analyzed in specified matrix.

Analyte	Surface Water	Sediment	Fish Tissues
chlordane	X	X	
cis-chlordane			X
trans-chlordane			X
o,p'-DDD			X
p,p'-DDD	X	X	X
o,p'-DDE			X
p,p'-DDE	X	X	X
o,p'-DDT			X
p,p'-DDT	X	X	X
cis-nonachlor			X
trans-nonachlor			X
toxaphene	X	X	X

Table 2: Initial Startup Monitoring Prior to Discharge

Matrix	Location	Collection Method	Frequency	Parameter
Mosquitofish	Within each flow-way of NBO & SBO	Net or Trap	One-time	THg cis-chlordane, trans-chlordane, o,p'-DDD, p,p'-DDD, o,p'-DDE, p,p'-DDE, o,p'-DDT, p,p'-DDT, cis-nonachlor, trans-nonachlor, toxaphene
Sediment	5 locations each within NBO & SBO	Sediment Core	One-time	THg, MeHg, Moisture Content, TOC, TS, and TFe Chlordane, p,p'-DDD, p,p'-DDE, p,p'-DDT, toxaphene
Surface Water	G-328, S-6, G434, G-435, G-335, and G-436	Grab	One-time	Chlordane, p,p'-DDD, p,p'-DDE, p,p'-DDT, toxaphene

The District shall provide the Department with the results of these analyses as well as the appropriate action levels for comparison. If the following criterion is met for NBO and SBO, the District may initiate flow-through operational and routine compliance monitoring (for details on routine monitoring, see below).

- If ambient mosquitofish do not demonstrate excessive bioaccumulation that exceeds a critical tissue benchmark used to establish SQAGs or in site-specific risk assessments;
- If concentrations in sediments do not exceed an effects-based, numerical sediment quality assessment guideline (SQAGs for sediment dwelling organisms, MacDonald Environmental Sciences Ltd. and USGS, 2003);
- If concentrations in sediments do not exceed an established bio-accumulative based SQAG, if available (MacDonald Environmental Sciences Ltd. and USGS, 2003), a action level reported in the ESA or a level that was determined to be critical in a site-specific risk assessment;
- If water-column concentrations do not exceeded the state water quality standard (WQS) in Chapter 62-302, Florida Administrative Code (F.A.C.)

However, if the above referenced action level is exceeded, the District shall immediately (within 14 days of receiving quality assured data from the laboratory) collect a sample(s) to confirm the exceedance(s). In addition, the District shall consult with the Department to determine the most appropriate course of action and obtain authorization to initiate flow-through operation from Compartment B. At a minimum, the course of action will include implementation of Tier 2 Expanded Monitoring and Risk Assessment by the District during initial flow-through operations. The recommended course of action may also include additional measures as determined to be appropriate. When results of expanded monitoring demonstrate concentrations in each flow-way has decreased to acceptable levels (below action levels referenced above), and

the concentrations at the downstream site are not significantly elevated above baseline levels, the District shall notify the Department and request that the monitoring revert back to Tier 1 routine monitoring.

2.0 Monitoring During Three-Year Stabilization Period

2.1 Phase 2 - Tier 1: Routine Monitoring During Stabilization Period

2.1.1. Water

An unfiltered surface water sample (n = 1) shall be collected in accordance with Chapter 62-160, F.A.C. at the G-328, S-6, G-434 and G-435 inflow pump stations and immediately upstream of the G-335 and G-436 outflow pump stations (Figure 1) on a quarterly basis and analyzed for THg and methylmercury (MeHg) (sulfate is being monitored under the EFA permit required routine WQ monitoring program). In addition, flow shall be monitored at the inflow and outflow to allow for load estimation to and from the project (it should be recognized that quarterly sampling would allow for only rough estimation of loads).

Based on the discussion above regarding toxicants other than mercury, a surface water sample will be collected quarterly at G-328, S-6, G-434 and G-435 and immediately upstream of G-335 and G-436 and analyzed for the parameters listed in Table 1 under surface water.

This data set will be assessed to determine if outflow concentrations exceed state water quality standards (WQS), and whether annual outflow loads of analytes are significantly greater than inflow loads, including atmospheric loading; load estimates will include confidence intervals that describe uncertainty in measures of flow and concentration (e.g., field and analytical precision) and resulting from interpolation (note: assessment protocol to be negotiated with permitting authority). Failure to satisfy these assessment measures would trigger Tier 2 Expanded Monitoring and Risk Assessment (see below).

Because of differences in the anticipated time frames under which sedimentary release are thought to occur (i.e., relative to MeHg that may have time lag associated with changes in biogeochemistry and microbial methylation driven by water quality, especially in sandy soils), monitoring for other toxicants would cease after one year if action levels are not exceeded within that time.

2.1.2. Fish Tissues

Samples of fish from multiple trophic levels will be collected from each independently operated flow-way (NBO and SBO) and from a single downstream site in the receiving water of the project (Figure 1). Specifically, mosquitofish will be collected quarterly from multiple locations within each NBO and SBO, physically composited into one (spatially-averaged) sample (to total at least 100 fish) per flow-way, and analyzed for THg and other toxicants listed in Table 1 under fish (note, a single aliquot will be analyzed per composite). Additionally, mosquitofish (to total at least 100 fish) will be collected quarterly from a single site located in the receiving waters

immediately downstream from the project (i.e., station CA2NF downstream of G-336 A-F within WCA-2) and analyzed for THg and other toxicants.

In addition, sunfish (n should be greater than or equal to 5) and largemouth bass (*Micropterus salmoides);* (n should be greater than or equal to 5) shall be collected annually from NBO and SBO and from station CA2NF located in the receiving waters and individually analyzed for THg and other toxicants listed in Table 1 under fish (i.e., whole sunfish and fillets from the bass). To reduce variance (i.e., due to species differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections should target *Lepomis macrochirus (*bluegill) ranging in size from 102 to 178 mm (i.e., 4 to 7 inches) and largemouth bass ranging in size from 307 to 385 mm (i.e., 12 to 15 inches). However, other Lepomids or sizes are to be collected if efforts fail to locate targeted fish. Owing to similar trophic status, if bluegill cannot be collected, first priority will be given to spotted sunfish, *Lepomis punctatus*. If neither sunfish nor bass are present, consideration should be given to sampling other species.

Table 3: Phase 2 – Tier 1: Routine Monitoring During Stabilization Period

Matrix	Location	Collection Method	Frequency	Parameter
Surface Water	G-328, S-6, G-434 G-435, G-335 and G-436	Grab	Quarterly	THg, MeHg Chlordane, p,p'-DDD, p,p'-DDE, p,p'-DDT, toxaphene*
Mosquitofish	NBO, SBO, and one downstream station (CA2NF)	Net or Trap	Quarterly	cis-chlordane, trans-chlordane, o,p'-DDD, p,p'-DDD, o,p'-DDE, p,p'-DDE, o,p'-DDT, p,p'-DDT, cis-nonachlor, trans-nonachlor, toxaphene*
Bass & Sunfish (n=5 each)	NBO, SBO, and one downstream station (CA2NF)	Electrofish or Hook & Line	Annually	THg cis-chlordane, trans-chlordane, o,p'-DDD, p,p'-DDD, o,p'-DDE, p,p'-DDE, o,p'-DDT, p,p'-DDT, cis-nonachlor, trans-nonachlor, toxaphene*

* Monitoring for toxicants other than mercury will cease after one year if action levels are not exceeded.

Assessment

To detect and minimize any adverse effects as early as possible (and to provide a basis for identifying adaptive management options, if deemed necessary), the results of this monitoring will be assessed based on the criteria and time table described under Phase 2 – Tier 1 in the *Protocol*. Monitoring results will be provided to the Department in accordance with the reporting requirements described below.

2.2 Phase 2 - Tier 2: Expanded Monitoring and Risk Assessment

In accordance with the *Protocol*, if Tier 1 data exceed the action levels identified under Phase 2 – Tier 2: Expanded Monitoring and Risk Assessment, the District shall notify the Department and

after obtaining the Department's concurrence, shall expand monitoring and undertake all necessary steps consistent with the *Protocol*.

3.0 Operational Monitoring

The monitoring plan and associated data will be re-evaluated on regular basis beginning after year 1 for other toxicants and after year 3 for mercury species to determine if criteria specified in the *Protocol* are being satisfied (following startup of Compartment B). Based on that assessment, and with the concurrency of the Department, monitoring and assessment efforts may be reduced (as identified in Phase 3 – Tier 1: Operational Monitoring from Year 4 to Year 9 of the *Protocol*) or eliminated altogether at the project level to be subsumed by regional monitoring (as identified in Phase 3 – Tier 3: Routine Operational Monitoring After Year 9 of the *Protocol*). However, if monitoring reveals anomalous conditions as described under Phase 3 – Tier 2: Expanded Monitoring and Risk Assessment, the District shall expand monitoring and undertake all necessary steps identified under Phase 3 – Tier 2 the *Protocol*.

3.1 Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9

3.1.1 Fish Tissues

Semiannually, mosquitofish will be collected from multiple locations within independently operated flow-way (NBO and SBO) and from a single downstream site in the receiving water of the project (Figure 1). Specifically, mosquitofish will be collected semiannually from multiple locations within each NBO and SBO, physically composited into one (spatially-averaged) sample (to total at least 100 fish) per flow-way, and analyzed for THg (note, a single aliquot will be analyzed per composite). Additionally, mosquitofish (to total at least 100 fish) will be collected semiannually from a single site located in the receiving waters immediately downstream from the project (i.e., station CA2NF downstream of G-336 A-F within WCA-2) and analyzed for THg.

To assess "worst case" conditions, large-bodied fish will be collected only from the flow-way with the highest observed concentration and the downstream station identified above once every three years. This limited spatial sampling of large-bodied fish within the STA is to revert back to include formerly sampled stations, if Tier 2 is triggered or if mosquitofish demonstrate significantly altered spatial patterns in mercury biomagnification.

Specifically, sunfish (n should be greater than or equal to 5) should be collected from each station and individually analyzed as whole-fish. At the same time, largemouth bass (*Micropterus salmoides*; n should be greater than or equal to 5) should be collected from each station and individually analyzed (fillets) for THg. To reduce variance (i.e., due to species differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections will target bluegill (*Lepomis microchirus*) ranging in size from 102 to 178 mm (i.e., 4 to 7 inches) and largemouth bass ranging in size from 307 to 385 mm (i.e., 12 to 15 inches); however, other lepomis (due to similar trophic status, first

priority being given to spotted sunfish (*L. punctatus*) or sizes will be collected if efforts fail to locate targeted fish.

This data will then be used to track the following:

- THg levels in individual mosquitofish composite;
- Annual average THg levels in mosquitofish;
- THg levels in large-bodied fish

Table 4: Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9

Matrix	Location	Collection Method	Frequency	Parameter
Mosquitofish	NBO, SBO, and one downstream station (CA2NF)	Net or Trap	Semiannually	THg
Bass & Sunfish (n=5 each)	Flow-way with historically highest [THg] (To Be Determined) and one downstream station (CA2NF)	Electrofish or Hook & Line	Triennially	THg

3.2 Phase 3 - Tier 2: Expanded Monitoring and Risk Assessment

Tier 2 monitoring and assessment is triggered if one of the following action levels is exceeded during operation:

- If annual average THg levels in mosquitofish progressively increased over time (i.e., two or more years) or any (semi-annual) mosquitofish composite exceeds the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceeds the 75th percentile concentration for the period of record for all basins; or
- If triennial monitoring of large-bodied fish reveal tissue Hg levels in fishes have statistically increased progressively over time or have become elevated to the point of exceeding the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceeded the 75th percentile concentration for the period of record for all basins.

The following steps will be taken if any action level in Tier 2 is triggered:

Step 1: Notify the Department;

Step 2: Resample fish species that triggered Tier 2;

If results of Step 2 (i.e., re-sampling) demonstrate that the anomalous condition was an isolated event, the Department will be notified that the project will revert back and continue with Tier 1 monitoring. Alternatively, if results of Step 2 reveal the anomalous condition was not an isolated event, proceed to Step 3.

Step 3: Expanding monitoring program as follows:

- Increase frequency of mosquitofish collection from semiannually to monthly.
- If Tier 2 was triggered by THg levels in fish at the downstream site, possibly due to excessive loading from the STA outflow, then quarterly water-column sampling the outflow station will begin. If necessary (i.e., if loading uncertainty is high), increase frequency of surface water collection to monthly (reducing temporal interpolation), or as appropriate for hydraulic retention time (HRT).
- If Tier 2 was triggered by THg levels in fish within only one of the treatment trains, further define spatial extent of problem by collecting multiple mosquitofish composites from within the treatment train exhibiting anomalous conditions.
- If Tier 2 was triggered by tissue THg levels in large-bodied fish, increase sample size of large-bodied fish to n = 20, i.e., 20 each of sunfish (collect various species and sizes) and/or bass (collect various sizes and extract otolith from bass for age determination).
- To evaluate possible trends in methylation rates in sediments (i.e., to determine if methylation rates are increasing or decreasing), replicate sediment cores (0-4 cm) can be collected from the suspected methylation "hot spot" and reference locations within the component (for THg, MeHg, moisture content, total organic carbon (TOC), total sulfur (TS), and total iron (TFe)) over a given period of time (i.e., 2 to 4 months). At these same locations and collection times, collect pore water samples and analyze for THg, MeHg, and sulfides, or if no acceptable pore water protocol has been developed, then acid-volatile sulfide (AVS) on solids shall be completed.

Projects shown to have (spatially) large or multiple MeHg "hotspots" should consider use of the Everglades Mercury Cycling Model (E-MCM) or comparable model as an assessment tool (i.e., to synthesize results of expanded monitoring).

Step 3 will also include the notification of the Department that anomalous conditions are continuing. The Department and the District may then develop an adaptive management plan using the data generated from the expanded monitoring program. This plan will evaluate the potential risks from continued operation under existing conditions (i.e., through a risk assessment for appropriate ecological receptors). If risk under existing operational conditions is deemed acceptable, then project monitoring would continue under a modified Tier 2 scheme to monitor exposure. On the other hand, if risk under existing operational conditions is deemed unacceptable, then the adaptive management plan would then proceed to determine potential remedial actions to (1) reduce exposure and risk (e.g., signage for human health concerns[1], reduce fish populations, reduce forage habitat suitability) and (2) affect mercury biogeochemistry to reduce net methylation (e.g., modify hydroperiod or stage, water quality).
In developing this adaptive management plan, the Department may conduct a publicly noticed workshop to solicit comments from the District, the U.S. Army Corps of Engineers, the U.S.

[1] Note that assessment of potential human health impacts and corrective actions (i.e., signage) will require the involvement of the Florida Department of Health)

Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Park Service, the Florida Fish and Wildlife Conservation Commission, and other interested persons.

The next step would then be to carry out such remedial or corrective action. If the remedial or corrective action is demonstrated to be successful, then the project would revert back to Tier 1 monitoring. Alternatively, if monitoring data indicate that the remedial action was unsuccessful in reducing fish tissue concentrations or downstream loading, the Department and the District would then initiate a peer-reviewed, scientific assessment of the benefits and risks of the project.

3.3 Phase 3 - Tier 3: Termination of Monitoring After Year 9

If fishes collected under Phase 3 - Tier 1 have not exceeded action levels by year 9, project-specific monitoring would be discontinued; future assessments would be based on regional monitoring.

4.0 Annual Mercury Monitoring Report

The District shall notify the Department immediately if monitoring data indicate that any of the action levels are exceeded. In addition, the District shall submit an annual report to be incorporated into the SFER and submitted to the Department no later than March 1st of each year. The annual report shall summarize the most recent results of the monitoring as defined above and compares them with the cumulative results from previous years. This report shall also evaluate assessment performance measures (i.e., action levels) outlined above.

5.0 Adaptive Management Strategy

It is the intent that this monitoring plan will be carried out within the context of an adaptive management strategy that will allow for appropriate changes based on new, better understanding of mercury cycling, fate and transport as conveyed in the guidance contained in the *Protocol*.

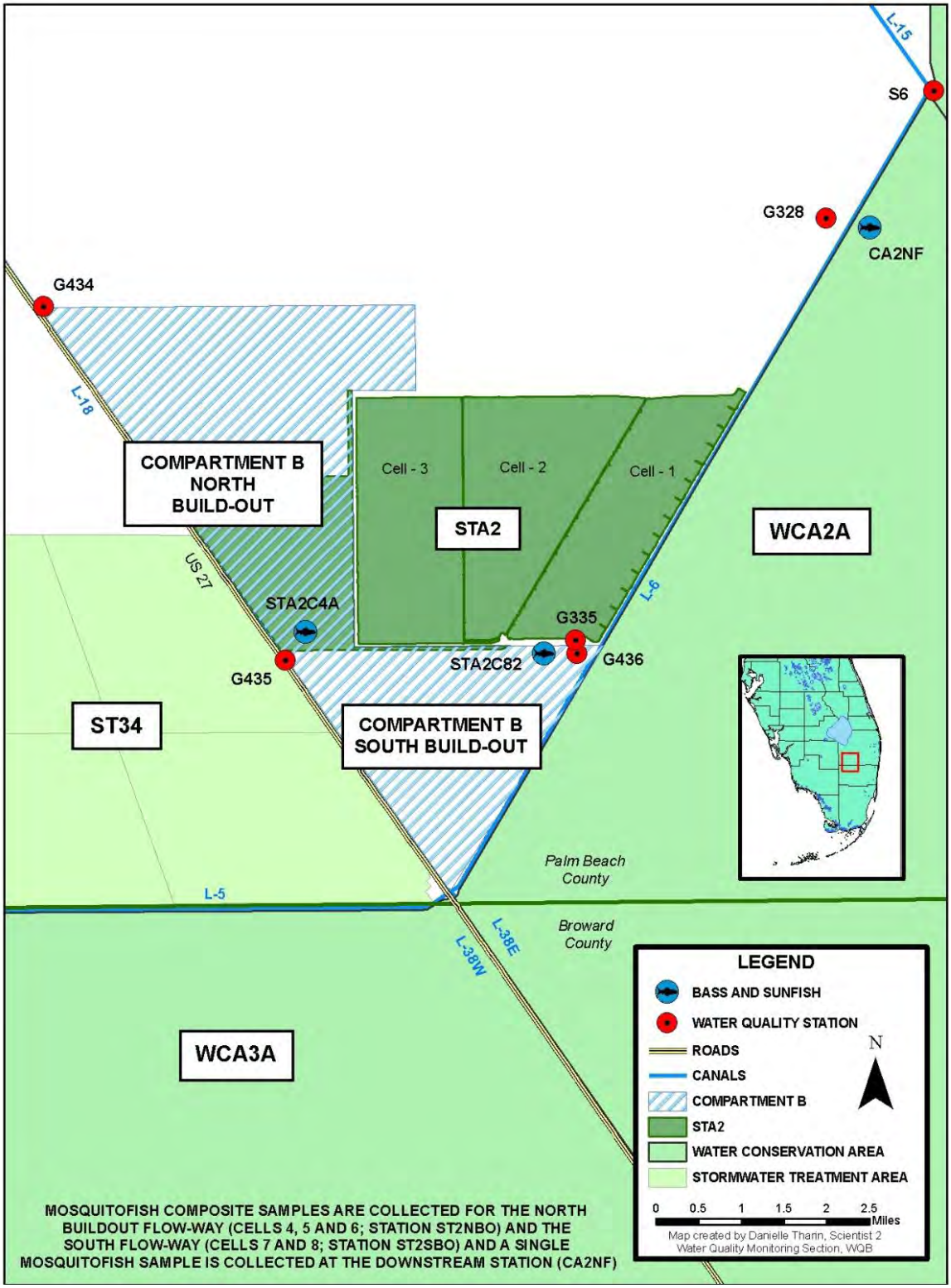


Figure 1: STA-2 Mercury and Other Toxicants Monitoring Stations

Operational Project Monitoring Plan

For

Central Flow-Way
Stormwater Treatment Area 3/4

Project Code: STA3/4

01/07/2013

This monitoring plan is adaptive and therefore subject to change based on operational needs. It will be reviewed and/or modified at a minimum, on an annual basis.

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

SFWMD-FIELD-MP-045-04

Table of Contents

Figures

Tables

Appendices

1.0 Glossary

ACF	Autosampler Composite Flow
CLQM	Clinical Laboratory Quality Manual
COC	Chain of Custody
DBHYDRO	South Florida Water Management District Environmental Database
DQOs	Data Quality Objectives
EAA	Everglades Agricultural Area
EFA	Everglades Forever Act
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FSQM	Field Sampling Quality Manual
F.S.	Florida Statutes
LIMS	Laboratory Information Management System
LTP	Long Term Plan
NPDES	National Pollutant Discharge Elimination System
PSTA	Periphyton-based Stormwater Treatment Area
QA/QC	Quality Assurance/Quality Control
QMP	Quality Management Plan
STA	Stormwater Treatment Area
SFER	South Florida Environmental Report
SFWMD	South Florida Water Management District
WQS	Water Quality Standard
WQM	Water Quality Monitoring Section

2.0 Project Organization

Overall project organization and responsibilities are detailed in the South Florida Water Management District (SFWMD or District) Water Quality Bureau (WQB) Quality Management Plan (QMP). Field activity responsibilities are detailed in the District's Field Sampling Quality Manual (FSQM). Laboratory analysis and data validation responsibilities are detailed in the District's Chemistry Laboratory Quality Manual (CLQM). These documents define the procedures used by SFWMD personnel to meet the Florida Department of Environmental Protection's (FDEP) Quality Assurance Rule, Florida Administrative Code (F.A.C.) 62-160. Refer to these documents for details on key personnel and relevant responsibilities.

3.0 Project Description

3.1 Project Introduction and Background

This document serves as a reference for surface water quality monitoring in Stormwater Treatment Area (STA) 3/4. The guidance contained herein is intended to assist in maintaining consistency in sampling locations, parameter lists, and frequencies as well as providing documentation of the project scope and an ongoing historical perspective.

The operational plan for STA3/4 contains detailed structure specifications including brief descriptions of permit required water quality monitoring at each structure.

3.2 Active Mandates and Permits

Station locations, sampling frequencies, and parameters to be sampled are dictated by the mandate and/or permits governing this project (see below). In addition, a mercury and toxicants monitoring program required by Everglades Forever Act (EFA) is included as Appendix 2.

As part of the Central Flow-way for the Everglades Construction Project, STA3/4 is subject to both the Everglades Forever Act Permit #0311207 and the National Pollutant Discharge Elimination System Industrial Wastewater Facility (NPDES) Permit FL0778451, both issued on September 10, 2012 and expiring on September 09, 2017. These permits dictate the types and frequencies of monitoring to be done, and the parameters to be analyzed, and can be viewed at:

- Everglades Forever Act Permit
  http://www.dep.state.fl.us/water/wqssp/everglades/docs/ecp-sta/draft-watershed-efa-permit.pdf
- NPDES Permit
  http://www.dep.state.fl.us/secretary/news/2012/06/npdes_watershed_permit_consent_order.pdf

Additional stations, parameters and frequencies are required as part of operational monitoring are detailed in Appendix 1.

3.3 Project Objectives

The primary objective of this monitoring project is to:

1. Assess compliance with applicable water quality standards and phosphorus discharge limits;
2. Aid in determining the nutrient concentrations to quantify the tons of nutrients removed by the STA annually;
3. Guide mid and long term resource management decisions for nutrient removal capabilities of the STA.

3.4 Duration

3.4.1 Initiation Conditions

The monitoring for this project was initiated in 2003 with twelve (12) stations sampled. Eighteen (18) project operation/mission driven stations were added through 2006 as illustrated in Table 1.

3.4.2 Modification or Termination Conditions

The mandated monitoring described in this document will be ongoing as required by the EFA 0311207 and NPDES FL0778451 permits, which are renewed once every 5 years. Conditions for modification or termination of the project are detailed in the permit(s) that specify the conditions of the project. Monitoring for operations will continue indefinitely in support of the project goals and objectives. Monitoring may increase or decrease over time, depending upon individual cell operations, data results, end user needs and permit requirements. Short-term changes to collection events may be made as a result of an extreme weather conditions (i.e., droughts and tropical storms/hurricanes), other safety concerns, or construction activities.

4.0 Geographic Location

4.1 Regional Area

This project is located within the south-central portion of the Everglades Agricultural Area (EAA) and includes wetlands and Class III freshwaters within the southernmost portion of Palm Beach County, Florida. The STA is located on 16,544 acres of lands located just north of the L-5 canal, directly north of the Palm Beach County line, extending from the Holey Land Wildlife Management Area eastward to U.S. Highway 27 (North New River Canal), and includes: Sections 31-36, Township 46 South, Range 37 East, Sections 1-16 and 22-24, Township 47 South, Range 37 East, Sections 6-8 and 16-21, Township 47 South, Range 38 East, and Section 31, Township 46 South, Range 38 East (Figure 1).

4.2 Sampling Locations

The locations of all monitoring stations are depicted in Figure 1 with exact locations described in Table 1.

4.3 Access and Authority

The gates on roadways into STA 3/4 are secured with a District “Clewiston” lock. The lock requires a “C” key which can be obtained through a District key permit. Samples are collected on the upstream side of structures/culverts.

Table 1: STA3/4 Surface Water Monitoring Sites, GPS Coordinates and Descriptions

Station	Latitude	Longitude	Description
G370	262346.672	83523.478	Inflow pump station
G370S	262346.673	803523.477	Seepage pump autosampler near inflow pump station G370
G371*	262013.31	803218.901	Diversion structure located north of the S7 structure
G372	262608.505	804828.09	Inflow pump station
G372S	262604.627	804836.937	Seepage pump autosampler near inflow pump station G372
G373*	262606.965	804841.241	Diversion located in the Miami Canal south of G372 Structure
G374B	262346.166	803541.879	Cell 1A inflow gate structure
G374E	262346.023	803624.747	Cell 1A inflow gate structure
G375B	262149.350	803417.953	Cell 1A to cell 1B
G375E	262148.731	803530.464	Cell 1A to cell 1B
G376B	262007.606	803320.636	Cell 1B outflow structure
G376E	262007.241	803441.973	Cell 1B outflow structure
G377B	262345.849	803715.344	Cell 2A inflow gate structure
G377D	262345.736	803747.237	Cell 2A inflow gate structure
G378B	262148.494	803644.126	Cell 2A to 2B
G378D	262148.329	803733.601	Cell 2A to 2B
G378 E	262148.218	803757.842	PSTA inflow cell 2A to 2B
G379B	262006.754	803626.394	Cell 2B outflow gated structure
G379D	262021.565	803727.797	Cell 2B outflow gated structure
G379E	262030.839	803755.033	Cell 2B outflow gated structure
G380B	262345.490	803855.421	Cell 3 inflow gate structure
G380E	262345.079	804023.401	Cell 3 inflow gate structure
G381B	262135.102	803855.680	Cell 3 outflow gated structure
G381E	262147.536	804023.581	Cell 3 outflow gated structure
G383	262347.025	803650.926	Inflow pump station
G384B	262240.700	804024.200	Cell 3A to Cell 3B – west of G384A
G384E	262240.700	804024.399	Cell 3A to Cell 3B – west of G384D
G388	262031.737	803800.628	Cell 2B, outflow pump station for PSTA project
G389A	262109.994	803745.370	Inflow to cell 2B_1_4
G389B	262110.020	803753.310	Inflow to cell 2B_1_4
G390A	262109.943	803759.459	Inflow to cell 2B_1_2
G390B	262109.994	803806.279	Inflow to cell 2B_1_2

The standard positional goal for site coordinates is ±1 meter. This standard can be obtained with a professional grade DGPS system. The coordinates are relative to NAD83 HARN horizontal datum.
*Sites collected as a part of the EAA Monitoring Plan

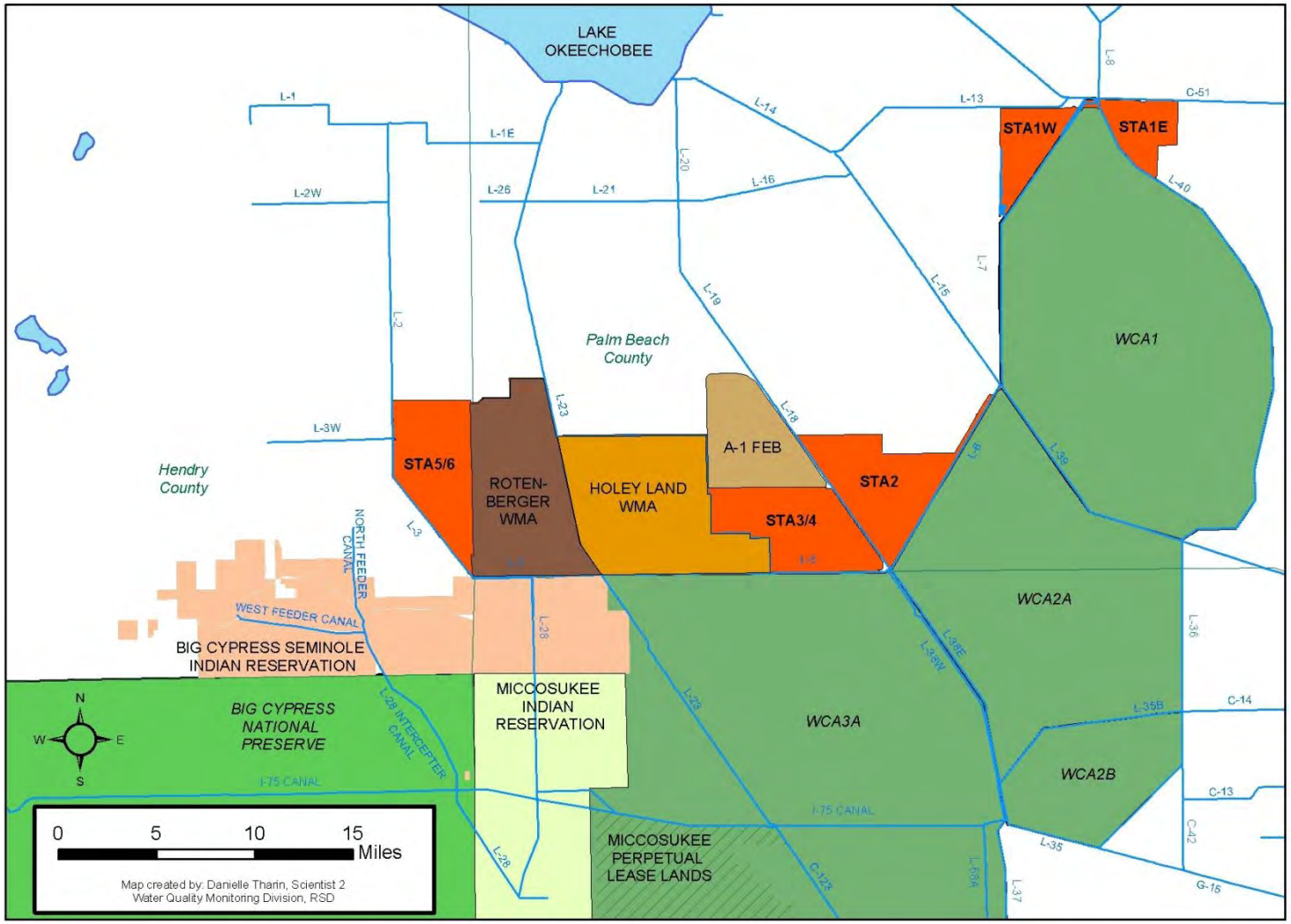


Figure 1: Regional Area of STA3/4

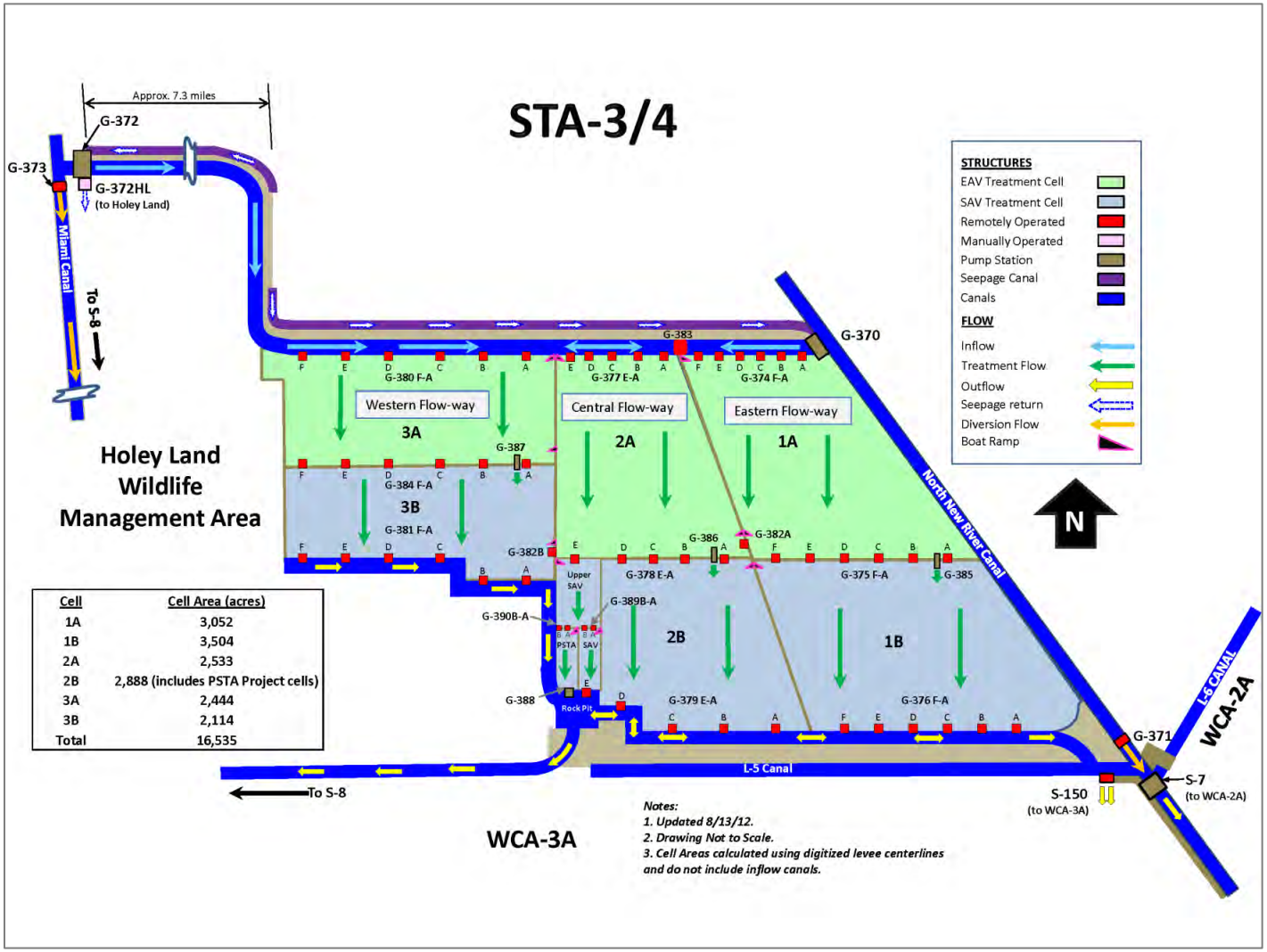


Figure 2: Project STA3/4 Station Map

Table 2: STA3/4 Sample Frequencies and Parameters

Station Name	Collection Method	Frequency	Parameter ACODES
Outflow and Flow Way End Stations			
G376B G376E G379B G379D G381B G381E	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
	Grab	Weekly Recorded Flow	Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS,
	Grab	Quarterly	DOC
	ACF	Weekly	TPO4
Inflow Stations			
G370 G372	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
	Grab	Weekly Recorded Flow	Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
	ACF	Weekly	TPO_4
	Grab	Quarterly	DOC
Diversion Stations			
G371† G373	ACF	Weekly	TPO_4
	Grab	Weekly	TPO_4
Flow-Way Starts and Interior Stations			
G374B G374E G377B G377D G380B G380E	Grab	Biweekly Recorded Flow	Ca, TPO_4, DO, pH, Scond, Temp
G375B G375E G378B G378D G384B G384E	Grab	Monthly Recorded Flow	Ca, OPO_4, TDP, TPO_4, DO, pH, Scond, Temp
Divides and Seepage Stations			
G383 G370S G372S	Grab	Monthly Recorded Flow	TPO_4, DO, pH, Scond, Temp
PSTA Stations			
G388 G379E G378E G389A G389B G390A G390B	Grab	Weekly	OPO_4, TPO_4, $TDPO_4$, DO, pH, Scond, Temp
	ACF	Weekly	TPO_4
	Grab	Biweekly	ALKA, Ca, Cl, DOC, Mg, Na, NH_4, NOx, K, SO_4, TDS, TKN, TSS, TURB

† Site collected as a part of EAA monitoring plan

5.0 Field Activities

5.1 Monitoring Frequencies by Station and Parameters

All samples required for collection are depicted in Table 2. Some stations within the monitoring network are collected based on whether flow has been recorded. Specifically, structure operation activity is determined within a specified timeframe through the review of electronic data. If no flow (i.e., no operations) has been recorded, the sample is considered a No Bottle sample (NOB) and the structure is not visited. Conversely, if flow has been recorded during the specified timeframe, a sample is collected.

5.2 Project Specific Guidelines

All surface water samples shall be collected on the upstream side of any structure at a depth of 0.5 m unless vegetation and/or other conditions inhibit the collection of a representative sample upstream. Prior to sampling an alternative site, a consultation with a Field Technician Supervisor and/or the FPM must take place; this action must be documented in the field notes.

Backup grab samples will accompany the autosampler collection based upon flow trigger (ACF) samples collected on a weekly basis. In addition, in situ readings (i.e., Temperature, pH, DO and Specific Conductance) are measured as the grab samples are being collected. Samples are collected on upstream side of structures/culverts.

5.3 Grab Sampling Procedures

Sample collection for this project shall follow the procedures and requirements found in the Field Sample Collection Procedures Section of the District's FSQM.

5.4 Field Testing Procedures

Field testing procedures shall follow the procedures and requirements found in the Field Testing Section of the District's FSQM. The field parameters for this project are described below.

Table 3: Field Analytical Parameter Collection

Parameter	Resolution	Accuracy
Dissolved Oxygen	0.01 mg/l	0-20 mg/l, $\pm$ 0.2 mg/l
Specific conductance	0.001 mS/cm	$\pm$ 0.5% of reading $\pm$ 0.001 mS/cm
Temperature	0.01^{o} C	$\pm$ 0.15^{o}C
pH	0.01 unit	$\pm$ 0.2 unit

5.5 Field Quality Control Requirements

Field quality control requirements shall follow the procedures found in the Quality Control Section of the District's FSQM.

5.6 Autosampler Collection

Samples are collected with flow-proportional (ACF) at the stations identified in Table 2. Frequency for ACF collections is determined by a "trigger volume" established through

the protocols established by Abtew and Powell (2004). The frequency of ADT collection is set by the FPM following discussions with the data end user(s). Discrete bottles within each autosampler are pre-acidified and composited on a weekly basis and analyzed for total phosphorus (TPO_4).

5.7 Sample Submission

Following completion of sample collection for each day, the samples are placed in ice and transported in coolers less than or equal to $\leq 6^{o}$ Celsius to the laboratory for analysis. Samples are submitted to the laboratory on the same day as collection or via courier the following day. Samples are submitted according to the requirements outlined in the District's FSQM. If samples are submitted to other than the District's laboratory, the laboratory must be a District approved laboratory.

6.0 Data Quality Objectives

6.1 Data Usage

The data from STA3/4 are compiled and reported in accordance with the conditions outlined in the permit or mandate specified in Section 3.2. Typically the data are reported in the District's Annual South Florida Environmental Report (SFER), or in some cases is reported in a standalone mandated report, such as the quarterly Everglades Settlement Agreement Report. The SFER can be found at www.sfwmd.gov/sfer/.

6.2 Data Quality

All monitoring required by the attached permit shall meet the indicators conveyed in the FDEP's Quality Assurance Rule, 62-160 F.A.C. The District has adopted a uniform set of Data Quality Objectives (DQOs) following criteria detailed within the "Analytical Methods and Default QA/QC Targets" table of the CLQM.

The DQOs of the field testing parameters for this project are covered by the table entitled *Field Quality Assurance Objectives* found in the field testing section of the FSQM. This manual is updated annually, and therefore, the most recent version of the District's FSQM details the specific field testing DQOs for this project at the time of sample collection.

Samples are analyzed according to the provisions within the FDEP Rule 62-160 F.A.C. and the District's CLQM. This manual is annually updated, and therefore, the most recent version of the District's CLQM details DQOs for this project at the time of sample collection for each specific laboratory analysis. Data are qualified in accordance with the FSQM and CLQM data validation and reporting sections.

6.3 Completeness Targets

Completeness targets (i.e., the number of samples successfully collected and analyzed) shall be 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 on an attempt due to no flow or low water conditions, unsafe station conditions, equipment malfunction, site maintenance, or other unforeseen problems that might

affect sample collection and/or quality. If samples cannot be collected on an attempt, collectors shall document "no bottle" (NOB in DBHYDRO) to indicate and attempt was made. Attempted collection (NOB) of samples will be considered a collected sample when calculating completeness targets.

7.0 Data and Records Management

The laboratory shall evaluate the data in accordance with the data quality objectives stated in the FSQM and CLQM. All data submittals shall conform to existing District guidelines.

7.1 Data Deliverables

There are no contract deliverables for this project.

7.2 Data and Record Storage

After the data validation process, all data and records are maintained so that end users can retrieve and review all information relative to a sampling event. Field records are maintained in NuGenesis by scanning actual field note pages records directly into NuGenesis (See SFWMD-FIELD-SOP-022). All analytical data and specified metadata are sent to a database (DBHYDRO) 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 current and historical method and operating procedures so that at any given time the conditions that were applied to a sampling event can be evaluated. At least quarterly, any contractor performing work for the project shall provide all original field records to the District's WQB for permanent archival.

Records shall be maintained for the life of the project and a minimum of five years thereafter, in a manner that will protect the physical condition and/or integrity of the records. Storage shall follow the SOP for Archive Records Storage and Retention (SFWMD-FIELD-SOP-022). Corrections of data or records shall follow the applicable District SOPs and FSQM.

8.0 Revisions and Modifications

Date	Section	Page Number(s)	Change From	Change To	Reason
01/01/2013	All	All			Monitoring plan modified to conform to requirements of EFA Permit # 0311207, NPDES Permit # FL0778451, and their associated Consent Orders as well as STA Operational considerations.

References:

Abtew, Wossenu & Powell, B. Water Quality Sampling Schemes for Variable Flow Canals at Remote Sites. Journal of the American Water Resources Association. October, 2007. Pp 1197 – 1204.

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

South Florida Water Management District, Chemistry Laboratory Quality Manual (CLQM), Version 1.0, October 2011 or a newer version if available.

http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/analytical%20services/tab2/tab5/2011%20quality%20manual.pdf

South Florida Water Management District, Field Sampling Quality Manual (FSQM), Version 7.0, December 2011 or a newer version if available.

http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/water%20quality%20monitoring%20division/subtab%20-%20wqm%20-%20qa/tab24442257/fsqm_sfwmd-field-qm-001-07.pdf

South Florida Water Management District, Field Sampling Quality Management Plan (QMP), Version 3.0, June 2011 or a newer version if available.

http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/subtab%20-%20qaqc/tab21630104/rsd_qmp_v3_0.pdf

Signature Page

Monitoring Plan

For

Central Flow-Way
Stormwater Treatment Area 3/4

(STA3/4)

Linda Crean, Water Quality Monitoring Section Administrator	Date
David Struve, Analytical Services Section Administrator	Date
Julianne LaRock, Compliance Assessment and Reporting Section Administrator	Date
Ming Chen, Quality Assurance Administrator	Date

Appendix 1: Site Requirements by Mandate

Station Name	Mandate	Collection Method	Frequency	Parameters
Outflow and Flow-Way End Stations				
G376B G376E G379B G379D G381B G381E	National Pollution Discharge Elimination System (NPDES)	Grab	Weekly Recorded Flow (WRF)	Total Phosphorus (TPO_4), pH
		ACF	Weekly (W)	TPO_4
	Everglades Forever Act (EFA)	Grab	See Specific Condition 21	Turbidity (TURB)
			WRF	TPO_4, Dissolved Oxygen (DO), pH, Specific conductance (Scond), Temperature (Temp)
		ACF	W	TPO_4
		Grab	Biweekly Recorded Flow (BWRF)	Nitrite-Nitrate (NOx), Sulfate (SO_4), Total Nitrogen (TN^1)
	STA Operations	ACF	W	TPO_4
		Grab	W	TPO_4, DO, pH, Scond, Temp
		Grab	WRF	Ammonia (NH_4), Calcium (Ca), Chloride (Cl), NOx, Orthophosphate (OPO_4), SO_4, Total Dissolved Phosphorus ($TDPO_4$), Total Kjeldahl nitrogen (TKN), Total Suspended Solids (TSS)
		Grab	Quarterly (Q)	Dissolved Organic Carbon (DOC)
G388 G379E	PSTA	ACF	W	TPO_4
		Grab	W	OPO4, TDPO4, TPO4, DO, pH, Scond, Temp
		Grab	BW	Alkalinity (ALKA), Ca, Cl, DOC, Magnesium (Mg), Sodium (Na), NH_4, NOx, Potassium (K), SO_4, TDS, TKN, TSS, TURB,
Inflow Stations				
G370 G372	NPDES	Grab	WRF	TPO_4
		ACF	W	TPO_4
	EFA	Grab	WRF	TPO_4, pH, Scond, Temp
		Grab	BWRF	NOx, SO_4, TN^1
		ACF	W	TPO_4
	Everglades Agricultural Area Chapter Rule 40E-63 (EAA Rule)	Grab	W	TPO_4
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, Scond, Temp
		Grab	WRF	Ca, Cl, NH_4, NO_X, OPO_4, SO_4, $TDPO_4$, TKN, TSS

Station Name	Mandate	Collection Method	Frequency	Parameters
		Grab	Q	DOC
		ACF	W	TPO_4
Seepage, Diversion and Divide Stations				
G383 G370S G372S	STA Operations	Grab	Monthly Recorded Flow (MRF)	TPO_4, DO, pH, Scond, Temp
G371 G373	EFA	Grab	WRF	TPO_4
	EAA Rule	Grab	W	TPO_4
		ACF	W	TPO_4
	STA Operations	Grab	WRF	TPO_4, DO, pH, Scond, Temp
		ACF	W	TPO_4
Flow-Way Start Stations				
G374B G374E G377B G377D G380B G380E	STA Operations	Grab	BWRF	Ca, TPO_4, DO, pH, Scond, Temp
Flow-Way Interior Stations				
G378E G389A G389B G390A G390B	PSTA	Grab	W	OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
		ACF	W	TPO_4
		Grab	BW	ALKA, Ca, Cl, DOC, Mg, Na, NH_4, NOx, K, SO_4, TDS, TKN, TSS, TURB
G375B G375E G378B G378D G384B G384E	STA Operations	Grab	MRF	CA, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp

[1]TN is calculated as the sum of TKN and NOx
Note: Mg, K, and Na are reported with all Ca requests

Appendix 2: Mercury and Other Toxicants Monitoring Plan

Flow-Path: Central
Stormwater Treatment Area 1E
EFA Permit No. 0311207

Monitoring of water-column concentrations of total mercury (THg) and methylmercury (MeHg) began in December 2003 at STA-3/4. The eastern flow-way (Flow-way 1 consisting of Cells 1A and 1B) met the mercury startup criteria as specified in Exhibit C of EFA Permit No 0192895 in January 2004, the western flow-way (Flow-way 3 consisting of Cell 3A and 3B) met the mercury startup criteria in June 2004, and the central flow-way (Flow-way 2 consisting of Cells 2A and 2B) met the mercury startup criteria in August 2004 (see Chapter 4 of the 2005 South Florida Environmental Report [SFER]). The Florida Department of Environmental Protection (Department) issued minor permit modification 0192895-011 June 6, 2008, approving transfer of STA-3/4 mercury monitoring from Phase 2 – Tier 1: Routine Monitoring during Stabilization Period to Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9 for all flow ways.

In October 2012, all Phase 3 – Tier 1 mercury monitoring criteria were met (see correspondence from H. Andreotta (District) dated January 17, 2013). February 20, 2013 the Department approved transfer of STA-3/4 mercury monitoring from Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9 to Phase 3 – Tier 3: Routine Operational Monitoring After Year 9. This implemented the termination of all site specific mercury monitoring at STA-3/4.

Operational Project Monitoring Plan

For

Western Flow-Way

Stormwater Treatment Areas 5 and 6
Rotenberger Wildlife Management Area

(STA5/6 and RTBG)

01/07/2013

This monitoring plan is adaptive and therefore subject to change based on operational needs. It will be reviewed and/or modified at a minimum, on an annual basis.

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

SFWMD-FIELD-MP-074-02

Table of Contents

Figures

Tables

Appendices

1.0 Glossary

ACF	Autosampler collection based upon flow trigger
ACT	Autosampler collection based upon time trigger
CLQM	Chemistry Laboratory Quality Manual (SFWMD)
Department	Florida Department of Environmental Protection or FDEP
District	South Florida Water Management District or SFWMD
DQOs	Data Quality Objectives
EAA	Everglades Agricultural Area
ECP	Everglades Construction Project
EFA	Everglades Forever Act
EPA	Everglades Protection Area
F.S.	Florida Statute
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FSQM	Field Sampling Quality Manual (SFWMD)
GPS	Global Positioning System
NAD83 HARN	North American Datum of 1983 High Accuracy Reference Network
NPDES	National Pollutant Discharge Elimination System
QMP	Quality Management Plan
RTBG	Rotenberger (project code)
RWMA	Rotenberger Wildlife Management Area
SFER	South Florida Environmental Report
SFWMD	South Florida Water Management District
SOP	Standard Operating Procedures
STA	Stormwater Treatment Area
ST5R	Stormwater Treatment Area 5 Research
USEPA	U.S. Environmental Protection Agency
WQB	Water Quality Bureau

2.0 Project Organization

Overall project organization and responsibilities are detailed in the South Florida Water Management District (SFWMD or District) Applied Sciences (ASB) and Water Quality Bureau (WQB) Quality Management Plan (QMP). Field activity responsibilities are detailed in the District's Field Sampling Quality Manual (FSQM). Laboratory analysis and data validation responsibilities are detailed in the District's Chemistry Laboratory Quality Manual (CLQM). These documents define the procedures used by SFWMD personnel to meet the Florida Department of Environmental Protection's (FDEP or the Department) Quality Assurance Rule, Florida Administrative Code (F.A.C.) 62-160. Refer to these documents for details on key personnel and relevant responsibilities.

3.0 Project Description

3.1 Project Introduction and Background

This document serves as a reference for surface water quality monitoring for Western Flow Way Stormwater Area 5/6 (STA5/6) and the Rotenberger (project code RTBG) Wildlife Management Area (RWMA). This integrated operational plan for the STA5/6 and RTBG project contains detailed structure specifications including brief descriptions of the mandate and/or permit required monitoring at each station. Current project status, schematics and the project operations plan can be viewed at the District's STA status page.

STA5/6 consists of Stormwater Treatment Area 5 (STA5), the Compartment C, and the Stormwater Treatment Area 6 (STA6). With the completion of Compartment C Built-out facilities, the total effective treatment area of STA5/6, is estimated to 13,008 acres, and will be distributed within eight parallel treatment cells or flow ways (Figure 2).

3.1.1 STA5 and the RWMA

STA5 is a part of the Everglades Construction Project (ECP), which is required by the Everglades Forever Act (EFA), Section 373.4592 of Florida Statute (F.S.). The original STA5 began operation in June 1999 and was designed to treat agricultural runoff and discharges from the C-139 Basin received from the L2 canal. Water was directed through two parallel flow-ways each subdivided into two treatments cells by interior levee. Each flow-way consists of two inflow structures (G342A-B; G342C-D); four interior structures (G343A-D; G342E-H) to control water flow and water elevation, and to optimize the cells performance; and two outflow structures (G344A-B; G344C-D) discharging into the STA5/6 discharge canal. G406 structure can be used in conjunction with G407 and G408 to facilitate diversion of Stormwater around STA5/6. The seepage pumps G349A and G349C can be used to return seepage to Cell 5-1A and Cell 5-1B. Pump stations G507 and G350B, located in the northeast side of STA5 can also provide supplemental water to Cell 5-1B and Cell 5-2B from the discharge canal. G-411 structure located within the STA5/6 Discharge Canal divides post treatment water from STA5/6 into north segment (waters from flow ways 1 and 2) and south segment (waters from flow ways 3 through 8). When G411 structure is closed, G350B, G410, and G507 Pump Stations deliver water composited of Miami Canal and the north segment of the STA5/6 discharge canal to the cells associated to each pump; when open, the water delivered is a composite of the entire STA5/6 discharge Canal and Miami Canal. Water can be transferred as well into flow-way

1 and 2 from flow-way 3 spreader canal via the G519, G520 and G521 transfer culverts equipped with manually operated gates.

The operation and maintenance of the RWMA Hydro pattern Restoration Project shall be consistent with the Florida Department of Environmental Protection (FDEP) approved RWMA Operation Plan and the objectives of the ECP, as outlined in the EFA, Section 373.4592 of Florida Statute (F.S.). Discharges to RWMA are for the purpose of hydrologic restoration of the approximate 29,000-acre wildlife management area. The G410 Pump Station which is located within the STA5/6 discharge canal along the eastern perimeter of STA5/6, north of the G411 structure, is the unique inflow for Rotenberger Wildlife Management Area (RWMA), and allows a portion of STA5/6 discharge canal to be routed to the RWMA and to the Miami canal through the RWMA discharges structures G402A-D. Monitoring for RWMA, through RTBG project, was initiated in July 2001.

3.1.2 Compartment C

The Compartment C Project is a 10,140 acre parcel of land located west of RWMA between STA-5 Flow-way 2 and STA-6 Section 1. Expansion of the STA5 and STA6 was being implemented in two phases. Phase 1, which was the Initial Expansion of STA-5 and STA-6 over an area of 3,844 acres, is complete and included construction of two additional flow-ways known as STA-5 Flow-way 3 (Cells 5-3A and 5-3B), and STA-6 Section 2 (Cell 6-2), which is a portion of flow way 6. Operation began at flow way 3 in July 2008 and at STA6 Section 2 in July 2007. Implementation of Phase 2 will allow for the expansion of the STAs into the remaining 6,296 acre area of Compartment C. This phase of implementation is known as the Compartment C Build out, and expected to further improve the quality of water entering the Everglades Protection Area (EPA). Upon completion of construction of the Build out on 2012, the entire STA-5, STA-6, and Compartment C Build out complex will be known as STA5/6. Phase 2 became flow capable in August 2012. Flow-way 4 (Cell 5-4A, and Cell 5-4B), and flow-way 6 (Cell 6-4, and Cell 6-2) built during Phase 2 began the phosphorous Start up testing at the end of October 2012, and received FDEP acknowledgement on 12/21/12. Upon passing the TPO4 Start up Test, these Cells can accept water either from G508 pump station, G508 seepage pump station, and G406 structure; also discharge is allowed from the outflow structures associated at these cells. However, due to the delay caused by the cultural resource work in Flow way 5, and the unavailability of water to hydrate this flow way after the completion of this work, the phosphorous start up test cannot not be performed in this flow way. Therefore, flow way 5 will be in operation when water is available during the 2013 rainy season.

Compartment C accepts waters from the inflow canal, which is supplied either by the main inflow G508 pump station, G342O gated culverts, G508 seepage pump station, G406 (via G342E and F, or G351). The inflow supply canal, through eight inflow structures, G342G-N, distributes water to the four flow ways components of Compartment C. G342G and H serve flow way 3 (Cell 5-3A and Cell 5-3B), G342I-J serve flow way 4 (Cell 5-4A and Cell 5-4B), G342K-M serve flow way 5

(Cell 5A and Cell 5B), and G342N serves flow way 6 (Cell 6-4 and Cell 6-2). Each flow-way is subdivided into two treatments cells by an interior levee. Flow ways 4 and 5 also include two intermediate berms in the upstream cells to minimize dry out of the treatment cells. Each structure of the seven G342G-M inflow structures consists of a single gated culvert, while G342N inflow structure is equipped of a two gated culverts. Treated water from the outflow structures G344F-K and from G352A-C is conveyed east to the STA5/6 discharge canal, south side of G411 structure. G344E and F serve flow way 3 (Cell 5-3A and Cell 5-3B), G344G-H serve flow way 4 (Cell 5-4A and Cell 5-4B), G344I-K serve flow way 5 (Cell 5A and Cell 5B), and G352A-C serve flow way 6 (Cell 6-4 and Cell 6-2). While each of the G352 structures and G344E-F are equipped of a double leaf gate to allow release of water from the upper section of the lower gate, each of the remaining G344 structures consists of a single gate culvert only.
G509 rehydration pump station, which is part of the Compartment C Built out, is located on the eastern levee between Cell 5-4B and Cell 5-5B at the discharge canal. G509 pump station will be used mainly during drought to withdraw water from STA5/6 discharge canal (south segment) to Cell 5-4B and Cell 5-5B for delivery to the other cells.

3.1.3 STA6

STA-6 is part of the ECP; the construction, operation and maintenance is required by the 1994 EFA, Section 373.4592 F.S. The original Stormwater Treatment Area 6 (STA6), which began operation in 1997, is designed to treat an effective area of 870 acres by means of two Cells, 6-5 and 6-3, known as Section 1 (both cells), or flow ways 7 and 8 respectively. After the completion of Compartment C, flows to STA6 is pumped south by G508 pump station, from the L2 canal to the inflow canal and then routed through G351 (open) and the inflow structures G353A-C. Each of the STA6 inflow structures is located along of the east levee of the L3 canal between G407 and G408 structures and is equipped of a single gate. G406 can also be operated to deliver water to STA6 (via the G408); the G351 and G407 structures would remain closed. Six outflow structures, G393A-C, and G354A-C, located along of the east perimeter release treated water from 6-3 and 6-5 into the STA5/6 discharge canal (south segment). These six outflow structures consist of a fixed weir box on the upstream end of the culvert to limit drawdown of flow ways, known as STA6 Section 1.G407 structure located within the L3 canal may be operated to allow diversion of Stormwater around STA5/6 via the seepage/L3 canal.

3.1.4 ST5R

Stormwater Treatment Area 5 Research (ST5R) water quality data are collected for research into STA nutrient removal optimization. ST5R is comprised of monitoring at interior structures located between Cells A and B. The STA5/6 interior works are divided into parallel treatment flow ways, each consisting of two treatment cells in series flowing in an easterly direction. Flow way 1(5-1A and 5-1B), flow way 2 (5-2A and 5-2B), flow way 3 (5-3A and 5-3B), flow way 4 (5-4A and 5-4B), flow way 5 (5-5A and 5-5B), and flow way 6 (6-4 and 6-2. All the G343s (G343A-O), and G396A-C are interior structures. Some of the

monitoring stations were formerly monitored as part of a marsh dry-out research project and were subsequently incorporated into the optimization research.

3.2 Mandates and Permits

Station locations, sampling frequencies, and parameters to be sampled are dictated by the mandate and/or permits governing this project (see Appendix 1 for details). In addition, the mercury and toxicants monitoring program required by Everglades Forever Act Permit (0311207) is included as Appendix 2.

As part of the Western Flow-way for the Everglades Construction Project, STA5/6 is subject to both the Everglades Forever Act Permit #0311207 and the National Pollutant Discharge Elimination System Industrial Wastewater Facility (NPDES) Permit FL0778451, both issued on September 10, 2012 and expiring on September 09, 2017. These permits dictate the types and frequencies of monitoring to be done, and the parameters to be analyzed, and can be viewed at:

- Everglades Forever Act Permit
  http://www.dep.state.fl.us/water/wqssp/everglades/docs/ecp-sta/draft-watershed-efa-permit.pdf
- NPDES Permit
  http://www.dep.state.fl.us/secretary/news/2012/06/npdes_watershed_permit_consent_order.pdf

Additional stations, parameters and frequencies are required as part of operational monitoring are detailed in Appendix 1.

3.2.1 STA5/6

On September 10, 2012, the FDEP has issued the permit number 0311207 in conjunction with the NPDES permit number FL0778451 for all the Everglades Construction Projects. In these permits, the *"Western Flow-path: Stormwater Treatment Area 5/6 (Palm Beach, Broward and Hendry Counties)"* refers to the complex STA5, STA6, and Compartment C. Both permits will expire on September 09, 2017. In addition, structures G-342A-D, G-406, and G-508/G-342O monitored under this project are mandated by the C-139 Rule, Chapter 40E-63, which mandates that the District monitor and quantify the total phosphorus concentrations in the water entering and leaving the EAA.

3.2.2 Rotenberger Wildlife Management Area (RWMA)

In accordance with the current EFA permit 0311207 (see Specific Conditions 12), the District is authorized to operate and maintain the RWMA consistently with the DEP approved RWMA Operation plan and the objectives of the ECP. The District monitors the unique inflow G410 pump station, the G402 outflow structures, the rainfall and evapotranspiration (ET) at nearby stations in order to analyze and report these data in the South Florida Environmental Report (SFER). In 2000, with the completion of the inflow and the outflow control structures, RWMA is flow capable.

3.3 Project Objectives

The primary objective of this monitoring project is to:

1. Assess compliance with applicable water quality standards and phosphorus discharge limits;
2. Aid in determining the nutrient concentrations to quantify the tons of nutrients removed by the STA annually;
3. Guide mid and long term resource management decisions for nutrient removal capabilities of the STA.

3.4 Duration

3.4.1 Initiation Conditions

Monitoring of the original STA-5 and STA-6 projects was initiated in June 1999 and April 1997, respectively. Upon completion of Compartment C Phase 1 build-out in July 2008 monitoring of Flow way 3 began; in July 2007 monitoring of STA6 Section 2 stations was initiated. Monitoring for the Compartment C Phase 2 components began on August 2012.

3.4.2 Modification or Termination Conditions

The mandated monitoring described in this document will be ongoing as required by the EFA 0311207 and NPDES FL0778451 permits, which are renewed once every 5 years. Conditions for modification or termination of the project are detailed in the permit(s) that specify the conditions of the project. Monitoring for operations will continue indefinitely in support of the project goals and objectives. Monitoring may increase or decrease over time, depending upon individual cell operations, data results, end user needs and permit requirements. Short-term changes to collection events may be made as a result of an extreme weather conditions (i.e., droughts and tropical storms/hurricanes), other safety concerns, or construction activities.

4.0 Geographic Location

4.1 Regional Area

The STA5/6 and RTBG projects consist of 54 monitoring stations in Palm Beach County (Figure 1). Table 1 provides the station names, global positioning system (GPS) coordinates, and a description of each monitoring station. The locations of all monitoring stations are depicted on the map in Figure 1.

4.2 Sampling Locations

The locations of all monitoring stations are depicted in Figure 1 with exact locations described in Table 1.

4.3 Access and Authority

The gates on roadways into the Build-out are secured with a District “C” lock. The lock requires a ”C” key which can be obtained through a request made through the FPM and/or Field Supervisor. Samples are collected on the upstream side of structures/culverts.

Table 1: STA5/6 Surface Water Monitoring Sites and GPS Coordinates

Station	Latitude	Longitude	Description
G342A	262742.661	805646.627	Cell 1A inflow
G324B	262654.733	805646.627	Cell 1A inflow
G342C	262652.813	805647.167	Cell 2A inflow
G342D	262604.755	805644.887	Cell 2A inflow
G406	262600.521	805647.994	Inflow structure for Compartment C and STA6
G343B	262721.644	805455.807	Interior structure located between Cells 1A and 1B
G343C	262709.197	805455.706	Interior structure located between Cells 1A and 1B
G343F	262632.364	805455.176	Interior structure located between Cells 2A and 2B
G343G	262619.897	805455.023	Interior structure located between Cells 2A and 2B
G344A	262729.460	805300.230	Cell 1B outflow
G344B	262703.670	805259.680	Cell 1B outflow
G344C	262637.940	805258.850	Cell 2B outflow
G344D	262612.200	805258.260	Cell 2B outflow
G349A	262742.170	805612.880	Seepage return pump station located at NW portion of Cell1A
G349C	262741.936	805453.761	Seepage return pump station located at NW portion of Cell 1B
G507	262731.520	805259.569	Cell 1B inflow from discharge canal (hydration pump for SAV cells)
G350B	262559.171	805257.841	South seepage canal pump station
G508, G342O	262558.706	805642.892	Inflow pump station/gravity inflow through pump station
G508S	262557.347	805644.778	G508 seepage return
G342G	262544.279	805643.896	Cell 3A inflow
G342H	262520.436	805643.895	Cell 3A inflow
G342I	262453.794	805643.781	Cell 4A inflow
G342J	262426.97	805643.866	Cell 4A inflow
G342K	262400.721	805627.658	Cell 5A inflow
G342L	262335.053	805605.124	Cell 5A inflow
G342M	262307.947	805541.359	Cell 5A inflow
G342N	262234.575	805512.087	Cell 4 inflow
G343I	262544.455	805425.675	Flow-way 3 interior structure
G343J	262519.756	805425.378	Flow-way 3 interior structure
G343K	262452.659	805339.711	Flow-way 4 interior structure
G343L	262426.954	805339.786	Flow-way 4 interior structure
G343M	262358.479	805337.385	Flow-way 5 interior structure
G343N	262334.707	805337.142	Flow-way 5 interior structure
G343O	262308.306	805336.847	Flow-way 5 interior structure
G396B	262215.680	805419.046	Interior structure located between cell 6-4 and cell 6-2

Station	Latitude	Longitude	Description
344E	262545.997	805257.918	Cell 3B outflow
G344F	262520.042	805257.253	Cell 3B outflow
G344G	262452.516	805256.874	Cell 4B outflow
G344H	262426.793	805256.287	Cell 4B outflow
G344I	262400.619	805255.640	Cell 5B outflow
G344J	262334.466	805255.066	Cell 5B outflow
G344K	262307.448	805254.463	Cell 5B outflow
G352B	262215.704	805253.139	Section 2 outflow
G509	262414.609	805255.486	Cells 4B & 5B hydration pump
G351	262135.838	805422.593	Seepage return or divide structure located at the south end of STA5/6 inflow canal
G353A	26126.468	805414.234	Section 1 cell 5 inflow
G353B	262106.069	805356.658	Section 1 cell 5 inflow
G353C	262046.584	805339.698	Section 1 cell 3 inflow
G354C	262100.262	805250.727	Section 1 cell 5 outflow
G393B	262011.505	805255.769	Section 1 cell 3 outflow
G406	262600.521	805647.994	Divide/diversion structure between L-2 & L-3 canals
G407	262000.538	805259.830	Diversion structure at south end of L-3 canal
G410	262610.687	805256.123	Pump station discharging from STA5/6. Discharge canal to RWMA
G402A	262117.725	804734.205	Outflow structure from RTBG to the Miami Canal
G402C	262531.761	804834.718	Outflow structure from RTBG to the Miami Canal

The standard positional goal for site coordinates is ±1 meter. This standard can be obtained with a professional grade DGPS system. The coordinates are relative to NAD83 HARN horizontal datum.

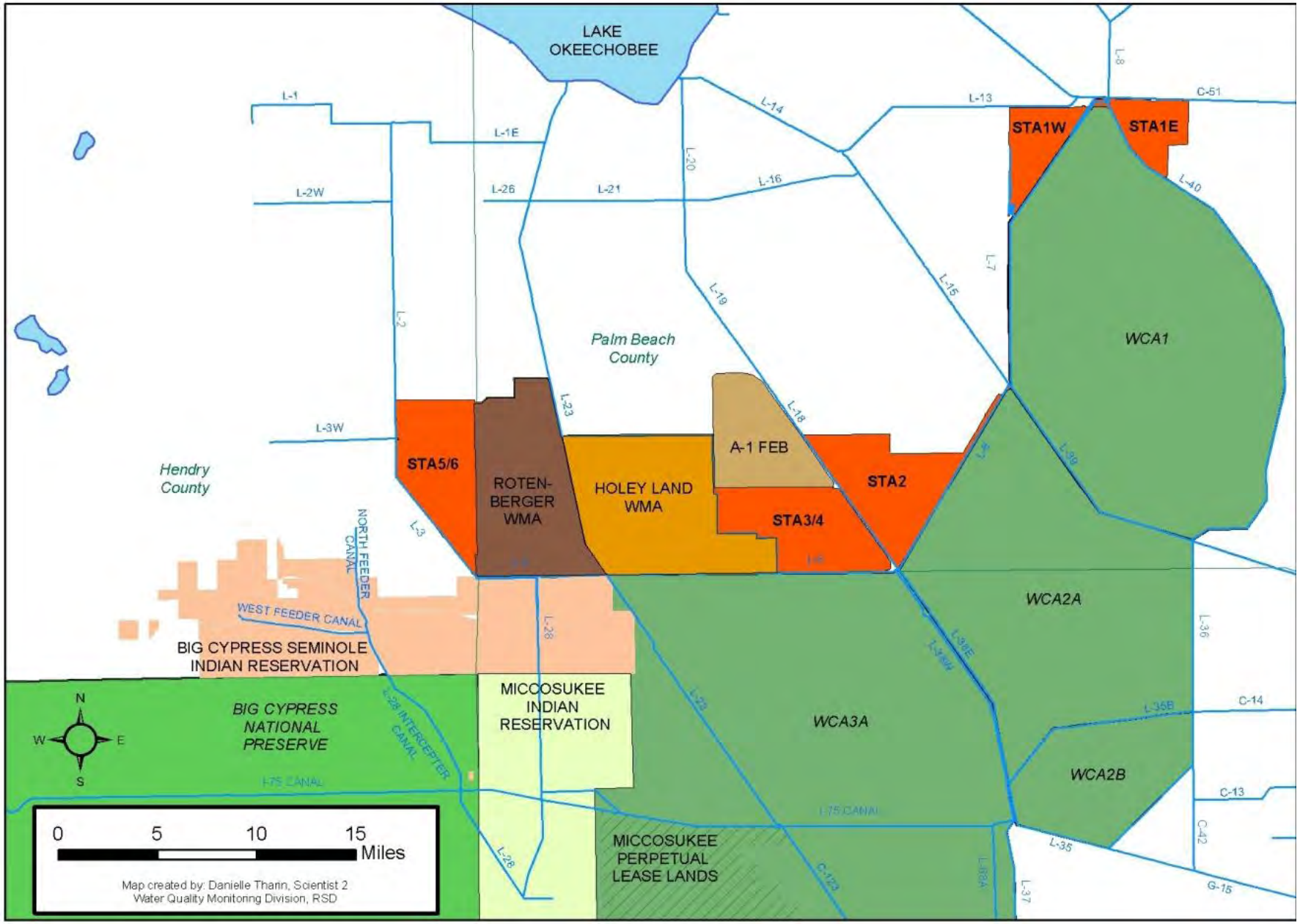
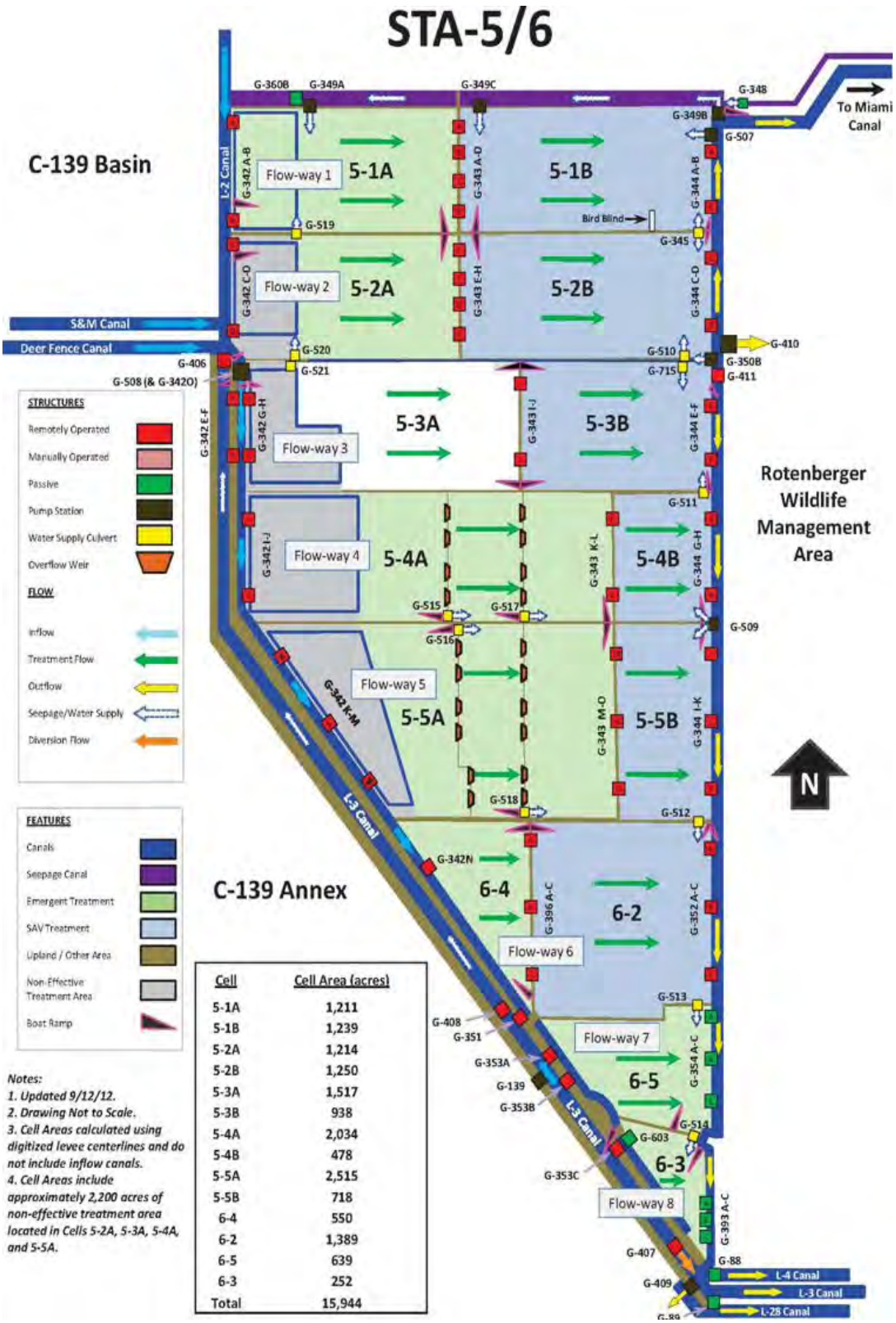


Figure 1: Regional Map including Compartment C, STA-5, STA-6, RTBG and EAA



Cell	Cell Area (acres)
5-1A	1,211
5-1B	1,239
5-2A	1,214
5-2B	1,250
5-3A	1,517
5-3B	938
5-4A	2,034
5-4B	478
5-5A	2,515
5-5B	718
6-4	550
6-2	1,389
6-5	639
6-3	252
Total	15,944

Notes:
1. Updated 9/12/12.
2. Drawing Not to Scale.
3. Cell Areas calculated using digitized levee centerlines and do not include inflow canals.
4. Cell Areas include approximately 2,200 acres of non-effective treatment area located in Cells 5-2A, 5-3A, 5-4A, and 5-5A.

Figure 2: STA5/6 Structures and Flow

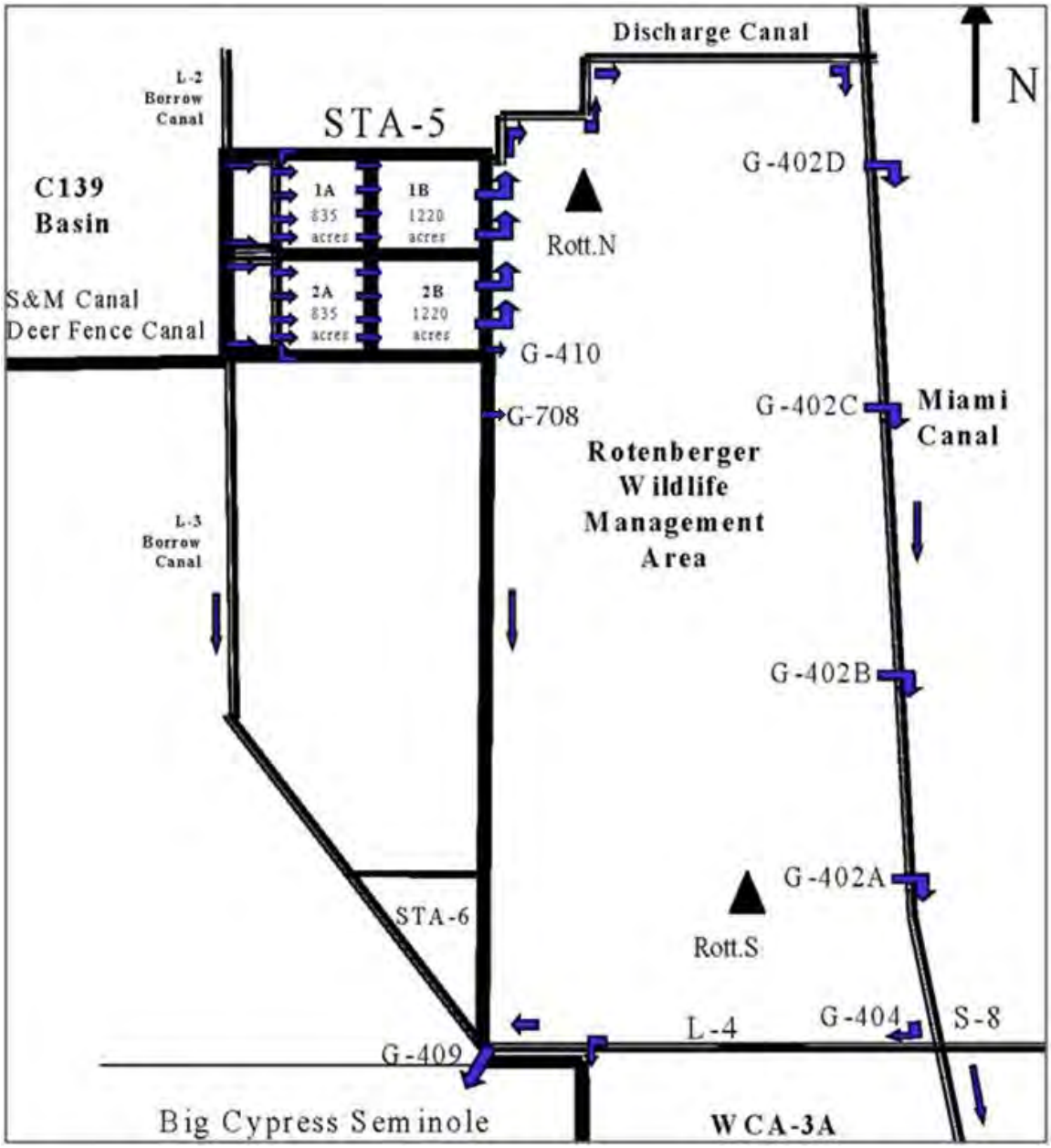


Figure 3: Rotenberger Wildlife Management Area Structures and Flow

Table 2: STA5/6 Grab/Autosampler Sample Frequency and Parameter ACODES

Station Name	Type	Frequency	Analytical Parameters
STA5/6 Outflow Stations			
G344A G344B G344C G344D G344E G344F G344G G344H G344I G344J G344K G352B G354C G393B	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
	ACF	Weekly	TPO_4
	Grab	Weekly Recorded Flow	Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
	Grab	Quarterly	DOC
STA5/6 Inflow Stations			
G406	ACT	Weekly	TPO_4
G508[1] G342O G342A G342B G342C G342D	ACF	Weekly	TPO_4
G406 G508[1] G342O G342A G342B G342C G342D	Grab	Weekly	TPO_4, DO, pH, Scond, Temp
		Weekly Recorded Flow	Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
		Quarterly	DOC
STA5/6 Diversion Stations			
G406 G407	Grab	Weekly Recorded Flow	TPO_4, DO, pH, Scond, Temp
STA5/6 Flow Way Starts, Ends and Interior Stations			
G342G G342H G342I G342J G342K G342L G342M G342N G353A G353B G353C	Grab	Biweekly Recorded Flow	Ca, TPO4, DO, pH, Scond, Temp

Station Name	Type	Frequency	Analytical Parameters
G343B **G343C** **G343F** **G343G** **G343I** **G343J** **G343K** **G343L** **G343M** **G343N** **G343O** **G396B**	Grab	Monthly Recorded Flow	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
STA5/6 Divides and Seepage Structures			
G349C **G507** **G350B** **G509**	Grab	WRF	TPO_4, DO, pH, Scond, Temp
G351 **G508S**	Grab	Monthly Recorded Flow	TPO_4, DO, pH, Scond, Temp
G349A	Grab	Monthly Recorded Flow	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
RTBG Inflow Stations			
G410	Grab	Weekly Recorded Flow or Quarterly	OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
RTBG Outflow Stations			
G402A **G402C**	ACF	Weekly	TPO_4
	Grab	Weekly if Flowing or Recorded Flow else Quarterly	OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp

[1]G508 is a representative monitoring site for G342O

5.0 Field Activities

5.1 Monitoring Frequencies by Site and Parameters

All samples required for collection by sampling are depicted in Table 2. Some stations within the monitoring network are collected based on whether flow has been recorded. Specifically, structure operation activity is determined within a specified timeframe through the review of electronic data. If no flow (i.e., no operations) has been recorded, the sample is considered a No Bottle sample (NOB) and the structure is not visited. Conversely, if flow has been recorded during the specified timeframe, a sample is collected.

5.2 Project Specific Guidelines

All surface water samples shall be collected on the upstream side of any structure at a depth of 0.5 m unless vegetation and/or other conditions inhibit the collection of a representative sample upstream. Prior to sampling an alternative site, a consultation with a Field Technician Supervisor and/or the FPM must take place; this action must be documented in the field notes.

Backup grab samples will accompany the autosampler collection based upon flow trigger (ACF) samples collected on a weekly basis. In addition, in situ readings (i.e., Temperature, pH, DO and Specific Conductance) are measured as the grab samples are being collected. Samples collected on upstream side of structures/culverts.

G351, a divide structure, may have flow occur in either direction. Flow originating from the G508 pump station (via the inflow canal) shall be considered the upstream location for the purposes of this monitoring plan and flows originating from the seepage canal (from G406 to G408) and the remaining of the L3 canal (from G408 to G407) shall be considered as reverse flow for this structure.

5.3 Grab Sampling Procedures

Sample collection for this project shall follow the procedures and requirements found in the Field Sample Collection Procedures Section of the District's FSQM.

5.4 Field Testing Procedures

Sample collection for this project shall follow the procedures and requirements found in the Field Sample Collection Procedures Section of the District's FSQM. The field parameters for this project are described in Table 3 below.

Table 3: Field Analytical Parameters Collected

Parameter	Resolution	Accuracy
Dissolved Oxygen	0.01 mg/L	0-20 mg/L, $\pm$ 0.2 mg/L
Specific Conductance	0.001 µS/cm	$\pm$ 0.5% of reading $\pm$ 0.001 µS/cm
Temperature	0.01^{o}C	$\pm$ 0.15^{o}C
pH	0.01 unit	$\pm$ 0.2 unit

5.5 Field Quality Control Requirements

Field quality control requirements shall follow the procedures found in the Quality Control Section of the District's FSQM.

5.6 Autosampler Collection

Samples are collected with flow-proportional (ACF) autosamplers at all inflow and outflow stations with the exception of G402A and G402C, the Rotenberger (RTBG) outflow stations and G406, see Table 2. Frequency for ACF collections is determined by a "trigger volume" established through the protocols established by Abtew and Powell (2004). The autosampler at G406 is programmed as time proportional (ACT) sampling. Data from this structure will be compared to G508; if these data are found to be statistically insignificantly different G406 sampling will discontinue and G508 will be used as its surrogate. The frequency of ADT collection is set by the FPM following discussions with the data end user(s).

Following the completion of construction of Compartment C, Cell 6-4 (November 23, 2010) the autosampler at G396B was taken offline; this autosampler was decommissioned on January 9, 2013 along with the autosamplers at G343B, G343C, G343F, G343G, G343J, G349A, G353A, G353B, and G353C. On September 17, 2012, the autosampler at G407 was also decommissioned. Consequently, only grab samples are collected at these decommissioned stations. For as long as the start-up phase for flow way 5 (Cell 5-5A and Cell 5-5B) does not demonstrate a net reduction in phosphorous level in

those cells, the autosamplers at G344I-K will remain on flow to capture any unexpected flow event that might occur at these structures.

5.7 Sample Submission

Following completion of sample collection for each day, the samples are placed in ice and transported in coolers at $\leq 6^{o}C$ to the laboratory for analysis. Samples are submitted to the laboratory on the same day as collection or via courier the following day. Samples are submitted according to the requirements outlined in the District's FSQM. If samples are submitted to other than the District's laboratory, the laboratory must be a District approved laboratory.

6.0 Data Quality Objectives

6.1 Data Uses

The data from STA5/6 and RTBG are compiled and reported in the District's South Florida Environmental Report (SFER). The SFER can be found at the District's website www.sfwmd.gov/sfer/.

6.2 Data Quality

All monitoring described herein shall meet the indicators conveyed in the FDEP's Quality Assurance Rule, 62-160 F.A.C. The District has adopted a uniform set of Data Quality Objectives (DQOs) following criteria detailed within the "Analytical Methods and Default QA/QC Targets" table of the CLQM.

The DQOs of the field testing parameters for this project are covered by the table entitled Field Quality Assurance Objectives found in the field testing section of the FSQM. This manual is updated regularly, and therefore, the most recent version of the District's FSQM details the specific field testing DQOs for this project at the time of sample collection.

Samples are analyzed according to the provisions within the FDEP Rule 62-160 F.A.C. and the District's CLQM. This manual is updated regularly, and therefore, the most recent version of the District's CLQM details DQOs for this project at the time of sample collection for each specific laboratory analysis. Data are qualified in accordance with the FSQM, CLQM and applicable data validation SOPs.

6.3 Completeness Targets

The completeness target (i.e., the number of samples successfully collected and analyzed) shall be 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 on an attempt due to no flow or low water conditions, unsafe station conditions, equipment malfunction, site maintenance, or other unforeseen problems that might affect sample collection and/or quality. If samples cannot be collected on an attempt, collectors shall document "no bottle" (NOB) to indicate and attempt was made and/or the sample could not be collected for the documented reasons. Attempted collection (NOB) of samples will be considered a collected sample when calculating completeness targets.

7.0 Data and Records Management

The laboratory shall evaluate the data in accordance with the data quality objectives stated in the FSQM and CLQM. All data submittals shall conform to existing District guidelines.

7.1 Data Deliverables

There are no contract deliverables for this project.

7.2 Data Storage

After the data validation process, all data and records are maintained so that end users can retrieve and review all information relative to a sampling event. Field records are maintained in NuGenesis by scanning actual field note pages records directly into NuGenesis (See SFWMD-FIELD-SOP-022). All analytical data and specified metadata are sent to a database (DBHYDRO) 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 current and historical method and operating procedures so that at any given time the conditions that were applied to a sampling event can be evaluated. At least quarterly, any contractor performing work for the project shall provide all original field records to the District's WQB for permanent archival.

Records shall be maintained for the life of the project and a minimum of five years thereafter, in a manner that will protect the physical condition and/or integrity of the records. Storage shall follow the SOP for Archive Records Storage and Retention (SFWMD-FIELD-SOP-022). Corrections of data or records shall follow the applicable District SOPs and FSQM.

8.0 Revisions and Modifications

Date	Section	Page Number(s)	Change From	Change To	Reason
01/01/2013	All	All			Monitoring plan modified to conform to requirements of EFA Permit # 0311207, NPDES Permit # FL0778451, and their associated Consent Orders as well as STA Operational considerations.

References:

Abtew, Wossenu & Powell, B. Water Quality Sampling Schemes for Variable Flow Canals at Remote Sites. Journal of the American Water Resources Association. October, 2007. Pp 1197 – 1204.

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

South Florida Water Management District, Chemistry Laboratory Quality Manual (CLQM), Version 1.0, October 2011 or a newer version if available.
http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/analytical%20services/tab2/tab5/2011%20quality%20manual.pdf

South Florida Water Management District, Field Sampling Quality Manual (FSQM), Version 7.0, December 2011 or a newer version if available.
http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/water%20quality%20monitoring%20division/subtab%20-%20wqm%20-%20qa/tab24442257/fsqm_sfwmd-field-qm-001-07.pdf

South Florida Water Management District, Field Sampling Quality Management Plan (QMP), Version 3.0, June 2011 or a newer version if available.
http://my.sfwmd.gov/portal/page/portal/restoration%20sciences/portlets/subtab%20-%20qaqc/tab21630104/rsd_qmp_v3_0.pdf

Signature Page

Monitoring Plan

For

Western Flow Way
Stormwater Treatment Area 5/6 and Rotenberger
(STA5/6 and RTBG)

Linda Crean, Water Quality Monitoring Section Administrator	**Date**
David Struve, Analytical Services Section Administrator	**Date**
Julianne LaRock, Compliance Assessment and Reporting Section Administrator	**Date**
Ming Chen, Quality Assurance Administrator	**Date**

Appendix 1: Monitoring Requirements by Mandates

Station Name	Mandate	Collection Method	Frequency	Analytical Parameters
WFW Outflow and Flow Way Ends Stations				
G344A G344B G344C G344D G344E G344F G354C G393B G352B G344G G344H G344I G344J G344K	Everglades Forever Act (EFA)	Grab	Weekly Recorded Flow (WRF)	Total Phosphorus (TPO_4), Dissolved Oxygen (DO), pH, Specific Conductance (Scond), Temperature (Temp)
		Grab	Biweekly Recorded Flow (BWRF)	Nitrate-nitrogen (NOx), Sulfate (SO_4), Total Nitrogen (TN^1)
		ACF	Weekly (W)	TPO_4
	National Pollution Discharge Elimination System (NPDES)	Grab	WRF	TPO_4, pH
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, Scond, Temp
		Grab	WRF	Ammonia (NH4), Calcium (Ca), Chloride (Cl), NOx, ortho-Phosphorus (OPO_4), SO_4, Total Dissolved Phosphorus ($TDPO_4$), Total Kjeldahl Nitrogen (TKN), Total Suspended Solids (TSS)
		Grab	Quarterly (Q)	Dissolved Organic Carbon (DOC)
		ACF	W	TPO_4
WFW Inflow Stations				
G342A G342B G342C G342D G508 (G342O)	EFA	Grab	WRF	TPO_4, pH, Scond, Temp
		Grab	BWRF	NOx, TN, SO_4
		ACF	W	TPO_4
	NPDES	Grab	WRF	TPO_4
		ACF	WRF	TPO_4
	C-139 Rule	Grab	W	TPO_4
		ACF	W	TPO_4
	STA Operations	Grab	W	TPO_4, DO, pH, Scond, Temp
		Grab	WRF	Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
		Grab	Q	DOC
		ACF	W	TPO_4
G406 (also classified as Diversion Structure, when operated in concert with G407)	EFA	Grab	WRF	TPO_4, pH, Scond, Temp
		Grab	BWRF	NOx, SO_4, TN
	NPDES	Grab	WRF	TPO_4
	C-139 Rule	Grab	W	TPO_4
		ACT	W	TPO_4
	STA Operations	ACT	W	TPO_4
		Grab	W	TPO_4, DO, pH, Scond, Temp
		Grab	WRF	Ca, Cl, NH_4, NOx, OPO_4, SO_4, $TDPO_4$, TKN, TSS
		Grab	Q	DOC

Station Name	Mandate	Collection Method	Frequency	Analytical Parameters
WFW Seepage and Diversion Stations				
G407	EFA	Grab	WRF	TPO_4
	STA Operations	Grab	WRF	TPO_4, DO, pH, Scond, Temp
G508S **G351**	STA Operations	Grab	Monthly Recorded Flow (MRF)	TPO_4, DO, pH, Scond, Temp
WFW Flow Way Start Stations				
G342G **G342H** **G342I** **G342J** **G342K** **G342L** **G342M** **G342N** **G353A** **G353B** **G353C**	STA Operations	Grab	BWRF	Ca, TPO_4, DO, pH, Scond, Temp
WFW Flow Way Interior Stations				
G343B **G343C** **G343F** **G343G** **G343I** **G343J** **G343K** **G343L** **G343M** **G343N** **G343O** **G396B**	STA Operations	Grab	MRF	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
WFW Hydration Stations				
G349A	Mission Driven	Grab	MRF	Ca, OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
G349C **G350B** **G507** **G509**	Mission Driven	Grab	WRF	TPO_4, DO, pH, Scond, Temp
RTBG Inflow Station				
G410	STA Operations	Grab	WRF	OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
RTBG Outflow Stations				
G402A **G402C**	STA Operations	Grab	WF/WRF/Q	OPO_4, $TDPO_4$, TPO_4, DO, pH, Scond, Temp
		ACF	W	TPO_4

[1]TN is calculated as the sum of TKN and NOx.

Appendix 2: STA5/6 Mercury and Other Toxicants Monitoring Program

Flow-Path: Western
Stormwater Treatment Area 5/6
EFA Permit No. 0311207

Monitoring of water-column concentrations of total mercury (THg) and methylmercury (MeHg) began in 1999 at STA-5 Flow-ways 1 and 2. These flow-ways met the mercury startup criteria as specified in Exhibit C of EFA Permit No. 0131842 in September 1999. In October 1999, the Florida Department of Environmental Protection (Department) issued Emergency Order 99-1748 in response to Hurricane Irene which included authorization for short-term temporary flow-through operations of STA-5 and acknowledgment that the mercury EFA permit startup requirements had been met. Because of drought conditions that followed and the detection of high phosphorus concentrations at the outflows, STA-5 did not begin routine flow-through until June 2000 for the Flow-way 2 and August 2000 for the Flow-way 1 (see Chapter 4 of the 2001 Everglades Consolidated Report). STA-5 Flow-ways 1 and 2 met Phase 3 – Tier 1 conditions contained in "*A Protocol for Monitoring Mercury and Other Toxicants"* (dated April 2011; hereafter referred to as the *Protocol*) in February 2008 (see data summary provided in correspondence from R. Bearzotti, SFWMD dated April, 2008). STA-5 Flow-ways 1 and 2 met Phase 3 – Tier 3 conditions "Routine Operational Monitoring After Year 9" in November 2008 (see data summary provided in correspondence from G. Vince, SFWMD dated October 12, 2009 and data for the final November 2009 fish collection submitted to the Department in December 2009 by H. Andreotta, SFWMD).

The District completed construction of a new southern flow-way (known as Flow-way 3 - consisting of Cells 5-3A and 5-3B) of STA-5 in May 2007. The flow-way was inundated in July 2008, met the mercury startup criteria as specified in Exhibit D of EFA Permit No. 0131842 in August 2008, and is currently in Phase 2 – Tier 1: Routine Monitoring During Stabilization Period.

STA-6 Section 1 (Cells 6-3 and 6-5) met the mercury start-up criteria as specified in Exhibit "C" of EFA Permit No. 262918309 in November 1997, and began flow-through operation in December 1997. Routine monitoring of mercury in STA-6 Section 1 was initiated in the first calendar quarter of 1998. The Department issued minor permit modification 0236905-001 June 6, 2008, approving transfer of mercury monitoring from Phase 2 – Tier 1: Routine Monitoring during Stabilization Period to Phase 3 – Tier 3: Routine Operational Monitoring from Year 4 to Year 9 for STA-6 Section 1. Phase 3 – Tier 3 implemented the termination of all site specific mercury monitoring at STA-6 Section 1.

STA-6 Section 2 (Cell 6-2) met the mercury startup criteria as specified in Exhibit "C" of EFA Permit No. 0236905-001 in September 2007, and began flow-through operation in December 2007. Routine monitoring of mercury in Section 2 was initiated January 2008, and is currently in Phase 2 – Tier 1: Routine Monitoring During Stabilization Period.

In September 2012, the District completed construction of the EAA Compartment C Buildout Project (Compartment C). Compartment C includes the G-508 pump station, STA-5 Flow-way 4

(consisting of Cells 5-4A and 5-4B), STA-5 Flow-way 5 (consisting of Cells 5-5A and 5-5B), and STA-6 Cell 6-4. STA-6 Cell 6-4, combined with the existing Cell 6-2, formed Flow-way 6. The entire STA-5, STA-6, and Compartment C Buildout complex is now referred to as STA5/6.

Startup monitoring for mercury and other toxicants was performed for Compartment C in September (mosquitofish) and October (sediment) of 2011 to capture the "first-flush effect" when the project was initially inundated. Compartment C met the mercury and other toxicant startup criteria as specified in Specific Condition 23 of EFA Permit No. 0311207 in October 2011 (see data summary provided in correspondence from H. Andreotta, SFWMD dated December 14, 2012). December 20, 2012, the Department approved transfer of monitoring from Phase 1 – Tier 2: Field Sampling for Initial Startup Monitoring Prior to Discharge to Phase 2 – Tier 1: Routine Monitoring During Stabilization Period for Compartment C (Flow-ways 4, 5, and 6).

Based on the performance of STA-5/6 flow-ways 1 through 8 and the guidance contained in the *Protocol*, the District shall conduct monitoring as follows:

- Phase 3 – Tier 3: Routine Operational Monitoring After Year 9 for STA-5/6 flow-ways 1, 2, 7, and 8
- Phase 2 – Tier 1: Routine Monitoring During Stabilization for STA-5/6 flow-ways 3, 4, 5, and 6

2.0 Phase 2: Monitoring During Three-Year Stabilization Period

2.1 Phase 2 - Tier 1: Routine Monitoring During Stabilization Period

2.1.1. Water

An unfiltered surface water sample (n = 1) shall be collected in accordance with Chapter 62-160, F.A.C. at the inflow pump station (G-508) and immediately upstream of the outflow structures (G-344F (Flow-way 3 outflow), G-344H (Flow-way 4 outflow), G-344J (Flow-way 5 outflow), and G-352B (Flow-way 6 outflow) (Figure 1) on a quarterly frequency and analyzed for THg and methylmercury (MeHg) (sulfate is being monitored under the EFA permit required routine WQ monitoring program). In addition, flow shall be monitored at the inflow and outflow to allow for load estimation to and from the project (it should be recognized that quarterly sampling would allow for only an approximate estimation of loads).

This data set will be assessed to determine if outflow concentrations exceed state water quality standards (WQS), and whether annual outflow loads of analytes are significantly greater than inflow loads, including atmospheric loading; load estimates will include confidence intervals that describe uncertainty in measures of flow and concentration (e.g., field and analytical precision) and resulting from interpolation (note: assessment protocol to be determined with permitting authority). Failure to satisfy these assessment measures would trigger Tier 2 Expanded Monitoring and Risk Assessment (see below).

2.1.2. Fish Tissues

Samples of fish from multiple trophic levels will be collected from each independently operated flow-way of the STA and from a single downstream site in the receiving water of the project (Figure 1). Specifically, mosquitofish will be collected quarterly from multiple locations within

each flow-way, i.e., STA-5/6 Cells 5-3A and 5-3B (Flow-way 3), Cells 5-4A and 5-4B (Flow-way 4), Cells 5A and 5B (Flow-way 5), and Cells 6-4 and 6-2 (Flow-way 6) and physically composited into one spatially-averaged sample (to total at least 100 fish) per flow-way for THg analysis (note, a single aliquot will be analyzed per composite). Additionally, mosquitofish (to total at least 100 fish) will be collected from a site located in the STA-5/6 receiving waters immediately downstream from the project (station RA1 located within RWMA) and a site downstream of G-352B in the STA-5/6 discharge canal (station STA6DC) and analyzed for THg.

Sunfish (n should be greater than or equal to 5) and largemouth bass (*Micropterus salmoides);* (n should be greater than or equal to 5) shall be collected from a site within STA-5/6 Flow-way 3 (i.e., Cell 5-3B), Flow-way 4 (i.e., Cell 5-4B), Flow-way 5 (i.e., Cell 5-5B), Flow-way 6 (i.e., Cell 6-2), from stations located in the STA-5/6 receiving waters (station RA1 located within RWMA) (station STA6DC) on an annual basis and individually analyzed for THg (i.e., whole sunfish and fillets from the bass). Based on the *Protocol* (page 14, 2nd paragraph), if after one year of monitoring, sufficient data are collected to demonstrate that conditions within the different flow-ways are equivalent, collection of large-bodied fish can be reduced to one flow-way with the highest observed concentration and assess results as "worst case". This assessment shall be re-evaluated annually based on Hg levels observed in mosquitofish, which will continue to be collected from each of the flow-ways. To reduce variance (i.e., due to species differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections should target *Lepomis macrochirus* (bluegill) ranging in size from 102 to 178 mm (i.e., 4 to 7 inches) and largemouth bass ranging in size from 307 to 385 mm (i.e., 12 to 15 inches). However, other Lepomids or sizes are to be collected if efforts fail to locate targeted fish. Owing to similar trophic status, if bluegill cannot be collected, first priority will be given to spotted sunfish, *Lepomis punctatus*. If neither sunfish nor bass are present, consideration should be given to sampling other species.

Assessment

To detect and minimize any adverse effects as early as possible (and to provide a basis for identifying adaptive management options, if deemed necessary), the results of this monitoring will be assessed based on the criteria and time table described under Phase 2 – Tier 1 in the *Protoco*l. Monitoring results will be provided to the Department in accordance with the reporting requirements described below.

Table 1 summarizes the monitoring requirements for Phase 2 - Tier 1: Routine Monitoring During Stabilization Period.

Table 1. Phase 2 - Tier 1: Routine Monitoring During Stabilization Period

Matrix	Location	Collection Method	Frequency	Parameter
Surface Water	G-508, G-344F, G-344H, G-344J, G-352B	Grab	Quarterly	THg, MeHg
Mosquitofish	STA-5/6 flow-ways 3, 4, 5, 6 & two downstream stations (RA1 and STA6DC)	Net or Trap	Quarterly	THg
Bass & Sunfish (n=5 each)	STA-5/6 Cells 5-3B, 5-4B 5-5B, 6-2, & two downstream stations (RA1 and STA6DC)	Electroshock or Hook and Line	Annually	THg

2.2 Phase 2 - Tier 2: Expanded Monitoring and Risk Assessment

In accordance with the Protocol, if Tier 1 data exceed the action levels identified under Phase 2 – Tier 2 Expanded Monitoring and Risk Assessment, the District shall notify the Department and after obtaining the Department's concurrence, shall expand monitoring and undertake all necessary steps consistent with the *Protocol*.

3.0 Operational Monitoring

The monitoring plan and associated data will be re-evaluated on an annual basis beginning after year 3 (following startup of Flow-ways , 4, and 5, and 6) to determine if criteria specified in the *Protocol* are being satisfied. Based on that assessment, and with the concurrency of the Department, monitoring and assessment efforts may be reduced (as identified in Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9 of the *Protocol*) or eliminated altogether at the project level to be subsumed by regional monitoring (as identified in Phase 3 – Tier 3: Routine Operational Monitoring After Year 9). However, if monitoring reveals anomalous conditions as described under Phase 3 – Tier 2: Expanded Monitoring and Risk Assessment, the District shall expand monitoring and undertake all necessary steps under Phase 3 – Tier 2: Expanded Monitoring and Risk Assessment in the *Protocol*.

3.1 Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9

3.1.1 Fish Tissues

Semiannually, mosquitofish will be collected from multiple locations within each flow-way (i.e., STA-5/6 Cells 5-3A and 5-3B (Flow-way 3), Cells 5-4A and 5-4B (Flow-way 4), Cells 5-5A and 5-5B (Flow-way 5), and Cell 6-4 and 6-2 (Flow-way 6)), and physically composited into one spatially-averaged sample (to total at least 100 fish) per flow-way for THg analysis (note, a single aliquot will be analyzed per composite). Additionally, mosquitofish (to total at least 100 fish) will be collected from two sites located in the STA-5/6 receiving waters immediately

downstream from the project (RA1 located within RWMA and STA6DC in the STA-5/6 discharge canal) and analyzed for THg.

To assess "worst case" conditions, large-bodied fish will be collected only from the flow-way with the highest observed concentration and the downstream station identified above once every three years. This limited spatial sampling of large-bodied fish within the STA is to revert back to include formerly sampled stations, if Tier 2 is triggered or if mosquitofish demonstrate significantly altered spatial patterns in mercury biomagnification.

Specifically, sunfish (n should be greater than or equal to 5) should be collected from each station and individually analyzed as whole-fish. At the same time, largemouth bass (*Micropterus salmoides*; n should be greater than or equal to 5) should be collected from each station and individually analyzed (fillets) for THg. To reduce variance (i.e., due to species differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections will target bluegill (*Lepomis microchirus*) ranging in size from 102 to 178 mm (i.e., 4 to 7 inches) and largemouth bass ranging in size from 307 to 385 mm (i.e., 12 to 15 inches); however, other lepomis (due to similar trophic status, first priority being given to spotted sunfish (*L. punctatus*) or sizes will be collected if efforts fail to locate targeted fish.

This data will then be used to track the following:

- THg levels in individual mosquitofish composite;
- Annual average THg levels in mosquitofish;
- THg levels in large-bodied fish
-

Table 2 summarizes the monitoring requirements for Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9.

Table 2. Phase 3 – Tier 1: Routine Operational Monitoring from Year 4 to Year 9

Matrix	Location	Collection Method	Frequency	Parameter
Mosquitofish	STA-5/6 flow-ways 3, 4, 5, 6, & two downstream stations (RA1 and STA6DC)	Net or Trap	Semiannually	THg
Bass & Sunfish (n=5 each)	Flow-way with historically highest [THg] (To Be Determined)	Electrofish or Hook & Line	Triennially	THg

3.2 Phase 3 - Tier 2: Expanded Monitoring and Risk Assessment

Tier 2 monitoring and assessment is triggered if one of the following action levels is exceeded during operation:

- If annual average THg levels in mosquitofish progressively increased over time (i.e., two or more years) or any (semi-annual) mosquitofish composite exceeds the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceeds the 75th percentile concentration for the period of record for all basins; or

- If triennial monitoring of large-bodied fish reveal tissue Hg levels in fishes have statistically increased progressively over time or have become elevated to the point of exceeding the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceeded the 75th percentile concentration for the period of record for all basins.

The following steps will be taken if any action level in Tier 2 is triggered:

Step 1: Notify the Department;

Step 2: Resample fish species that triggered Tier 2;

If results of Step 2 (i.e., re-sampling) demonstrate that the anomalous condition was an isolated event, the Department will be notified that the project will revert back and continue with Tier 1 monitoring. Alternatively, if results of Step 2 reveal the anomalous condition was not an isolated event, proceed to Step 3.

Step 3: Expanding monitoring program as follows:

- Increase frequency of mosquitofish collection from semiannually to monthly.
- If Tier 2 was triggered by levels in fish at the downstream site, possibly due to excessive loading from the STA outflow, then quarterly water-column sampling at outflow stations will begin. If necessary (i.e., if loading uncertainty is high), increase frequency of surface water collection to monthly (reducing temporal interpolation), or as appropriate for hydraulic retention time (HRT).
- If Tier 2 was triggered by levels in fish within only one of the treatment trains, further define spatial extent of problem by collecting multiple mosquitofish composites from within the treatment train exhibiting anomalous conditions.
- If Tier 2 was triggered by tissue levels in large-bodied fish, increase sample size of large-bodied fish to n = 20, i.e., 20 each of sunfish (collect various species and sizes) and/or bass (collect various sizes and extract otolith from bass for age determination).
- To evaluate possible trends in methylation rates in sediments (i.e., to determine if methylation rates are increasing or decreasing), replicate sediment cores (0-4 cm) can be collected from the suspected methylation "hot spot" and reference locations within the component (for THg, MeHg, moisture content, total organic carbon (TOC), total sulfur (TS), and total iron (TFe)) over a given period of time (i.e., 2 to 4 months). At these same locations and collection times, collect pore water samples and analyze for THg, MeHg, and sulfides, or if no acceptable pore water protocol has been developed, then acid-volatile sulfide (AVS) on solids shall be completed.

Projects shown to have (spatially) large or multiple MeHg "hotspots" should consider use of the

Everglades Mercury Cycling Model (E-MCM) or comparable model as an assessment tool (i.e., to synthesize results of expanded monitoring).

Step 3 will also include the notification of the Department that anomalous conditions are continuing. The Department and the District may then develop an adaptive management plan using the data generated from the expanded monitoring program. This plan will evaluate the potential risks from continued operation under existing conditions (i.e., through a risk assessment for appropriate ecological receptors). If risk under existing operational conditions is deemed acceptable, then project monitoring would continue under a modified Tier 2 scheme to monitor exposure. On the other hand, if risk under existing operational conditions is deemed unacceptable, then the adaptive management plan would then proceed to determine potential remedial actions to (1) reduce exposure and risk (e.g., signage for human health concerns[1], reduce fish populations, reduce forage habitat suitability)) and (2) affect mercury biogeochemistry to reduce net methylation (e.g., modify hydroperiod or stage, water quality).

In developing this adaptive management plan, the Department may conduct a publicly noticed workshop to solicit comments from the District, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Park Service, the Florida Fish and Wildlife Conservation Commission, and other interested persons.

The next step would then be to carry out such remedial or corrective action. If the remedial or corrective action is demonstrated to be successful, then the project would revert back to Tier 1 monitoring. Alternatively, if monitoring data indicate that the remedial action was unsuccessful in reducing fish tissue concentrations or downstream loading, the Department and the District would then initiate a peer-reviewed, scientific assessment of the benefits and risks of the project.

3.3 Phase 3 - Tier 3: Termination of Monitoring After Year 9

If fishes collected under Phase 3 - Tier 1 have not exceeded action levels by year 9, project-specific monitoring would be discontinued; future assessments would be based on regional monitoring.

4.0 Annual Mercury Monitoring Report

The District shall notify the Department immediately if monitoring data indicate that any of the action levels are exceeded. In addition, the District shall submit an annual report to be incorporated into the SFER and submitted to the Department no later than March 1st of each year. The annual report shall summarize the most recent results of the monitoring as defined above and compares them with the cumulative results from previous years. This report shall also evaluate assessment performance measures (i.e., action levels) outlined above.

5.0 Adaptive Management Strategy

It is the intent that this monitoring plan will be carried out within the context of an adaptive management strategy that will allow for appropriate changes based on new, better understanding of mercury cycling, fate and transport as conveyed in the guidance contained in the *Protocol*.

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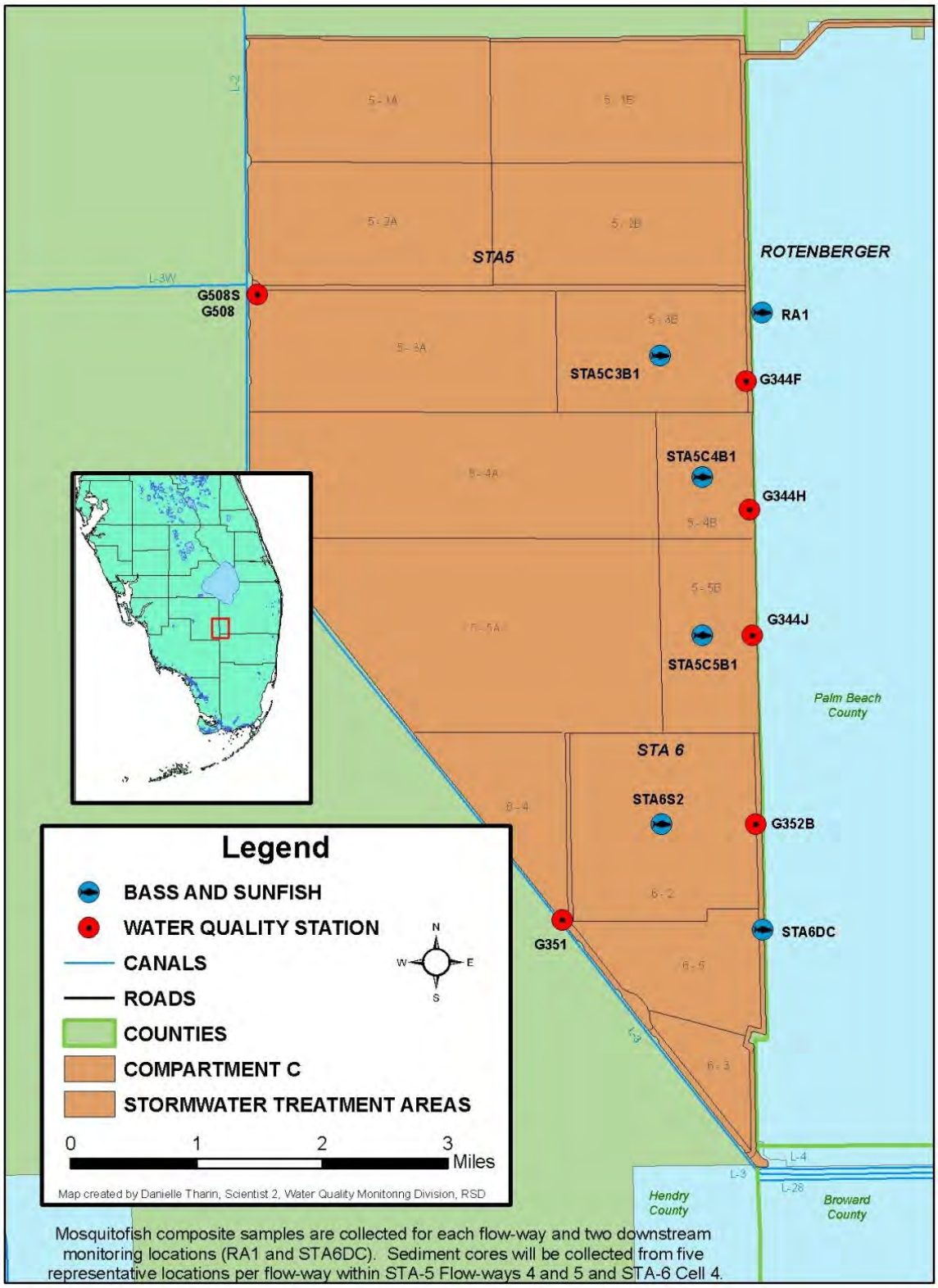
[1] Note that assessment of potential human health impacts and corrective actions (i.e., signage) will require the involvement of the Florida Department of Health)



Map of STA-5/6 Mercury Monitoring Locations