Appendix 4-3: Water Year 2008 Supplemental Evaluations for Regulatory Source Control Programs in Everglades Construction Project Basins

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INTRODUCTION

Chapter 40E-63, Florida Administrative Code (F.A.C.) (Rule 40E-63), requires the South Florida Water Management District (SFWMD or District) to report on the status of the required water quality monitoring for determining compliance with total phosphorus (TP) load mandates for two Everglades Construction Project (ECP) basins, specifically, the Everglades Agricultural Area (EAA) and C-139 basins. Data collection efforts for Water Year 2008 (WY2008) (April 1, 2007–May 30, 2008) were consistent with the background and detail presented in Appendix 3-1b of the *2006 South Florida Environmental Report – Volume I* (SFER). Rule 40E-63 Appendices A and B of that appendix present information on the basin-level monitoring requirements, equations, and models used to calculate observed and predicted TP loads for the EAA and C-139 basins, and Appendices A3 and B2 outline data collection requirements. The rule appendices are available on the District's web site at www.sfwmd.gov/rules/, under the *What We Do*, *Permitting/ Regulation*, *Rules, Statutes & Criteria* section.

This appendix provides summaries of TP data collected at all EAA and C-139 basin-level compliance structures, updates on the status of the current quality level of flow rating equations, and summaries of the flow, TP load, and flow-weighted mean (FWM) TP concentration at each structure for WY2008. This appendix provides a summary of the EAA basin permit-level water quality monitoring data, which includes observed flows, FWM concentrations, and unit area loads (UALs). Additionally, this appendix describes the EAA and C-139 TP load calculation methodologies and equations details using WY2008 data.

EAA BASIN SUPPLEMENTAL EVALUATION

EAA BASIN COMPLIANCE CALCULATION DETAILS

Compliance with EAA basin mandates is based on mathematical equations and methodology dictated by Rule 40E-63. The equations are reproduced in **Figure 1**. **Figure 2** presents the monthly rainfall totals for the EAA basin during WY2008 and related coefficients used to calculate the target load per rule's equations. The target load accounts for a reduction in the EAA basin area by a factor equal to the current acreage divided by the baseline acreage. The predicted load is the pre-Best Management Practices (BMP) baseline period load adjusted for hydrologic variability associated with rainfall. Calculation of the limit is not required for WY2008 as the basin load was less than the target load.

RULE 40E-63 BASIN COMPLIANCE MODEL (excerpt from Chapter 40E-63, F.A.C.)

To reflect the required 25% reduction, period of record (POR) TP loads are multiplied by 0.75 before performing the following regression:

$$\ln(L) = -7.998 + 2.868\ X + 3.020\ C - 0.3355\ S$$

[Explained Variance = 90.8%, Standard Error of Estimate = .183]

Predictors (X, C, S) are calculated from the first three moments (m_1, m_2, m_3) of the 12 monthly rainfall totals (r_i, I = 1, 12, inches) for the current year:

$m_1 =$ Sum $[r_i] / 12$

$m_2 =$ Sum $[r_i - m_1]^2 / 12$

$m_3 =$ Sum $[r_i - m_1]^3 / 12$

$X = \ln(12\ m_1)$

$C = [(12/11)\ m_2]^{0.5} / m_1$

$S = (12/11)\ m_3 / m_2^{\ 1.5}$

where,

L = 12-month load attributed to EAA Runoff, reduced by 25% (metric tons)

X = natural logarithm of 12-month total rainfall (inches)

C = coefficient of variation calculated from 12 monthly rainfall totals

S = skewness coefficient calculated from 12 monthly rainfall totals

The first predictor (X) indicates that load increases approximately with the cube of total annual rainfall. The second and third predictors (C & S) indicate that the load resulting from a given annual rainfall is higher when the distribution of monthly rainfall has higher variance or lower skewness. For a given annual rainfall, the lowest load occurs when rainfall is evenly distributed across months and the highest load occurs when all of the rain falls in one month. Real cases fall in between.

Compliance will be tracked by comparing the measured EAA Load with:

$$\text{Target} = \exp[-7.998 + 2.868\ X + 3.020\ C - 0.3355\ S]$$

$$\text{Limit} = \text{Target}\ \exp(1.476\ SE\ F)$$

$$SE = 0.1833\ [1 + 1/9 + 5.125\ (X-X_m)^2 + 17.613\ (C-C_m)^2 + 0.5309\ (S-S_m)^2 + 8.439\ (X-X_m)\ (C-C_m) - 1.284\ (X-X_m)\ (S-S_m) - 3.058\ (C-C_m)\ (S-S_m)]^{0.5}$$

where,

m = subscript denoting average value of predictor in base period ($X_m = 3.866$, $C_m = 0.7205$, $S_m = 0.7339$)

Target = predicted load for future rainfall conditions (metric tons/yr)

Limit = upper 90% confidence limit for target (metric tons/yr)

SE = standard error of predicted ln(L) for May-April interval

F = factor to reflect variations in model standard error as a function of month (last in 12-month interval), calculated from base period:

Month:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
F:	1.975	1.609	1.346	1.000	1.440	1.238	1.321	2.045	2.669	2.474	2.420	2.216

Figure 1. Rule 40E-63, Florida Administrative Code (F.A.C.), Appendix A3 excerpt: hydrologic adjustment and basin compliance mathematical equations to calculate annual TP reductions.

WY2008 EAA basin compliance TP load calculation

See 40E-63 Appendix A for "Target" equation

Month	Rainfall (in)			
May	2.66 in		m_1 =	3.91
June	7.45 in		m_2 =	5.43
July	6.93 in		m_3 =	(0.55)
August	5.02 in		X =	3.849
September	6.89 in		C =	0.622
October	4.07 in		S =	-0.047
November	0.28 in		SE =	0.2145
December	0.91 in			
January	0.83 in		Target[1] TP Load =	125.5 mtons
February	4.30 in		Limit[2] TP Load =	172.3 mtons
March	3.90 in		Observed TP Load =	94.1 mtons
April	3.71 in		Predicted =	167.4 mtons
Total Rainfall	46.95 in		% Reduction =	44%

Notes:

[1] Target load is adjusted for reduction in EAA land area (472339 ac./ 523721 ac.)
Target load calculation accounts for 25% reduction of baseline period loads

[2] Limit load in upper 90% confidence limit for Target

[3] Predicted load = Target load / (1 - 0.25)

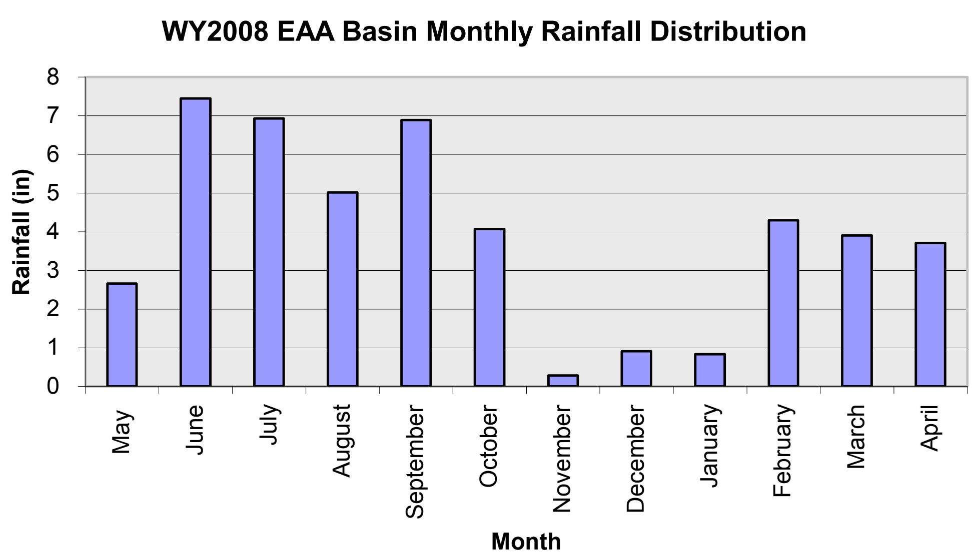


Figure 2. Water Year 2008 (WY2008) EAA basin monthly rainfall totals, compliance calculation coefficients, and target load calculation.

EAA BASIN-LEVEL MONITORING DATA

During WY2008, 15 structures comprised the modeling boundary of the EAA basin and 17 water quality monitoring sampling points represented the water quality of flow through those structures.

The EAA basin-level compliance determination is based on water year monitoring at various inflow and outflow points defining the boundary of the four major EAA sub-basins (S5A, S2/S6, S2/S7, and S3/S8) and the conveyance canals serving those sub-basins. **Table 1** summarizes the structures defining the WY2008 boundary for each EAA sub-basin. **Table 2** provides TP sampling statistics for all the locations monitored by the District for the EAA basin during WY2008.

EAA BASIN-LEVEL WATER QUALITY SUMMARY

Table 3 summarizes the annual flow, TP load, and FWM TP concentration for every structure used during WY2008 to determine overall compliance with EAA load reduction requirements. Annual individual summaries are not intended to be aggregated to mass-balance the flows and loads for a reported EAA TP load. Rather, the structure summaries are presented as an accounting of the annual flow and TP load at each structure that inflows and outflows from each EAA sub-basin. The more complicated runoff determination procedures outlined in Rule 40E-63 for deriving the annual water year TP load values within the EAA basin are accomplished through daily inflows to the EAA, excluding irrigation flow, subtracted from the runoff results for each hydrologic sub-basin.

Since the implementation of BMPs required by the Everglades Regulatory Program, TP loads from the surface water runoff attributable to the lands within the EAA basin have been evaluated on an annual basis taking into account changes brought about from lands converted to STAs, inflow sources from external basins, and the addition of new water control structures. To interpret TP measurements taken at inflow and outflow water control structures defining the boundary of the EAA basin, it is important to recognize that water leaving the EAA basin through these structures is a combination of EAA farm and urban-generated runoff and water passing through the EAA basin canals from external basins. This pass-through water includes discharges from Lake Okeechobee and 298 District diversion areas. The diversion areas location, shown in Chapter 4, Figure 4-5 of this volume, include the South Florida Conservancy District (SFCD), South Shore Drainage District (SSDD), East Beach Water Control District (EBWCD), East Shore Water Control District (ESWCD), and Closter Farms. The runoff from lands within the diversion areas enter the EAA through four pump stations: EBWCD (pump station EBPS3), the combined area of ESWCD and Closter Farms (pump station ESPS2), SSDD (pump station SSDDMC), and SFCD (pump station SFCD5E).

Depending on the inflow source and the entry point into the EAA basin, water quality within the basin can be influenced, although the extent of the influence is generally difficult to interpret. Therefore, separate accounting of TP loads from various sources is required to develop conclusions about TP loads originating from lands (or sub-basins) within the overall EAA basin. The TP loads in runoff from the sub-basin lands are conveyed primarily to STAs by the West Palm Beach Canal (WPB) (S5A sub-basin), the Hillsboro Canal (HILLS) (S6 sub-basin and a portion of the S2 sub-basin), the North New River Canal (NNR) (S7 sub-basin and remaining portion of S2 sub-basin), and the Miami Canal (MIA) (S8 and S3 sub-basins). The accounting of tributary sources and flow configurations to the Everglades is complex, and the reported TP loads attributed to the farms, cities, and industries within the EAA basin should not be confused with the total load being delivered to the Everglades.

Currently, the EAA basin-level compliance determination is based on monitoring at various inflow and outflow points defining the boundary of the sub-basins (S5A, S2/S6, S2/S7, and S3/S8) in any given water year and the conveyance canals serving those sub-basins. These boundary structures are listed in **Table 1**. Currently, the assumption from a water budget perspective is inter sub-basin transfers of flows through the Cross, Ocean, and Bolles canals are negligible in the overall accounting of runoff from the EAA basin. Several Everglades Restoration Projects in the EAA are under evaluation, like the EAA Reservoir Phase I and ECART. District staff has initiated evaluation of how model assumptions will need to be revised based on these projects.

Table 1. EAA sub-basin inflow and outflow monitoring points during WY2008.

EAA Sub-Basin (Canal)	**Structure/Site**	**Inflow**	**Outflow**
S5A (WPB Canal)	S-5A (S-5A Complex)		●
	S-5AW (S-5A Complex)	●	●
	S-352	●	●
	EBPS3	●	
S2/S6 (HILLS Canal)	S-6		●
	G-328		●
	S-2 (S-2 Complex)		●
	S-351 (S-2 Complex)	●	
	ESPS2	●	
S2/S7 (NNR Canal)	G-370		●
	G-371		●
	S-2 & S-351 (see above)	●	●
S3/S8 (MIA Canal)	G-372		●
	G-373		●
	S-3 (S-3 Complex)		●
	S-354 (S-3 Complex)	●	
	SSDDMC	●	
	SFCD5E	●	
	G-136	●	

Table 2. Summary statistics – WY2008 total phosphorus (TP) monitoring data for the Everglades Agricultural Area (EAA) basin.

Sub-Basin (canal)	Structure	Sampling Point	Sample Type	Number Sampled	Number Used	Min. (ppm)	Max. (ppm)	Number Flagged	Flow[1] Curve Rating
S5A (WPB canal)	S-352	S-352	Grab	73	15	0.091	2.183	0	Good
			Composite*	16	16	0.111	2.568	0	
	S-5A Complex	S-5A	Grab	52	19	0.033	0.314	0	Good
			Composite*	30	25	0.051	0.325	0	
	EBPS	EBEACH	Grab	51	14	0.079	1.087	1	Good[3]
			Composite*	36	36	0.106	1.389	1	
S2/S6 (HILLS canal)	S-2 Complex	S2	Grab	14	2	0.043	0.505	0	Good
			Composite*	2	2	0.089	0.123	0	
		S351	Grab	58	9	0.030	0.263	0	Good
			Composite*	8	8	0.050	0.217	0	
	S-6	S-6	Grab	51	18	0.016	0.242	0	Good
			Composite*	32	31	0.022	0.163	0	
	G-328	G328	Grab	50	14	0.013	0.234	0	Fair
			Composite*	17	16	0.020	0.245	5	
	ESPS	ESHORE2	Grab	51	6	0.027	0.694	0	Good[3]
			Composite*	18	18	0.033	0.397	0	
S2/S7 (NNR canal	S-2 Complex	S2	Grab	14	2	0.043	0.505	0	Good
			Composite*	2	2	0.089	0.123	0	
		S351	Grab	58	9	0.03	0.263	0	Good
			Composite*	8	8	0.05	0.217	0	
	G-370	G-370	Grab	52	14	0.018	0.131	0	Excellent
			Composite*	28	28	0.032	0.218	0	
	G-371	G-371	Grab	52	1	0.011	0.078	0	Good
			Composite*	1	1	0.038	0.038	0	

Table 2. Continued.

Sub-Basin (canal)	Structure	Sampling Point	Sample Type	Number Sampled	Number Used	Min. (ppm)	Max. (ppm)	Number Flagged	Flow[1] Curve Rating
S3/S8 (MIA canal)	S-3 Complex	S3	Grab	12	0	0.038	0.095	0	Good
			Composite*	0	0			0	
		S354	Grab	58	7	0.027	0.283	0	Excellent
			Composite*	9	9	0.029	0.079	0	
	G-136	G136	Grab	53	8	0.035	0.161	0	Poor[4]
			Composite*	13	8	0.015	0.114	0	
	SSDDMC	SSDDMC	Grab	52	4	0.033	0.222	0	Fair
			Composite*	12	11	0.088	0.279	0	
	SFCD5E	SFCD5E	Grab	52	5	0.033	0.222	0	Fair
			Composite*	12	11	0.088	0.279	0	
	G-372	G-372	Grab	52	15	0.015	0.102	0	Excellent
			Composite*	29	29	0.031	0.591	0	
	G-373	G-373	Grab	52	2	0.014	0.097	0	Good
			Composite*	6	6	0.035	0.088	0	

1 Flow Curve Rating: Discharge estimates derived from theoretical equations are within a range of expected values based on streamflow measurements used to calibrate the theoretical equations and are classified as: Excellent (< 5%), Good (< 10%), Fair (< 15%), or Poor (> 15%).

2 Composite samples could be time-proportional, flow-proportional, or a combination of the two.

3 Good, based on experience with theoretical ratings based on pump manufacturers' performance curves, but streamflow measurements are not sufficient to calibrate theoretical equations and the flow curve rating cannot adequately be determined.

4 Poor, based on experience with ratings at culverts with flashboards, but streamflow measurements are not sufficient to calibrate theoretical equations and the flow curve rating cannot adequately be determined.

Table 3. WY2008 flow volumes, TP loads, and flow-weighted mean (FWM) TP concentrations for EAA basin structures.

Sub-Basin (canal)	Direction		Structure	Load (mt)	Flow (kac-ft)	Conc. (ppb)
S5A (WPB canal)	Outflow	to Lake Okeechobee	S-352	0.00	0.00	N/A
		to STA-1 Inflow & Distribution Works	S-5A + S-5AW	25.62	125.34	166
		Total		**25.62**	**125.34**	**166**
	Inflow	from Lake Okeechobee	S-352	6.62	20.51	262
		from L-8 Canal	S-5A + S-5AW	2.44	39.08	51
		from East Beach WCD	EBPS3	4.56	7.15	517
		Total		**13.63**	**66.74**	**166**
S2/S6 (HILLS Canal)	Outflow	to Lake Okeechobee	S-2	0.20	1.34	121
		to STA-2 Inflow Distribution Canal	S-6	24.94	184.84	109
		to STA-2 Inflow Distribution Canal	G-328	2.06	22.73	74
		Total		**27.20**	**208.91**	**106**
	Inflow	from Lake Okeechobee*	S-351	7.00	42.80	133
		from East Shore WCD	ESPS2	3.04	13.76	179
		Total		**10.03**	**56.55**	**144**
S2/S7 (NNR canal)	Outflow	to Lake Okeechobee	S-2	0.37	2.51	121
		to STA-3/4	G-370	20.46	155.78	106
		to STA-3/4 Bypass Structure	G-371	0.01	0.21	38
		Total		**20.85**	**158.50**	**107**
	Inflow	from Lake Okeechobee*	S-351	see S-351 above		
		from WCA2	G-371	0.51	31.90	13
		Total		**not applicable**		
S3/S8 (MIA canal)	Outflow	to Lake Okeechobee	S-3	0.09	0.26	295
		to STA-3/4	G-372	29.65	157.11	153
		to STA-3/4 Bypass Structure	G-373	0.34	5.78	48
		Total		**30.09**	**163.15**	**150**
	Inflow	from Lake Okeechobee	S354 (S3)	2.46	31.63	63
		from South Shore DD	SSDDMC	0.57	2.76	167
		from South Florida Conservancy Dist.	SFCD5E	0.75	6.95	88
		from WCA 3	G-373	1.22	35.99	27
		from C-139 Basin	G-136	0.11	1.38	66
		Total		**5.12**	**78.71**	**53**

Note: The S-351 inflow and S-2 outflow sites serve the S2/S6 and S2/S7 sub-basins. The total is shown only once to avoid double-counting the data.

EAA Basin Phosphorus Loads, Flows, and Phosphorus Flow-Weighted Mean Concentrations by Sub-Basin

Based on the boundary conditions, **Table 4** presents the summaries of flows and TP loads for each sub-basin identified in **Table 1**. The summaries in **Table 4** generally describe the mass balance of inflows and outflows from the EAA sub-basins. The observed runoff TP load and runoff volume from each sub-basin, summing up to a total observed EAA basin runoff TP load of 94 metric tons (mt) and runoff volume of 618,567 acre-feet (ac-ft), is noted in this table. More detailed WY2008 information on the annual load, flow, and TP FWM concentration at each of the individual inflow and outflow structures for each sub-basin in **Table 1,** along with TP data collection statistics and the current quality level of flow information at each structure, can be found in **Tables 2** and **3**.

Table 5 presents a summary of the inflow and outflow TP concentrations for WY2008, which contrasts the concentrations of incoming flows from Lake Okeechobee with the total outflow concentrations from each sub-basin. The TP concentrations at the Lake Okeechobee inflow points (S-351, S-352, S-354) to the EAA sub-basins for WY2008 ranged between 63 ppb and 262 ppb. High lake inflow TP concentrations to the EAA are often cited as cause for concern in maintaining the actual performance level of BMPs reducing TP loads because the lake is a major source of irrigation water. An evaluation of this relationship was under way during WY2008 to ascertain the relationships between the lake inflows and EAA basin TP levels. The completed evaluation will be available during WY2009 and an update is expected to be provided in the 2010 *South Florida Environmental Report* (SFER) – *Volume I.*

While the accounting of flows and TP loads associated with EAA basin runoff and from other sources flowing into and out of the EAA basin is complicated, it is possible to determine the contributions from each of these sources by reviewing the total observed load at the basin outflow structure. For instance, during WY2008, the Miami Canal conveyed EAA basin runoff, Lake Okeechobee pass-through flows, C-139 basin runoff, and runoff from two diversion area basins (SFCD and SSDD) to the Stormwater Treatment Area 3/4 (STA-3/4) inflow structure (G-372). Therefore, G-372 received multiple sources of water of varying amounts (flow and TP load) which contributed to the total observed flow and TP load.

It is not the intent of this document to quantify or report how flows and TP loads from the various sources are allocated, or apportioned, to the various sub-basin outflow points. However, this information is useful in knowing how much water from sources external to the EAA basin (Lake Okeechobee and diversion areas), in addition to EAA basin runoff, is routed for treatment in or to bypass an STA because of capacity constraints in any given water year. Therefore, this type of detailed information is reported in other chapters of this volume, specifically Chapter 3A and Chapter 5, which provide a comprehensive picture of flow and TP loads (and the source) being discharged to the EPA and on STA performance, respectively.

Table 4. EAA sub-basin flows and TP loads by source for WY2008.

S5A Sub-Basin (WPB Canal)	**Load (mt)**		**Flow (kac-ft)**	
Source	Inflow	Outflow	Inflow	Outflow
EAA*	N/A	21.00	N/A	117.93
Lake	6.62	0.06	20.51	0.25
EBWCD	4.56	4.56	7.15	7.15
Total	**11.18**	**25.62**	**27.66**	**125.33**
S2/S6 Sub-Basin (HILLS Canal)	**Load (mt)**		**Flow (kac-ft)**	
Source	Inflow	Outflow	Inflow	Outflow
EAA*	N/A	24.05	N/A	194.68
Lake	2.44	0.11	14.91	0.48
ESWCD & Closter	3.04	3.04	13.76	13.76
Total	**5.48**	**27.20**	**28.67**	**208.92**
S2/S7 Sub-Basin (NNR Canal)	**Load (mt)**		**Flow (kac-ft)**	
Source	Inflow	Outflow	Inflow	Outflow
EAA*	N/A	20.82	N/A	158.34
Lake	4.56	0.02	27.89	0.16
Total	**4.56**	**20.84**	**27.89**	**158.50**
S3/S8 Sub-Basin (MIA Canal)	**Load (mt)**		**Flow (kac-ft)**	
Source	Inflow	Outflow	Inflow	Outflow
EAA*	N/A	28.26	N/A	146.87
Lake	2.46	0.39	31.63	4.44
C-139	0.11	0.11	1.38	1.38
SSDD	0.57	0.57	2.76	2.76
SFCD	0.75	0.75	6.95	6.95
Total	**3.89**	**30.08**	**42.72**	**162.40**

Note: The total loads and flows leaving the sub-basins represent pass through volumes as well as volumes originating within the basin. With the exception of lake inflows, it is assumed that 100 percent of all other inflow sources to the EAA sub-basins pass through the main EAA conveyance canals directly to the outlet of each sub-basin. These assumptions are mandated in the model developed under Rule 40E-63 for determining EAA basin phosphorus load reductions.

EAA* Represents each sub-basin's portion of the total EAA basin TP load and volume from runoff.

N/A Not Applicable

Table 5. EAA sub-basin inflow and outflow FWM TP concentration for WY2008.

EAA Sub-Basin	**Lake Inflow FWM Concentration (ppb)**	**Total Outflow FWM Concentration (ppb)**
S5A (WPB Canal)	262	166
S2/S6 (HILLS Canal)	133	106
S2/S7 (NNR Canal)	133	107
S3/S8 (MIA Canal)	63	150

EAA Basin Short-Term and Long-Term Variations

Rainfall variation in both spatial and temporal distribution influence runoff patterns throughout the basin. For instance, a basinwide average rainfall amount of 37 inches occurring in two separate water years can produce markedly different runoff volumes and TP loads. The impact of spatial and temporal rainfall variation on runoff is the basis for the rainfall adjustments that are applied to pre-BMP baseline predicted loads. **Figure 3** depicts the annual variation of total rainfall occurring within each of the four major sub-basin groups (averaged rainfall from sites within the sub-basin) compared to the total rainfall for the entire EAA basin (averaged rainfall from all sites) since WY1996. During WY2008, the S2/S6 sub-basin received the highest amounts of rainfall, and the S3/S8 sub-basin received the lowest. **Figure 4** depicts the variation of WY2008 sub-basin monthly rainfall compared to the total monthly rainfall for the EAA basin. A more detailed summary of the WY2008 rainfall and predicted load adjustments based on Rule 40E-63 compliance calculations for the EAA is provided in the *EAA Basin Compliance Calculation Details* section of this appendix. Chapter 2 of this volume provides more in-depth explanations of the hydrologic events that occurred throughout the District during WY2008.

Since WY1996, runoff volumes between the sub-basins have typically shown an evenly distributed and narrower range of variation when based on the percent contribution of each (typically 20 to 30 percent each) to the total EAA basin runoff volume (**Figure 5)**. However, with runoff TP loads among the sub-basins, a wider range of variation is seen (**Figure 6**). The range of variation has become more evenly distributed in the past three years.

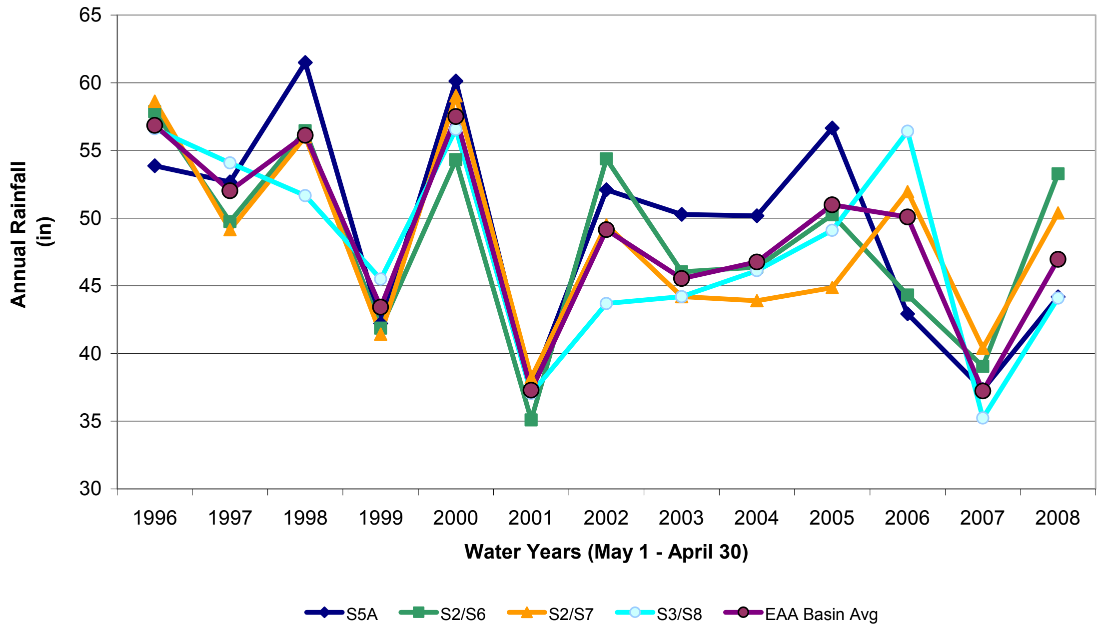


Figure 3. WY1996-WY2008 EAA sub-basin annual rainfall distribution trend.

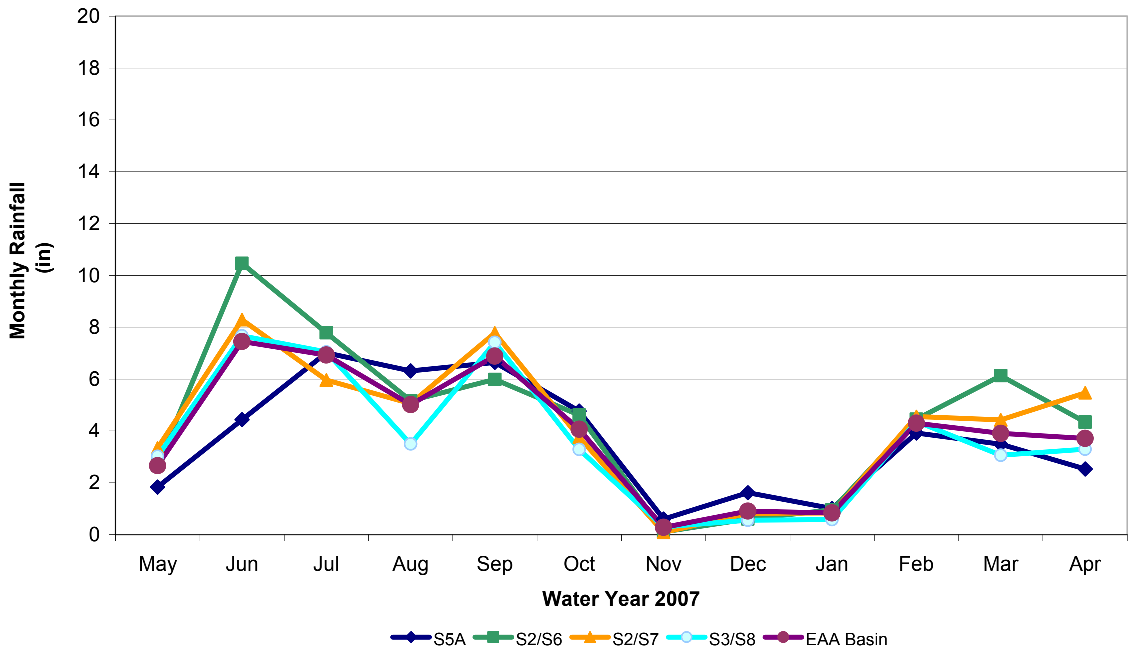


Figure 4. WY2008 EAA sub-basin monthly rainfall distribution trend.

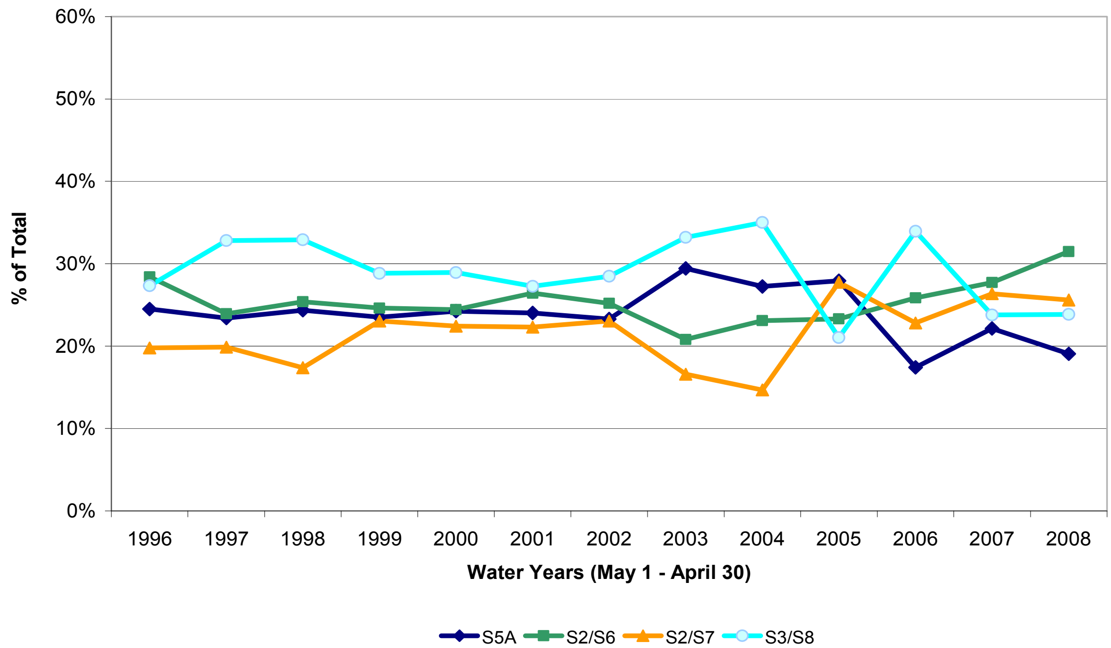


Figure 5. WY1996–WY2008 EAA sub-basin annual runoff volume percent "relative" contribution trend of basin total.

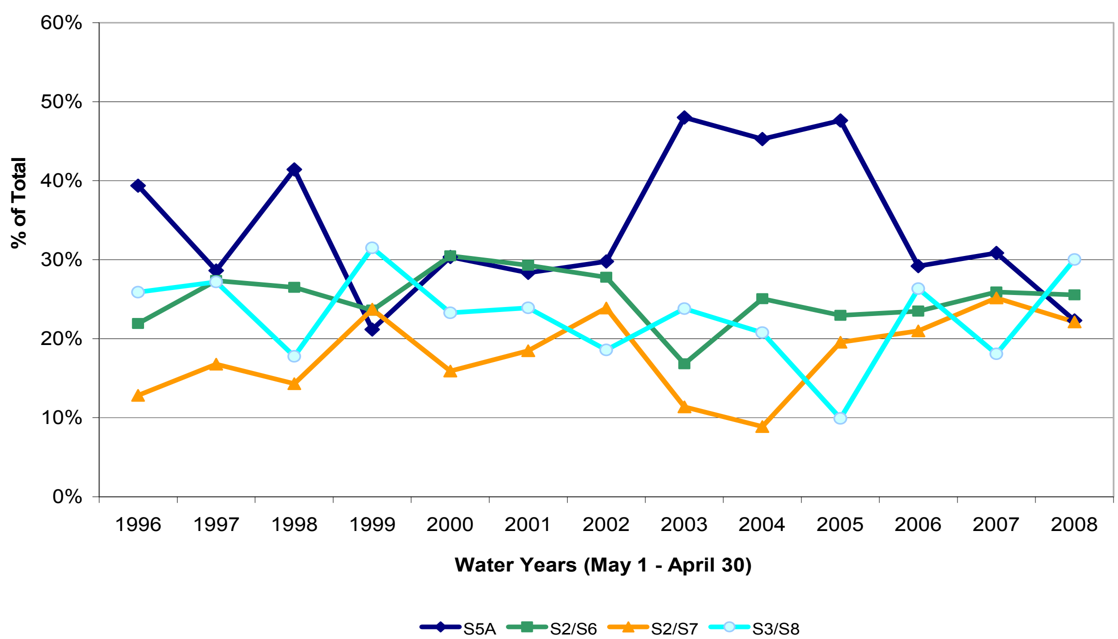


Figure 6. WY1996–WY2008 EAA sub-basin annual TP load percent relative contribution trend of basin total.

PERMIT-LEVEL MONITORING DATA

The TP concentrations and load data for individual farms within the EAA basin for WY2008 are presented in this section in both tabular form and as a spatial distribution. Individual farms within the EAA are required to submit these permit-level data for any discharge structure as a condition of a BMP permit issued in accordance with Chapter 40E-63, Part 1 (Rule 40E-63), F.A.C. **Table 6** identifies separate hydraulic drainage areas (e.g., individual farms) within the EAA basin. Drainage areas are identified according to the unit area or basin identification (ID) number. The table summarizes the area FWM TP concentration, observed TP UAL, and the rainfall adjusted UAL for WY2008.

Table 6 has been updated to include five basins (East Beach Water Control District, East Shore Water Control District, Closter Farms, South Shore Drainage District, and South Florida Conservancy District) that historically discharged to Lake Okeechobee and where diversion of the majority of discharges to the Everglades was recently initiated in accordance with Everglades Forever Act (EFA) [Section 373.4592, Florida Statutes (F.S.)] requirements.

Permit-level data allows relative comparisons between farms, between water years for a single farm, and between water years and a baseline for a single farm. The District uses such relative comparisons when considering individual farm BMP performance with permittees. Factors that affect permit-level concentrations and loads were discussed in the 2006 SFER – Volume I, Chapter 3 (refer to *EAA Basin Permit-Level Monitoring Results* section).

Permit-level data are used for compliance determination only if the EAA basin as a whole does not meet its compliance requirement. The permit-level results are not used to calculate TP reduction at the EAA basin level.

Table 6 lists the TP data using the following column designations:

- *Basin ID* is a unique identifier for each hydraulic drainage area within a permit. It may represent one or more farms.
- *Early Baseline* indicates whether a farm qualifies for early baseline status by having implemented BMPs since January 1, 1994, initiated a discharge monitoring plan since January 1, 1993, and submitted specific information at the initial application period in 1992. A "Y" indicates an early baseline farm; "N" indicates that a farm does not qualify for early baseline status. If the EAA basin as a whole falls out of compliance, then the methodology applied to assess compliance at the farm level is different for early baseline and non-early baseline farms. These methodologies are described in Rule 40E-63, F.A.C.
- *Baseline Year* is the water year for which a farm established its baseline period load. For early baseline farms, the baseline period load is based on data collected between May 1, 1993, and April 30, 1994.
- *Rainfall Adjusted Unit Area Load* (pounds per acre, or lbs/ac):
    - Baseline is the TP load per unit area measured for the baseline year for a farm (includes 10-year base period rainfall adjustment). A baseline has not been calculated for two of the five Lake Okeechobee diversion basins. Three of the five Lake Okeechobee diversion basins have baselines remaining from the portions of those basins that have historically discharged into the EAA and were originally tracked in the permit-level data. A methodology to

evaluate compliance at the permit level for the Lake Okeechobee diversion basins similar to that for the historic EAA areas does not exist. Preliminary data analysis in support of a compliance methodology was performed in WY2008.

- WY2008 is the TP load per unit area for the current water year for a farm (includes 10-year base period rainfall adjustment).

- *WY2008 Percent (%) TP Reduction* is the WY2008 TP load reduction for the farm compared to the baseline year.
- *WY2008 TP Concentration* (parts per billion, or ppb) is the FWM TP concentration for the farm for WY2008.
- *WY2008 TP Unit Area Load* (pounds per acre, or lbs/ac) is the observed TP load per unit area for the current water year for a farm.

Figures 7, 8, and **9** depict the spatial distribution of TP concentrations, rainfall adjusted UALs, and observed UALs found in the EAA. These figures are graphical representations of the **Table 6** data from individual permit holders. Each basin I.D. is mapped as a whole, and no information is available to account for localized variations within a basin.

Table 6. WY2008 permit-level data for the EAA basin.

Basin ID	Basin Acreage	Early Baseline	Baseline Year	Rain Adjusted Unit Area Load (lbs/ac)		WY2008 % TP Reduction	WY2008 Unit Area Load (lbs/ac)	WY2008 TP Conc. (ppb)	Comments
				Baseline	WY2008				
26-001-01	767.8	Y	1994	2.12	0.36	83%	0.30	71.6	
26-002-01	897.8	N	2001	Unable to Calculate	0.00	Unable to Calculate	0.00	0.0	Pasture Area with no recorded flows
26-003-01	599.2	N	1999	0.27	Unable to Calculate	Unable to Calculate	Unable to Calculate	Unable to Calculate	<75% annual load sampled (0% Sampled)
26-004-01	4501.6	N	1999	1.22	0.34	72%	0.29	62.8	
26-006-01	1198.4	N	1998	1.19	0.08	93%	0.07	133.9	
26-007-01	653.3	N	1999	2.07	0.63	70%	0.53	161.1	
26-008-01	120.0	Y	1994	2.12	0.36	83%	0.30	71.6	
26-009-01	159.8	N	1999	0.74	Unable to Calculate	Unable to Calculate	Unable to Calculate	Unable to Calculate	<75% annual load sampled (5.8% Sampled)
26-010-01	1231.0	N	1995	1.81	Unable to Calculate	Unable to Calculate	Unable to Calculate	Unable to Calculate	<75% annual load sampled (0% Sampled)
26-010-02	9961.3	N	1995	5.83	0.11	98%	0.09	73.3	
50-002-01	5656.4	Y	1994	3.21	1.10	66%	0.62	297.7	
50-002-02	9285.4	Y	1994	2.90	1.04	64%	0.58	214.7	
50-003-01	242.0	Y	1994	0.40	Unable to Calculate	Unable to Calculate	Unable to Calculate	Unable to Calculate	<75% annual load sampled (26.2% Sampled)
50-003-02	520.0	Y	1994	0.62	0.07	89%	0.08	67.0	
50-003-03	117.6	N	1995	0.22	1.63	-630%	2.02	363.2	
50-003-04	320.0	Y	1994	0.91	0.11	88%	0.13	65.6	
50-004-01	908.9	Y	1994	3.68	2.05	44%	1.15	228.0	
50-005-01	319.8	Y	1994	0.91	0.21	76%	0.26	113.9	
50-005-02	232.9	Y	1994	0.06	0.11	-80%	0.14	182.1	
50-005-03	320.0	Y	1994	0.26	0.33	-29%	0.41	104.1	
50-005-04	309.6	Y	1994	1.49	0.26	83%	0.32	250.3	
50-005-05	747.0	Y	1994	1.95	0.10	95%	0.09	99.5	
50-005-06	502.0	Y	1994	1.56	2.00	-29%	2.47	321.5	
50-006-01	397.2	Y	1994	4.53	1.55	66%	0.87	201.8	
50-006-02	359.3	Y	1994	5.50	0.39	93%	0.48	149.3	
50-006-03	640.3	Y	1994	3.55	0.20	94%	0.24	74.2	
50-007-01	6472.6	Y	1994	1.56	0.57	63%	0.71	62.5	
50-007-02	5716.7	Y	1994	15.11	2.80	81%	1.57	248.5	
50-008-01	7261.2	Y	1994	0.34	0.21	39%	0.18	73.6	
50-009-04	317.0	N	1999	5.19	1.38	73%	1.71	149.2	
50-009-05	1479.4	Y	1994	1.54	1.96	-27%	2.41	133.2	
50-010-01	784.2	N	1995	2.42	0.48	80%	0.59	141.2	
50-010-02	5327.1	N	1994	1.80	0.67	63%	0.83	127.4	
50-010-03	5826.3	Y	1994	1.31	0.59	55%	0.60	116.6	
50-010-04	7159.0	Y	1994	4.76	0.58	88%	0.72	139.5	

Table 6. Continued.

Basin ID	Basin Acreage	Early Baseline	Baseline Year	Rain Adjusted Unit Area Load (lbs/ac)		WY2008 % TP Reduction	WY2008 Unit Area Load (lbs/ac)	WY2008 TP Conc. (ppb)	Comments
				Baseline	WY2008				
50-010-06	10487.3	N	2001	1.31	0.19	86%	0.16	87.7	South Florida Conservancy District[1]
50-011-01	1747.7	Y	1994	2.76	0.45	84%	0.56	143.3	
50-011-03	14337.8	Y	1994	5.79	1.17	80%	1.45	462.0	
50-011-04	4066.0	Y	1994	5.21	1.37	74%	1.70	193.9	
50-011-06	638.0	N	1999	0.02	0.15	-892%	0.13	50.0	
50-012-01	1021.5	Y	1994	4.06	Unable to Calculate	Unable to Calculate	Unable to Calculate	Unable to Calculate	<75% annual load sampled (69.9% Sampled)
50-013-01	1362.6	N	1997	2.98	1.33	55%	0.75	153.1	
50-014-01	1520.4	Y	1994	1.37	0.40	71%	0.50	344.7	
50-015-01	3276.4	Y	1994	2.62	1.19	54%	0.67	225.4	
50-015-02	2554.5	Y	1994	5.28	0.90	83%	0.51	244.5	
50-016-01	1497.3	Y	1994	15.11	1.39	91%	0.78	177.8	
50-017-01	895.0	Y	1994	3.22	0.54	83%	0.67	117.9	
50-018-01	5901.5	Y	1994	2.82	2.06	27%	1.16	275.0	
50-018-02	6594.0	Y	1994	3.54	0.70	80%	0.39	81.1	
50-018-03	9062.3	Y	1994	1.98	1.64	17%	0.92	116.1	
50-018-04	1913.1	Y	1994	3.88	0.30	92%	0.25	67.9	
50-018-05	1827.1	N	1995	3.64	1.06	71%	0.89	186.5	
50-018-06	1255.1	Y	1994	1.46	0.72	51%	0.61	124.8	
50-018-07	1117.4	Y	1994	2.12	0.36	83%	0.30	71.6	
50-018-08	3208.6	Y	1994	2.28	0.32	86%	0.27	58.0	
50-018-09	1736.6	Y	1994	4.22	0.63	85%	0.54	99.1	
50-018-10	8254.4	Y	1994	3.05	0.59	81%	0.73	132.8	
50-018-11	1871.1	Y	1994	19.73	1.35	93%	1.68	245.5	
50-018-12	1655.2	Y	1994	1.78	14.14	-693%	7.94	601.8	
50-018-13	594.3	Y	1994	0.40	7.86	-1866%	4.42	384.3	
50-018-14	569.9	N	1994	2.21	0.85	62%	1.04	144.0	
50-018-15	757.3	Y	1994	1.12	1.76	-56%	2.17	179.9	
50-018-16	240.0	Y	1994	4.11	0.98	76%	1.21	49.7	
50-018-17	488.1	Y	1994	3.10	1.88	39%	2.32	417.8	
50-018-18	357.7	Y	1994	0.64	2.07	-224%	2.56	156.1	
50-018-19	314.3	Y	1994	35.32	1.70	95%	2.09	107.0	
50-018-20	380.6	Y	1994	3.59	0.45	87%	0.55	56.5	
50-018-22	4481.2	Y	1994	8.18	0.25	97%	0.21	78.3	
50-018-23	2946.0	Y	1994	2.22	0.27	88%	0.23	59.6	
50-018-24	3800.3	Y	1994	1.96	0.76	62%	0.64	90.2	
50-018-25	3808.4	Y	1994	4.99	0.47	91%	0.58	116.7	
50-019-01	568.4	Y	1994	1.54	0.15	90%	0.19	69.8	
50-019-02	1210.0	Y	1994	1.38	0.22	84%	0.27	105.0	
50-019-03	1051.4	Y	1994	0.58	0.26	54%	0.33	172.0	

Table 6. Continued.

Basin ID	Basin Acreage	Early Baseline	Baseline Year	Rain Adjusted Unit Area Load (lbs/ac) Baseline	WY2008	WY2008 % TP Reduction	WY2008 Unit Area Load (lbs/ac)	WY2008 TP Conc. (ppb)	Comments
50-020-01	320.0	Y	1994	3.32	2.66	20%	3.29	234.9	
50-021-01	2558.0	Y	1994	8.92	1.10	88%	1.37	237.6	
50-022-01	320.0	Y	1994	0.80	0.22	72%	0.28	112.6	
50-023-01	278.0	Y	1994	11.83	0.53	96%	0.66	284.5	
50-024-01	574.0	N	1995	6.43	0.37	94%	0.46	143.5	
50-025-01	823.7	Y	1994	3.68	2.16	41%	1.21	775.7	
50-027-01	2771.8	Y	1994	2.40	0.34	86%	0.42	97.3	
50-027-02	798.5	Y	1994	1.22	0.76	38%	0.94	127.0	
50-027-03	1353.1	Y	1994	2.32	0.48	79%	0.60	222.0	
50-027-04	2520.0	Y	1994	2.10	0.66	68%	0.82	176.6	
50-028-01	220.0	Y	1994	14.54	0.79	95%	0.98	109.6	
50-029-01	530.6	Y	1994	4.30	2.18	49%	2.69	327.3	
50-030-01	446.1	Y	1994	14.14	0.62	96%	0.76	152.5	
50-031-01	1608.9	Y	1994	2.56	1.99	22%	2.47	80.5	
50-031-02	1387.0	Y	1994	5.48	6.03	-10%	7.48	491.5	
50-031-03	602.4	Y	1994	8.57	2.20	74%	2.73	194.0	
50-032-01	305.7	Y	1994	0.84	0.17	79%	0.21	130.7	
50-033-02	6196.8	N	1994	12.52	3.55	72%	1.99	517.1	East Beach Drainage District[1]
50-034-01	7897.1	Y	1994	1.68	0.41	75%	0.51	91.2	
50-034-02	600.5	Y	1994	3.37	0.51	85%	0.63	94.4	
50-034-03	4611.8	Y	1994	4.08	0.69	83%	0.85	143.3	
50-034-04	4138.0	Y	1994	1.54	1.56	-1%	1.93	166.7	
50-035-01	478.5	Y	1994	5.74	1.12	81%	1.38	159.4	
50-035-02	1634.3	N	1997	2.98	1.33	55%	0.75	153.1	
50-035-03	158.1	N	1999	8.71	16.53	-90%	9.28	284.0	
50-037-01	1568.4	Y	1994	6.70	0.00	100%	0.00	0.0	Reported no offsite discharge consistent with ERP Permit.
50-038-01	1285.0	Y	1994	3.71	1.29	65%	0.73	229.0	
50-039-01	62.5	N	1995	4.01	0.00	100%	0.00	0.0	
50-039-02	143.1	N	1995	4.25	1.29	70%	1.59	184.2	
50-040-01	216.2	N	1995	1.40	0.84	40%	0.47	132.4	
50-040-02	498.6	N	1995	3.61	0.76	79%	0.43	136.4	
50-041-01	108.8	N	1998	2.69	0.43	84%	0.54	88.6	
50-041-02	300.4	N	1998	2.44	0.71	71%	0.88	140.1	
50-042-01	320.0	N	1995	0.14	0.16	-9%	0.19	83.2	
50-044-01	2168.8	N	1996	5.02	2.93	42%	1.65	223.9	
50-045-01	281.8	N	1995	4.35	0.47	89%	0.59	132.4	
50-045-02	160.6	N	1995	1.41	0.61	57%	0.76	98.0	
50-046-01	35.0	N	1994	2.21	0.85	62%	1.04	144.0	
50-047-01	630.3	N	1996	1.46	0.30	80%	0.37	105.7	

Table 6. Continued.

Basin ID	Basin Acreage	Early Baseline	Baseline Year	Rain Adjusted Unit Area Load (lbs/ac)		WY2008 % TP Reduction	WY2008 Unit Area Load (lbs/ac)	WY2008 TP Conc. (ppb)	Comments
				Baseline	WY2008				
50-047-02	640.0	N	1995	0.84	0.54	36%	0.67	133.1	
50-047-03	1832.0	N	1997	0.44	0.76	-74%	0.94	207.8	
50-047-04	198.5	N	1996	0.68	0.10	85%	0.13	52.2	
50-047-05	314.0	N	1997	0.55	1.72	-213%	2.14	171.7	
50-047-07	3494.2	N	1996	0.67	1.07	-59%	0.60	135.3	
50-047-08	1557.7	N	1996	0.96	1.14	-18%	1.41	146.3	
50-048-01	1185.1	N	1995	1.25	0.73	41%	0.90	136.7	
50-048-02	640.0	N	1995	0.36	0.50	-38%	0.62	122.1	
50-051-01	811.4	N	1995	0.97	0.47	51%	0.59	89.5	
50-053-01	148.9	N	1995	5.16	0.72	86%	0.90	488.8	
50-054-01	9682.8	N	1996	1.16	1.11	4%	0.62	161.4	
50-054-02	960.0	N	1996	0.50	2.41	-386%	1.35	188.1	
50-054-03	1227.2	N	1996	0.35	0.90	-155%	0.50	222.7	
50-054-04	3684.3	N	1996	0.82	1.68	-104%	0.94	86.8	
50-055-01	392.9	N	1997	0.86	0.10	89%	0.12	103.6	
50-055-02	810.4	N	1999	0.45	0.28	39%	0.34	78.2	
50-055-03	2871.2	N	1996	0.74	0.19	75%	0.23	68.3	
50-056-01	849.8	N	1996	0.98	0.77	22%	0.95	195.0	
50-058-01	157.0	N	1995	0.02	Unable to Calculate	Unable to Calculate	Unable to Calculate	Unable to Calculate	<75% annual load sampled (0% Sampled)
50-059-01	11522.9	N	1996	2.35	1.41	40%	0.79	214.9	
50-059-02	1767.6	N	1997	1.07	1.18	-10%	0.66	108.3	
50-059-03	709.5	N	1996	1.65	3.51	-112%	1.97	529.7	
50-059-04	306.1	N	1996	1.14	0.35	69%	0.20	142.1	
50-060-01	8137.2	N	1995	0.18	0.63	-257%	0.79	205.2	
50-060-02	7613.8	N	1995	0.75	0.37	50%	0.46	69.7	
50-061-01	639.5	N	1995	1.44	0.05	96%	0.07	138.3	
50-061-03	3434.3	N	1995	0.76	0.46	40%	0.56	120.8	
50-061-05	313.7	N	1995	1.89	1.16	38%	1.44	154.2	
50-061-06	237.0	N	1995	1.68	0.42	75%	0.52	210.5	
50-061-07	318.2	N	1995	1.24	0.92	26%	1.14	135.5	
50-061-08	375.2	N	1999	1.76	1.25	29%	0.70	135.6	
50-061-10	25062.2	N	1996	0.60	0.22	63%	0.19	51.3	
50-061-12	730.0	N	1995	2.55	0.49	81%	0.60	113.8	
50-061-13	1059.6	N	1995	1.16	0.90	23%	1.11	46.2	
50-061-15	6760.2	N	1995	1.91	0.28	85%	0.28	78.2	
50-061-17	1598.1	N	1995	12.22	6.74	45%	3.79	287.9	
50-061-18	1555.1	N	1995	9.82	0.83	92%	1.03	45.8	
50-061-20	156.1	N	1994	1.80	0.67	63%	0.83	127.4	
50-061-22	3739.3	N	1996	0.49	0.15	70%	0.13	94.4	
50-061-23	5511.4	N	1995	0.77	0.98	-27%	1.21	68.4	

Table 6. Continued.

Basin ID	Basin Acreage	Early Baseline	Baseline Year	Rain Adjusted Unit Area Load (lbs/ac)		WY2008 % TP Reduction	WY2008 Unit Area Load (lbs/ac)	WY2008 TP Conc. (ppb)	Comments
				Baseline	WY2008				
50-062-01	4625.8	N	1996	0.20	0.75	-281%	0.92	163.7	
50-062-02	10754.2	N	1996	0.46	0.29	38%	0.36	70.5	
50-062-03	1188.3	N	1996	0.54	0.37	32%	0.45	86.6	
50-062-04	901.2	N	1996	0.26	0.33	-29%	0.41	117.0	
50-062-05	5249.6	N	1996	0.41	0.50	-21%	0.61	86.9	
50-062-09	7658.9	N	1997	0.22	0.20	7%	0.25	68.4	
50-062-10	8772.4	N	1997	0.72	0.41	43%	0.51	73.3	
50-062-11	1276.6	N	1996	0.44	0.33	24%	0.41	120.8	
50-063-01	9792.2	N	1996	0.45	0.27	41%	0.33	99.2	
50-064-01	898.7	N	1997	2.98	1.33	55%	0.75	153.1	
50-064-03	145.0	N	1997	2.98	1.33	55%	0.75	153.1	
50-064-04	1150.4	N	1997	2.98	1.33	55%	0.75	153.1	
50-065-02	938.1	N	1995	3.64	0.22	94%	0.27	167.9	
50-065-03	3751.7	N	1997	2.98	1.33	55%	0.75	153.1	
50-065-05	929.8	N	1997	2.98	1.33	55%	0.75	153.1	
50-065-06	453.9	N	1997	2.98	1.33	55%	0.75	153.1	
50-065-07	513.0	N	1995	3.92	0.36	91%	0.44	108.0	
50-065-08	628.0	N	1997	2.98	1.33	55%	0.75	153.1	
50-065-10	792.3	N	1995	1.55	0.23	85%	0.29	88.0	
50-066-01	1233.6	N	1995	2.13	Unable to Calculate	Unable to Calculate	Unable to Calculate	Unable to Calculate	<75% annual load sampled (0% Sampled)
50-067-01	1143.9	N	1996	0.40	0.55	-39%	0.47	48.3	
50-067-02	10257.1	N	1996	0.94	0.39	58%	0.33	69.4	
50-067-03	681.6	N	1996	1.02	0.47	54%	0.40	45.8	
50-067-04	3819.5	N	1996	0.55	0.21	62%	0.18	68.6	
50-067-05	7322.6	N	1996	0.42	0.35	16%	0.30	56.6	
50-067-06	1277.2	N	1999	0.49	0.92	-86%	0.78	104.3	
50-067-07	1975.5	N	1999	0.54	0.36	33%	0.30	25.1	
50-067-09	1277.7	N	1999	0.54	0.20	63%	0.17	45.0	
50-067-10	2551.8	N	1999	1.21	1.08	10%	0.92	79.7	
50-067-11	6179.0	N	1999	0.85	0.45	46%	0.38	69.4	
50-067-13	685.3	N	1997	2.29	Unable to Calculate	Unable to Calculate	Unable to Calculate	Unable to Calculate	<75% annual load sampled (0% Sampled)
50-068-01	2615.8	N	1996	1.13	3.30	-191%	1.86	217.6	
50-069-01	317.5	N	1996	1.06	0.46	57%	0.56	156.5	
50-070-01	245.0	N	1995	Unable to Calculate	0.69	82%	0.85	154.4	
50-070-02	244.0	N	1995	3.09	0.44	86%	0.55	128.0	
50-073-01	67.8	N	2001	Baseline Year	0.00	Unable to Calculate	0.00	0.0	Not Used for agriculture; has onsite retention area and does

Table 6. Continued.

Basin ID	Basin Acreage	Early Baseline	Baseline Year	Rain Adjusted Unit Area Load (lbs/ac) Baseline	Rain Adjusted Unit Area Load (lbs/ac) WY2008	WY2008 % TP Reduction	WY2008 Unit Area Load (lbs/ac)	WY2008 TP Conc. (ppb)	Comments
									not discharge
50-077-01	3168.0				0.83		1.03	141.5	715 Farms (Closter Farms)[2]
50-078-01	71.6	N	1999	8.71	1.06	88%	1.31	110.9	
50-080-01	8108.5				0.34		0.42	238.7	East Shore Drainage District[2]
50-081-01	210.0	N	2004	0.66	0.40	40%	0.49	98.5	
50-081-02	4845.5	N	1994	1.31	0.37	72%	0.31	162.4	South Shore Drainage District[2]
50-082-01	484.5	N	1995	9.82	4.19	57%	5.17	80.6	

Table 6 Notes:

1 A small portion of the South Florida Conservancy District and the East Beach Water Control District was capable of discharging to the Everglades. However, a majority of the area historically discharged only to Lake Okeechobee and is now discharging to the Everglades. A BMP permit issued under Rule 40E-63 and permit-level monitoring are required.

2 Closter Farms (a.k.a. 715 Farms), East Shore Water Control District, and the South Shore Drainage District historically discharged only to Lake Okeechobee and are now discharging to the Everglades. A BMP permit issued under Rule 40E-63 and permit-level monitoring are required.

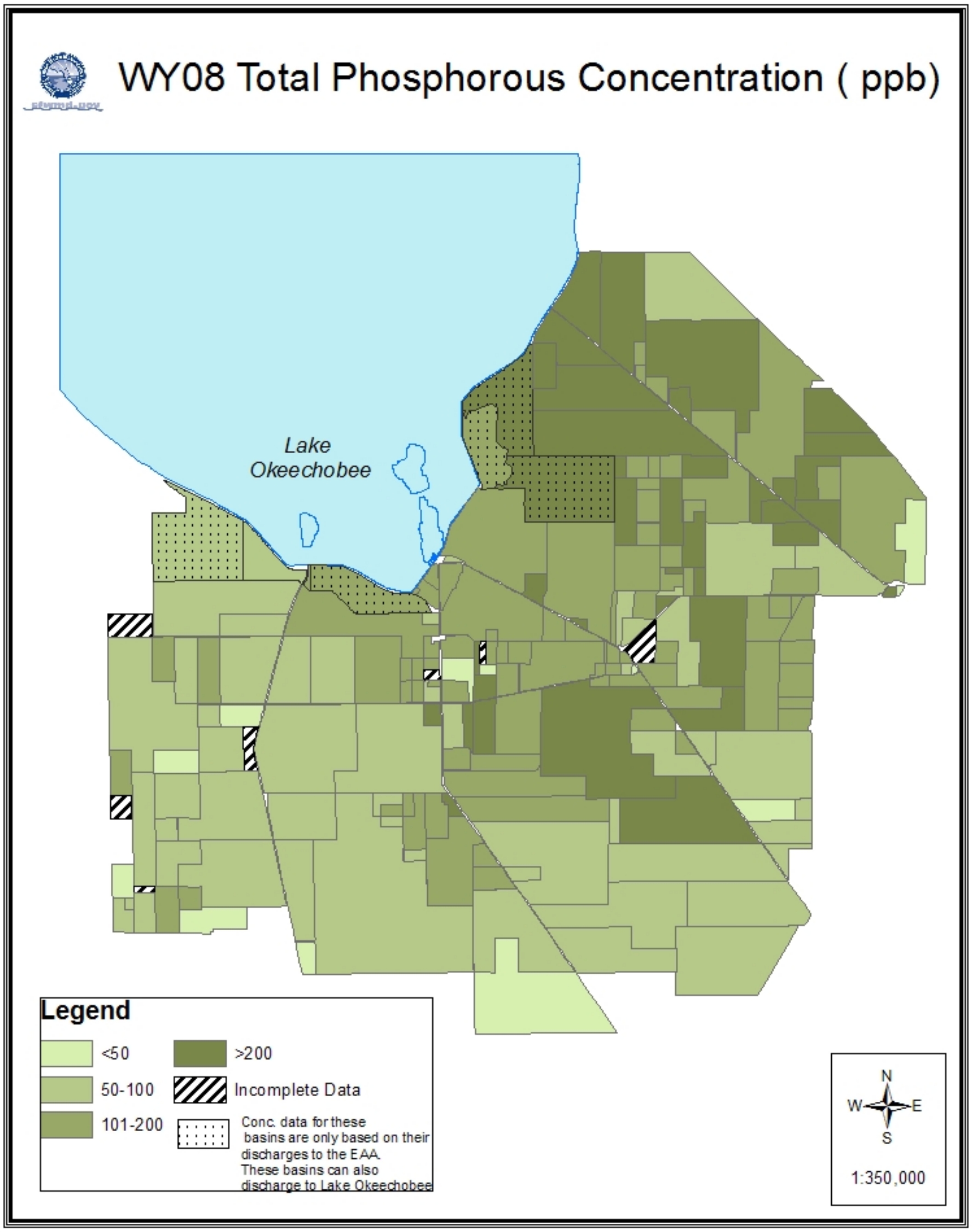


Figure 7. TP FWM concentrations (parts per billion, or ppb) in the EAA in WY2008.

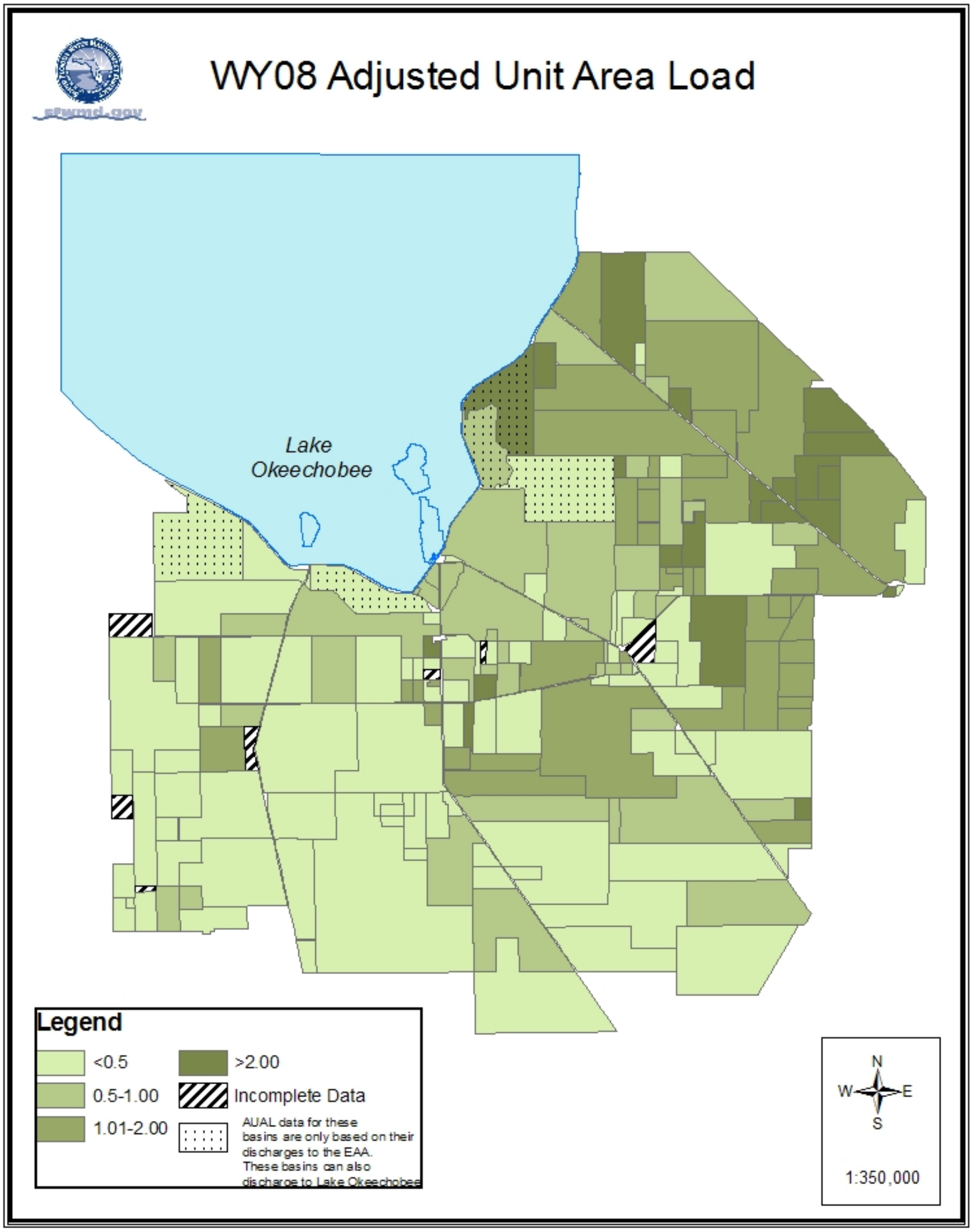


Figure 8. WY2008 rainfall-adjusted unit area TP load (lbs/acre) in the EAA basin.

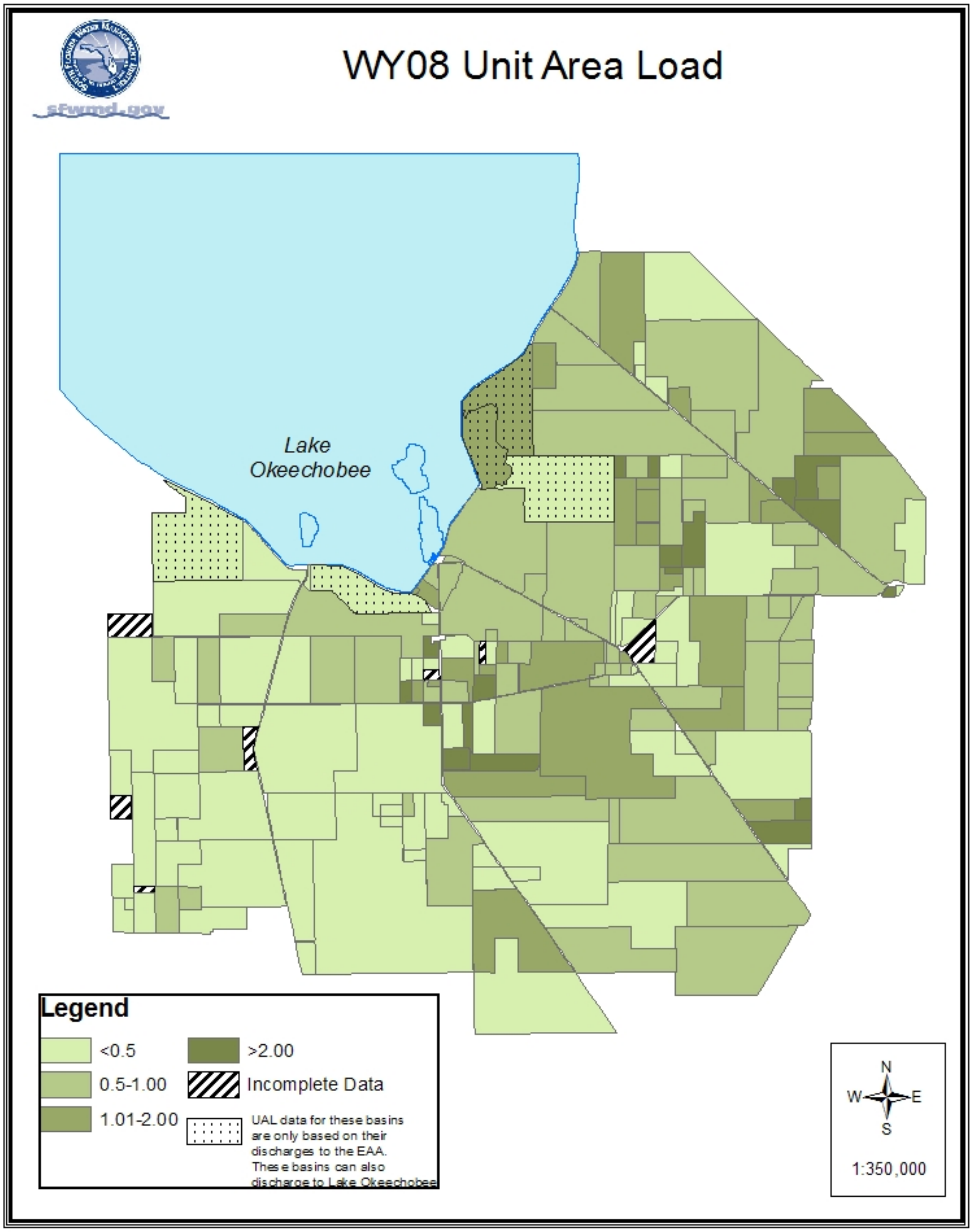


Figure 9. WY2008 observed unit area TP load (lbs/acre) in the EAA basin.

AGRICULTURAL PRIVILEGE TAX INCENTIVE CREDITS

The EFA imposed an Agricultural Privilege Tax for all real property located within the EAA that is classified as agricultural. Incentive credits against the Agricultural Privilege Tax are set forth to encourage the performance of BMPs to maximize the reduction of phosphorus loads at the points of discharge from the EAA. **Table 7** lists the Everglades Agricultural Privilege area-wide incentive credit schedule and tax credits earned to date for the EAA.

Table 7. Everglades Agricultural Privilege Tax area-wide incentive credits for the EAA basin.

Everglades Agricultural Privilege Tax
Area-Wide Incentive Credit Schedule

Calendar Year	Water Year	Min. Phos. Reduction Required (%)	Actual Phos. Reduction Achieved (%)	Credits Earned	Total Credits (Cumulative)	Credits Used	Credit Balance	Fiscal Year
1994	1993	25	44	19	19.00	0.00	19.00	FY1995
1995	1994	25	17	0	19.00	0.00	19.00	FY1996
1996	1995	25	31	6	25.00	0.00	25.00	FY1997
1997	1996	25	68	43	68.00	0.00	68.00	FY1998
1998	1997	25	49	24	92.00	3.91	88.09	FY1999
1999	1998	25	34	9	97.09	3.91	93.18	FY2000
2000	1999	25	49	24	117.18	3.91	113.27	FY2001
2001	2000	25	55	30	143.27	3.91	139.36	FY2002
2002	2001	25	73	48	187.36	10.02	177.34	FY2003
2003	2002	25	55	30	207.34	10.02	197.32	FY2004
2004	2003	25	35	10	207.32	10.02	197.30	FY2005
2005	2004	25	64	39	236.30	10.02	226.28	FY2006
2006	2005	25	59	34	260.28	15.55	244.73	FY2007
2007	2006	25	44	19	263.73	15.55	248.18	FY2008
2008	2007	25	18	0	248.18	15.55	232.63	FY2009
2009	2008	25	44	19	251.63	15.55	236.08	FY2010
2010	2009	25			236.08	15.55	220.53	FY2011
2011	2010	25			220.53	15.55	204.98	FY2012
2012	2011	25			204.98	15.55	189.43	FY2013
2013	2012	25			189.43	15.55	173.88	FY2014

Note: Water Year 2008 (Calendar Year 2009 / Fiscal Year 2010) subject to Governing Board approval at the August 14, 2008 public hearing.

Additional Information of Interest

Per Acre Charge	Years	Area-Wide Incentive Credit	Min. Phos. Reduction Required
$24.89	1994 - 1997	0.33	25%
$27.00	1998 - 2001	0.54	25%
$31.00	2002 - 2005	0.61	25%
$35.00	2006 - 2013	0.65	25%
$25.00	2014 - 2016	N/A	N/A
$10.00	2017	N/A	N/A

Note:

1. Vegetable classified acreage is never charged more than $24.89 pre acre.
2. Vegetable classified acreage is not eligible for incentive credits.
3. The minimum per acre charge will never drop below $24.89 through Nov 2013. If incentive credits would cause the per acre charge to drop below $24.89, any earned, unused credits will we carried forward and applied to the following year.
4. Any unused or excess incentive credits remaining after certification of the Everglades agricultural privilege tax roll for the tax notices mailed in November 2013 shall be canceled.
5. The annual Everglades agricultural privilege tax for the tax notices mailed in November 2014 through November 2016 shall be $25 per acre and for tax notices mailed in November 2017 and thereafter shall be $10 per acre.

Florida Statute 373.4592, Everglades Forever Act

Calculating Credits:

1994 - 1997	N/A
1998 - 2001	$27.00 - $24.89 = $2.11 / .54 = 3.91
2002 - 2005	$31.00 - $24.89 = $6.11 / .61 = 10.02
2006 - 2013	$35.00 - $24.89 = $10.11 / .65 = 15.55

C-139 BASIN SUPPLEMENTAL EVALUATION

C-139 BASIN COMPLIANCE CALCULATION DETAILS

Compliance with C-139 basin mandates is based on mathematical equations and methodology dictated by Rule 40E-63. The equations are reproduced in **Figure 10**. **Figure 11** presents the monthly rainfall totals for the C-139 basin during WY2008 and related coefficients used to calculate the target load per rule's equations. The predicted load is the pre-BMP baseline period load adjusted for hydrologic variability associated with rainfall. The observed TP load for WY2008 is lower than the target. Therefore, the basin is in compliance and no comparison to the limit is necessary. Submittal of permit-level data is not currently a mandatory requirement, but rather an optional method for individual farms to show farm-level compliance with TP loads when the basin as a whole is out of compliance. The optional farm-level monitoring and farm-level compliance methodology for the C-139 basin is described in Part III of Rule 40E-63. Since the C-139 regulatory program began in WY2003, BMP permit holders in the basin have not requested the optional farm-level compliance method and, therefore, no data have been submitted.

RULE 40E-63 C-139 BASIN COMPLIANCE MODEL (from Chapter 40E-63, F.A.C.)

The Target and Limit will be calculated according to the following equations and explanation:

$\ln(L) = -12.898 + 4.126\ln(\text{Rain})$

[Explained Variance = 88.6%, Standard Error of Estimate = 0.387]

where: L = 12-month load attributed to C-139 Basin Runoff (metric tons)

Compliance will be tracked by comparing the measured C-139 Basin Load with:

Target = Load Predicted from current Rainfall using Base Period Model (mtons) Target $= 2.50271 \times 10^{-6} R^{4.12603}$

Limit = Target x Uncertainty Factor (mtons)

σ = Standard Error of predicted ln(L) for May-April interval

$\sigma = 0.38700 [1 + 1/9 + 2.08621 (\ln(R) - 3.87905)^2]^{0.5}$

where:

R = Water Year total rainfall (inches)

σ = Standard error of predicted phosphorus load (on a natural logarithmic scale)

The following standard statistical notes are not included within Rule 40E-63, but are required for calculation of the limit value.

Uncertainty Factor = $e^{t\sigma}$

t = t-statistic for 9-2=7 degrees of freedom

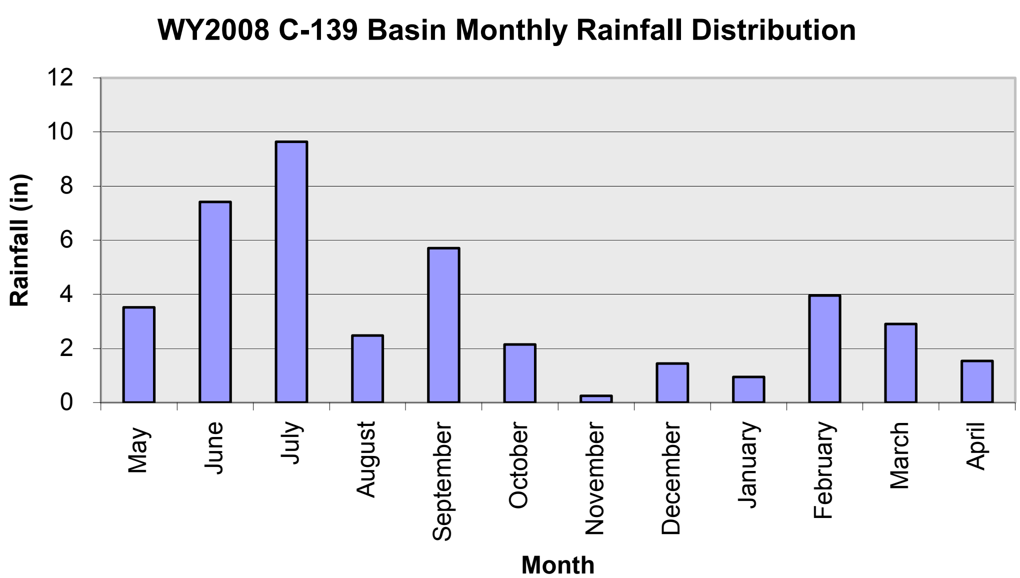
t = 1.414924

Figure 10. Rule 40E-63, F.A.C., Appendix B2 excerpt: hydrologic adjustment and basin compliance mathematical equations to calculate annual TP reductions.

WY2008 C139 basin compliance TP load calculation

See 40E-63 Appendix B2 for "Target" equation

Month	Rainfall (in)	
May	3.52 in	
June	7.42 in	SE = 0.4157
July	9.64 in	
August	2.48 in	Target TP Load = 12.41 mtons
September	5.71 in	Limit TP Load = 22.34 mtons
October	2.15 in	Observed TP Load = 5.42 mtons
November	0.25 in	
December	1.45 in	
January	0.94 in	
February	3.96 in	
March	2.90 in	
April	1.54 in	
Total Rainfall	41.95 in	



Note: Monthly data is not factored into calculation.

Figure 11. Rule 40E-63, F.A.C., Appendix B2 excerpt: hydrologic adjustment and basin compliance mathematical equations to calculate annual TP reductions.

C-139 BASIN-LEVEL MONITORING DATA

During WY2008, six structures comprised the modeling boundary of the C-139 and six water quality monitoring sampling points represented the water quality of flow through those structures. In the C-139 basin, all six modeling boundary structures (G-406, G-342A–D, and G-136) are monitored directly. The G-136 structure also serves as the inflow and outflow boundary point, respectively, for the EAA and C-139 basins. **Table 8** of this appendix provides TP sampling statistics for all the locations monitored by the District for the C-139 basin during WY2008.

Table 8. Summary statistics – WY2008 TP monitoring data for the C-139 basin.

Structure	Sampling Point	Sample Type	Number Sampled	Number Used	Min. (ppm)	Max. (ppm)	Number Flagged	Flow[1] Curve Rating
G-342A	G342A	Grab	52	10	0.045	0.465	0	Good
		Composite[2]	9	9	0.054	0.154	0	
G-342B	G342B	Grab	52	8	0.044	0.183	0	Good
		Composite[2]	7	7	0.059	0.187	0	
G-342C	G342C	Grab	52	8	0.030	0.264	0	Good
		Composite[2]	8	8	0.061	0.144	0	
G-342D	G342D	Grab	52	10	0.034	0.377	0	Good
		Composite[2]	8	7	0.079	0.241	0	
G-406	G406	Grab	39	21	0.039	0.362	0	Good
		Composite[2]	19	19	0.064	0.223	0	
G-136	G136	Grab	53	12	0.035	0.161	0	Poor [3]
		Composite[2]	13	8	0.015	0.114	0	

1 Flow Curve Rating: Discharge estimates derived from theoretical equations are within a range of expected values based on stream-flow measurements used to calibrate the theoretical equations and are classified as: Excellent (< 5%), Good (< 10%), Fair (< 15%), or Poor (> 15%).

2 Composite samples could be time-proportional, flow-proportional, or a combination of the two.

3 Poor, based on experience with ratings at culverts with flashboards, but stream-flow measurements are not sufficient to calibrate theoretical equations and the flow curve rating cannot adequately be determined.

C-139 BASIN-LEVEL WATER QUALITY SUMMARY

As in the EAA basin, the District is required to collect monitoring data from the C-139 basin to determine compliance with the TP load limitations. The TP load ultimately discharging to the Everglades is not the same as the TP loads leaving the outflow structures from the C-139 basin because discharges are directed into other water bodies. The outfall structures accounting for the loads in the C-139 basin compliance determination include G-136 discharging to the L-1 canal, G-342A, G-342B, G-342C, and G-342D discharging into Stormwater Treatment Area 5 (STA-5) Flow-ways 1 and 2, and G-406 discharging into the L-3 canal leading to STA-5 Flow-way 3 and Stormwater Treatment Area 6 (STA-6). The overall flow, TP load, and FWM concentration at the six primary basin outflow structures during WY2008 are summarized in **Table 9**.

Table 9. C-139 basin flows, TP loads, and FWM concentrations by source for WY2008.

C-139 to EAA Source	TP Load (mt)	Flow (kac-ft)	FWM (ppb)	% of Total Load	% of Total Flow
G-136 Total [1]	**0.11**	**1.38**	**66**	**2.1%**	**3.6%**
C-139 to STA-5/6 Source	**TP Load** (mt)	**Flow** (kac-ft)	**FWM** (ppb)	**% of** Total Load	**% of** Total Flow
G-342A	0.28	2.51	92	5.2%	6.5%
G-342B	0.64	3.44	152	11.9%	8.9%
G-342C	0.44	3.18	111	8.1 %	8.2%
G-342D	0.61	4.79	103	11.2%	12.4%
G-406 [2]	3.33	23.43	115	61.5%	60.5%
STA-5/6 Total	**5.30**	**37.35**	**115**	**97.9%**	**96.4%**
C-139 Basin	**TP Load** (mt)	**Flow** (kac-ft)	**FWM** (ppb)	**% of** Total Load	**% of** Total Flow
Total for Basin	**5.41**	**38.73**	**113**	**100%**	**100%**

[1] G-136 discharges runoff from C-139 basin lands that are tributary to the L-1 canal. Conveyance of runoff through G-136 into the Miami Canal for eventual treatment in STA-3/4 is due to flood control necessities in the L-1 canal and capacity limitations in sending the runoff to the south through the L-2 and L-3 canals for treatment in STA-5.

[2] G-406 is no longer a STA-5 bypass structure. Discharge through G-406 flows south typically to STA-5 Flow-way 3 or to STA-6, unless bypass is necessary through G-407 to WCA-3.

The C-139 basin exported 5.4 metric tons (mt) of TP during WY2008, substantially less than 29.1 mt of TP during WY2007. During WY2008, 5.3 mt of TP was exported to STA-5 and STA-6 via G-342A, G-342B, G-342C, G-342D, and G-406 (96.4 percent) and 0.1 mt (2.1 percent) to the L-1 canal via G-136.

Although the C-139 basin received slightly more rainfall in WY2008 (40.95 inches) than in WY2007 (36.85 inches), the total runoff volume discharged in WY2008 (39 kiloacres per foot, or kac-ft) was about 50 percent less than in WY2007 (77 kac-ft). The annual FWM TP concentration was 113 ppb for C-139 basin in WY2008, which was 63 percent less than in WY2007. Factors that potentially limited the TP runoff for WY2008 include the following (1) pre-existing drought conditions continued through WY2008, inducing water conservation; (2) BMPs have been in place longer, potentially increasing their effectiveness; and (3) rainfall was distributed relatively evenly over the water year, with limited periods of rainfall requiring release through the basin compliance structures.

C-139 Basin Short-Term and Long-Term Variations

The 2008 SFER – Volume I, Chapter 4, presents a preliminary review of rainfall, runoff volumes, and water quality data conducted to identify causes for the C-139 basin repetitive out of compliance results, specifically focusing on WY2007. The conclusion that the temporal distribution of rainfall substantially affects the ability for the basin to retain runoff has been supported by further analysis including WY2008 data. A discussion of potential factors that contribute to the general observed increase in basin loads is presented in the 2008 SFER – Volume I, Chapter 4, under the *C-139 Basin Phosphorus Investigation* section. The following discussion focuses on the derivation of relationships from monthly rainfall, flow, and TP load data over the period of record. These efforts combined with the concurrent activities described in Chapter 4 of this volume should, in the long term, help the C-139 meet its TP discharge goals.

Dry WY2008 conditions can be seen in the annual rainfall as a departure from average depicted in **Figure 12** for WY1980–WY2008. The seven lowest rainfall water years for this basin were WY1981, WY2001, WY2007, WY1982, WY1990, WY1989, and WY2008, in order from least to most rain. Because the target TP load for the basin is rainfall adjusted, lower rainfall amounts result in a lower TP performance measure target. **Figure 13** shows how the amount of annual rainfall in the C-139 basin compares with the amount of rainfall that translates into excess runoff. In general, a reduction in annual rainfall corresponds to a lower rainfall to runoff ratio. WY2008, with a ratio of 0.07, was the least of the seven lowest rainfall years previously stated and produced a lowest recorded total runoff volume. The relationships of rainfall to runoff for WY2007 and WY2008 are significantly different, and evaluation of the intra-annual data should contribute to better understanding, future prediction, and control of TP discharges.

The rainfall distribution pattern appears to have had a significant impact on the basin loads. Rainfall patterns potentially affect both the amount of rainfall translated to runoff and the TP concentration of the runoff. The scatter plot of monthly flow versus monthly TP FWM concentration in **Figure 14** implies that monthly TP concentrations from C-139 increase strongly with monthly flow. In WY2008, the maximum monthly flow was significantly less than WY2007, and correspondingly the annual TP FWM concentration in WY2008 was also much less. The reduction of both runoff volume and TP concentration accounted 81 percent reduction of TP loads in WY2008 compared to WY2007.

Several water years with annual rainfall totals comparable to the two most recent water years were selected for analysis. Five out of the seven lowest rainfall years (WY1982, WY1989, WY1990, WY2007, and WY2008) have a similar range of annual rainfall amount from 37 to 42 inches. As shown in **Table 10**, WY1989 and WY2007 observed loads were greater than the predicted value. The cumulative rainfall, flow, and load plots in **Figure 15** show that these years have a similar rainfall distribution pattern, and the rainfall during July and August accounted more than 50 percent of total annual rainfall amount. The rainfall in WY1982, WY1990, and WY2008 has a different distribution pattern as depicted in **Figure 16**. The rainfall is spread more evenly, resulting in the peak monthly flows in WY1982, WY1990, and WY2008 being much lower than in WY1989 and WY2007. The annual runoff to rainfall ratio (R:R) is common among the water years as grouped, with significantly higher values for water years with rainfall concentrated in a short period. Though it is recognized that these ratios can be influenced by a number of factors, for the lower rainfall range included in this analysis the intra-annual rainfall pattern appears to be a significant influence on runoff from the basin.

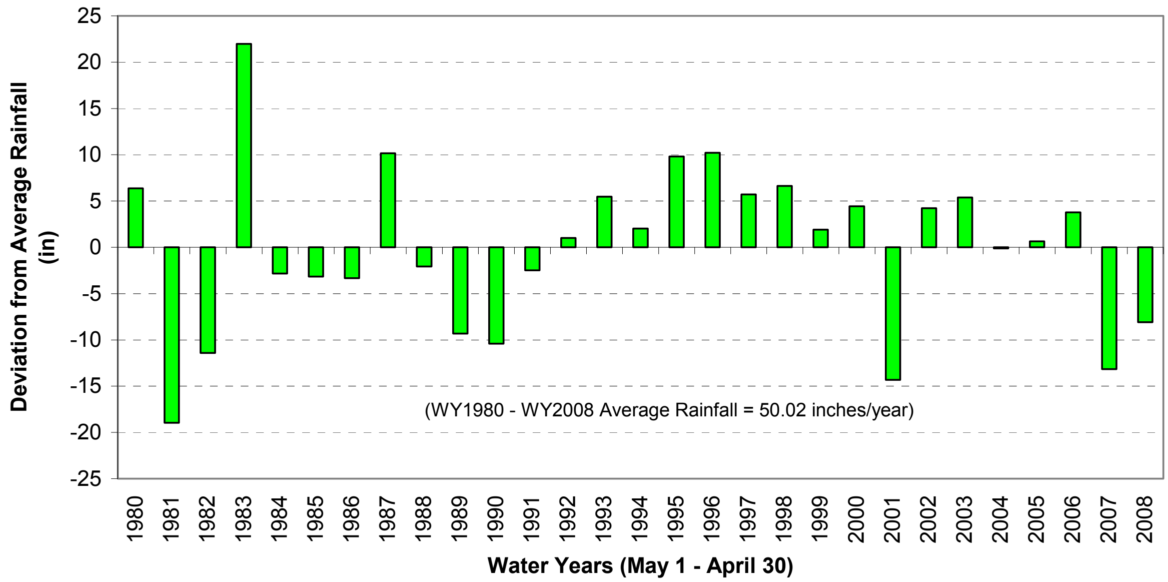


Figure 12. WY1980–WY2008 C-139 basin annual rainfall deviation from the long-term average.

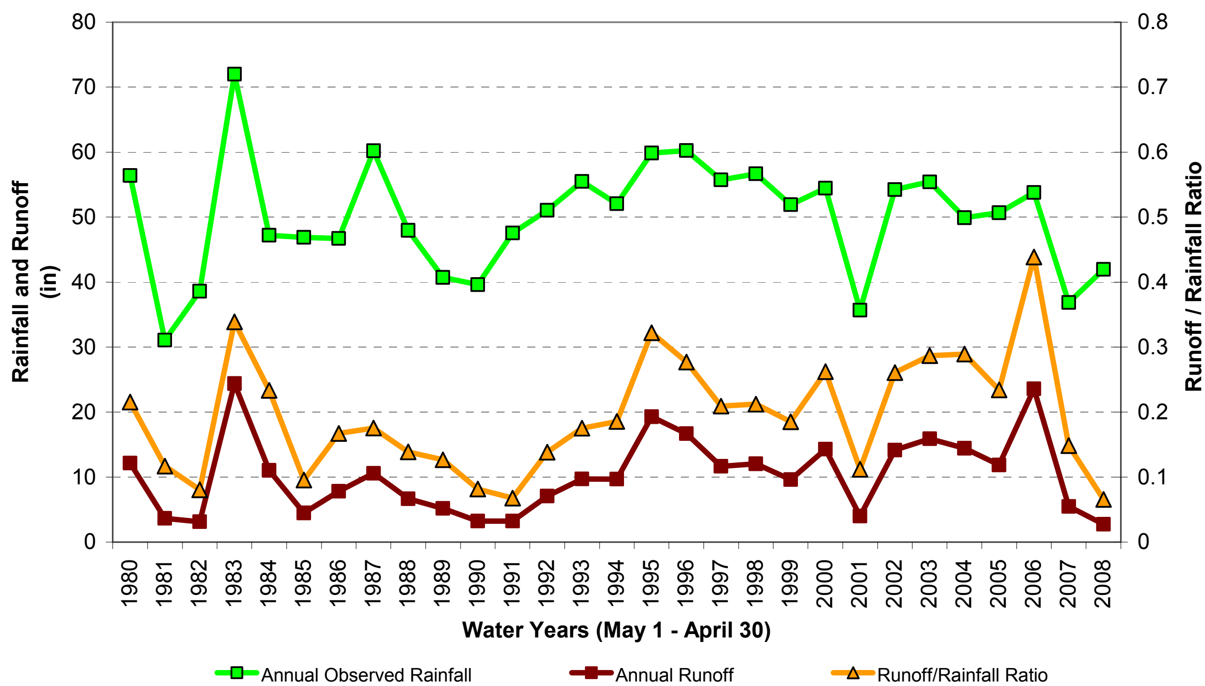


Figure 13. WY1980–WY2008 C-139 basin annual rainfall and runoff relationship.

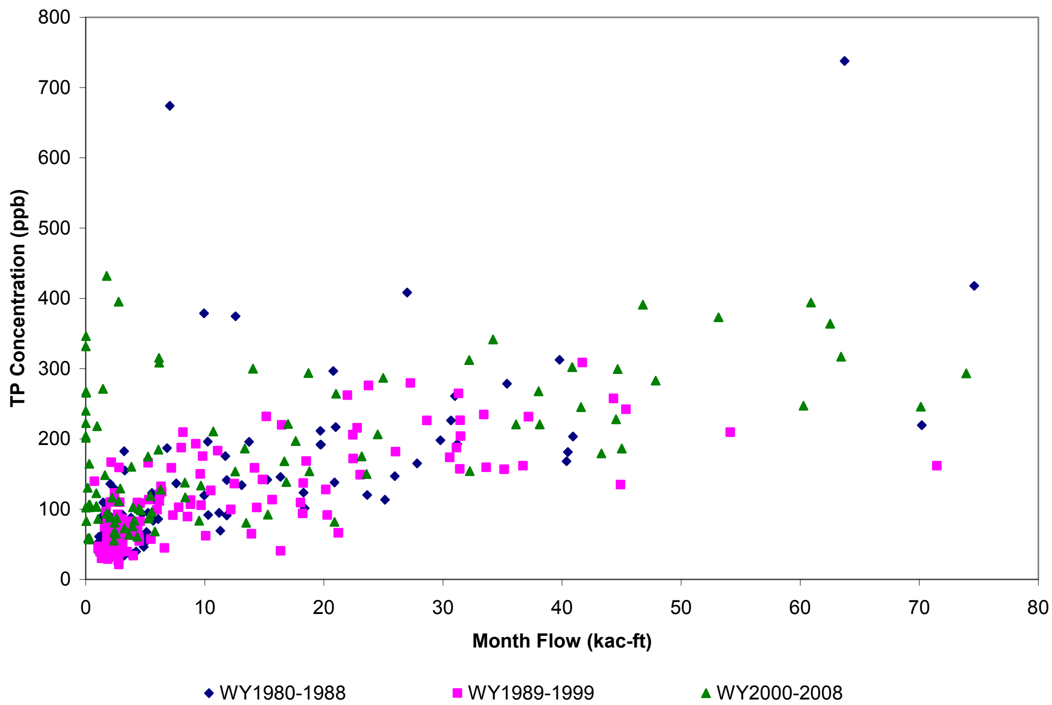


Figure 14. C-139 basin monthly flow volume (kac-ft) versus monthly FWM TP concentration (ppb) for selected water years.

Table 10. C-139 basin annual rainfall and runoff data for selected water years.

	WY2008	WY1990	WY1982	WY1989	WY2007
Observed Load (mt)	5.4	5.5	6.1	**14.2** [1]	**29.1** [2]
Predicted Load (mt)	**12.4**	9.8	8.8	**11.0**	7.3
Annual Rainfall (in)	**42.0**	39.6	38.6	**40.7**	36.9
Annual Runoff (in)	2.74	3.23	3.11	**5.15**	**5.47**
R:R (Runoff / Rainfall)	0.07	0.08	0.08	**0.13**	**0.15**
Annual FWMC (ppb)	113	97	113	**158**	**305**
Max. Monthly Flow (kac-ft)	9.67	12.5	15.3	**33.4**	**46.8**
Variance of Monthly Rain	7.21	5.52	6.08	**11.50**	**13.37**
Skewness of Monthly Rain	1.15	0.37	0.75	**1.27**	**1.89**
Kurtosis of Monthly Rain	0.74	-1.60	-0.08	**0.84**	**3.76**

[1] Bold text denotes two highest in category.

[2] Underline text denotes highest in category.

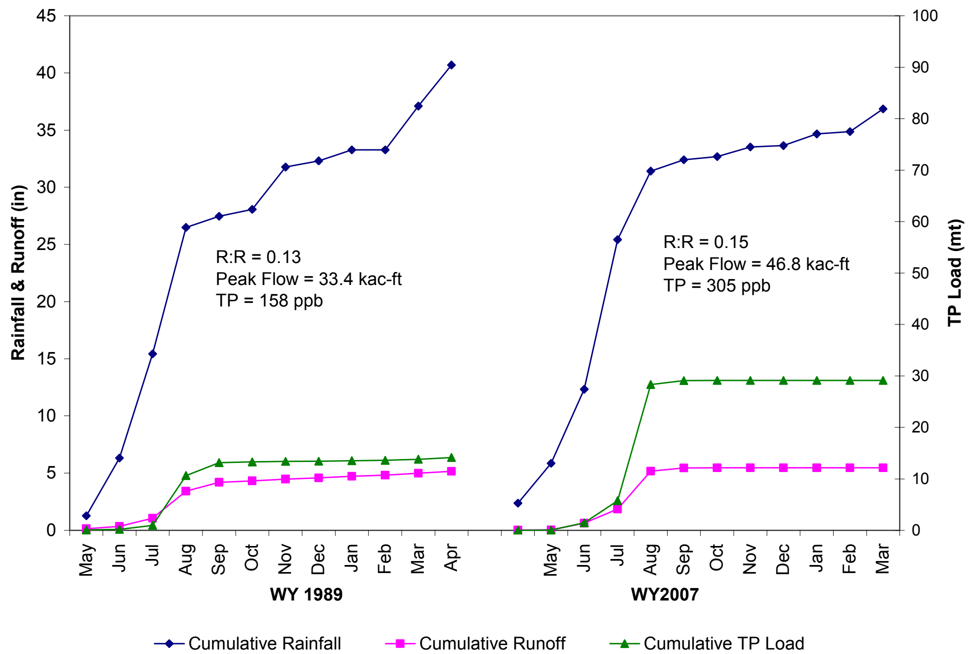


Figure 15. WY1989 and WY2007 comparison of C-139 basin cumulative monthly rainfall, runoff, and TP load.

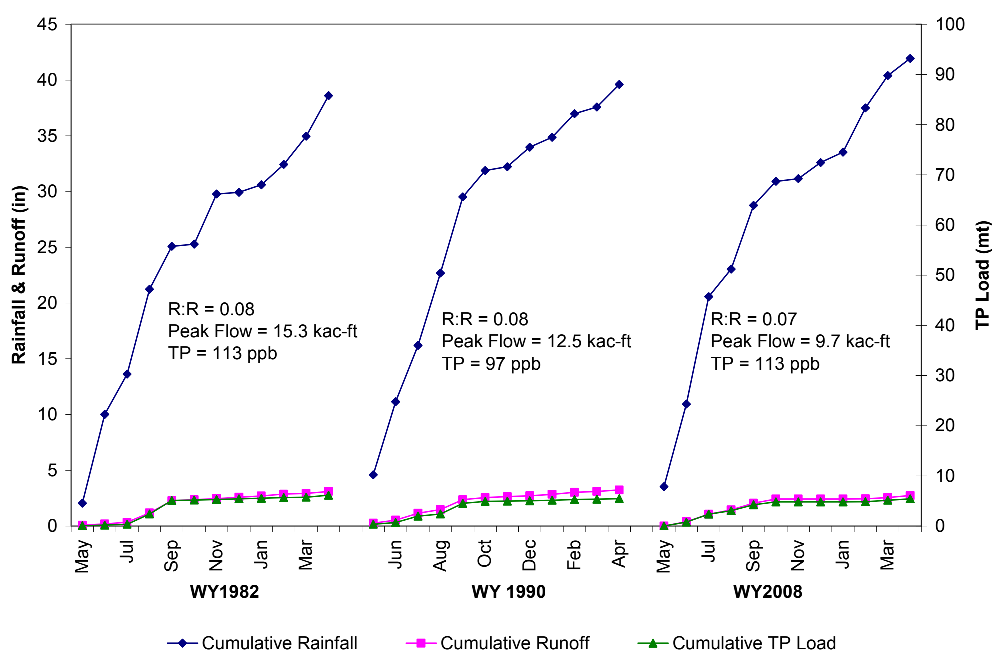


Figure 16. WY1982, WY1990, and WY2008 comparison of C-139 basin cumulative monthly rainfall, runoff, and TP load.

C-139 Basin Sub-regional Monitoring Network

To supplement the basin-level analysis with information from smaller units of area contributing flow and TP load, the District has established an upstream monitoring network of automatic sampling equipment, known as the C139D Monitoring Project. This monitoring project has eight automatic samplers for determining water quality and flow data from C-139 basin sub-regions (**Figure 17**). Three automatic samplers were installed in WY2006 (G150, SM00.2TW/SMSBV, and DF02.1TW/DFNBV), four were installed in WY2007 (DF11.3TW01/C139S1, L202.0TN/C139S2, L207.0TN/C139S3, and G151), and two were installed in WY2008 (C139S4 and C139S6). C139S4 was installed to replace G151. Total phosphorus (TP), total dissolved phosphorus (TDP), soluble reactive phosphorus (SRP), and flow are measured weekly. **Table 11** summarizes station names, collection methods, sampling start date, and number of samples collected during WY2008. The water quality data from these sites is stored in the District's DBHYDRO hydrometeorological database under the project name C139D. Calculation of TP loads and FWM concentrations will require additional processing and therefore is anticipated to be reported on an annual basis in future SFERs.

The sites were not fully established in WY2008 for calculation of WY2008 flows, loads, and concentrations at the sub-regional level. In addition to the several sites not being installed, some other sites cannot yet accurately calculate flow. To supplement the measured canal stage and velocity, field measured calibrations must be performed under flow conditions to estimate flow. Drought conditions in this and the previous water year have limited the capability of the District to establish flow equations to produce accurate flow data for these sites. Once the details are completed for these sites to become fully operational, flow and stage data will be available daily or even finer increments with FWM TP concentration data collected weekly. At these same sites, grab samples will be collected for TP, TDP, and SRP.

Table 11. C-139 basin upstream automatic sampling stations under the C139D Monitoring Project.

Flow Station Name	Water Quality Station Name	First Auto Collection	# of WY2008 Samples Grab/Auto	Type of Flow Calculation	First Flow or Velocity Record
G150	G150	10/25/06	53/4	CULV	5/3/1989
C139S1	C139S1	12/20/06	50/51	IVEL	2/28/2007
C139S2	C139S2	10/25/06	53/48	IVEL	8/30/2006
C139S3	C139S3	10/25/06	52/49	IVEL	10/20/2006
C139S4	C139S4	1/2/08	29/18	IVEL	9/27/2007
C139S6	C139S6	6/11/08	8/0	IVEL	3/16/2008
SMSBV	SM00.2TW	4/25/06	53/35	IVEL	12/19/2005
DFNBV	DF02.1TW	4/25/06	53/48	IVEL	1/7/2006

Note: Culvert (CULV), Index Velocity Meter (IVEL), and Stage (STG). No flow measurements at C139S5.

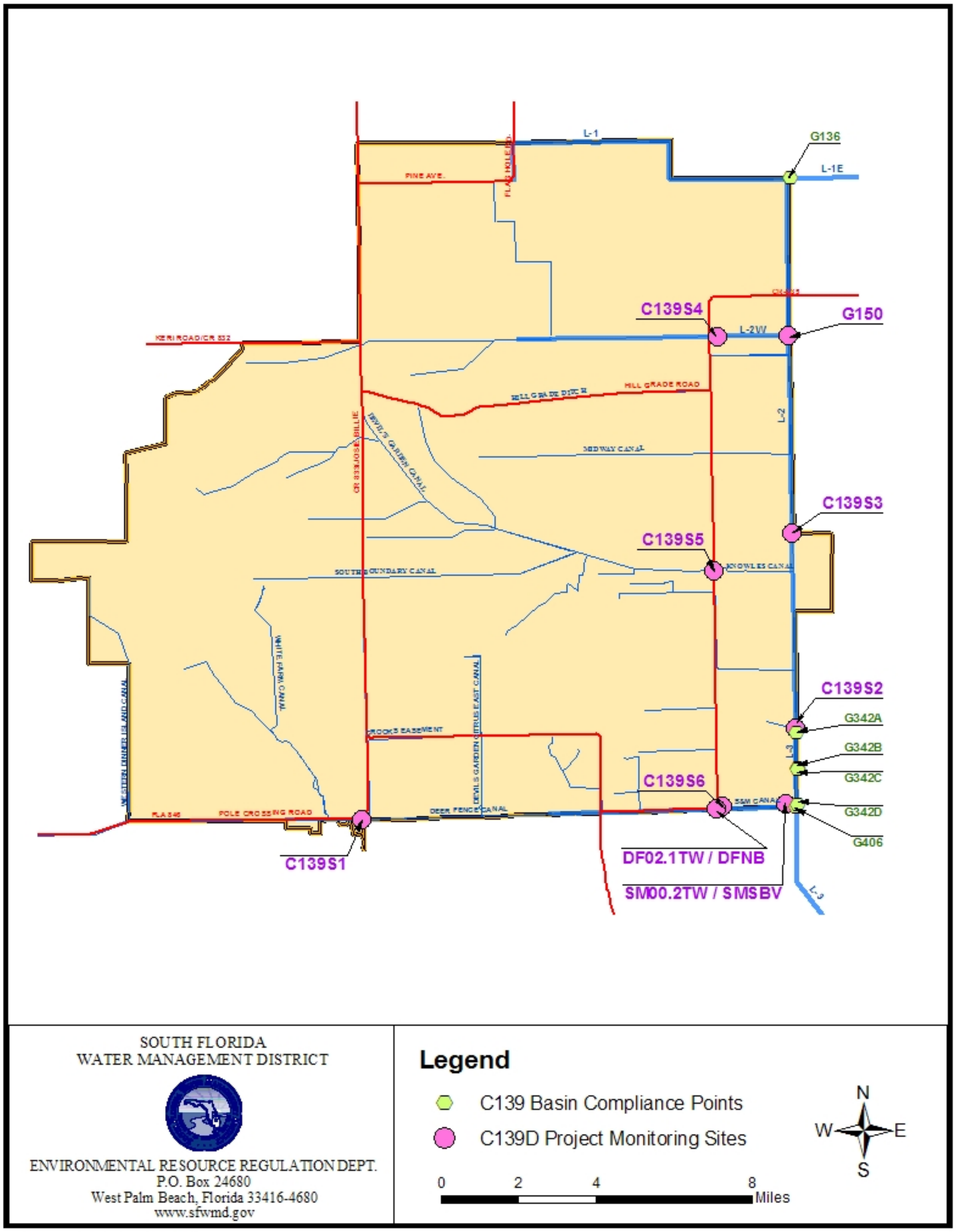


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Figure 17. C-139 basin upstream automatic sampling stations under the C139D Monitoring Project location map.