Chapter 4: Nutrient Source Controls for the South Florida Environment

Edited by Agnes Ramsey and Pamela Wade

SUMMARY

This chapter and related appendices provide a Water Year 2010 (WY2010) (May 1, 2009–April 30, 2010) update on the status of source control programs implemented by the South Florida Water Management District (SFWMD or District), the Florida Department of Agriculture and Consumer Services (FDACS), and the Florida Department of Environmental Protection (FDEP) in the Everglades. An update is also provided on the efforts to develop a consistent and holistic approach to source control programs in the major watersheds, while at the same time recognizing the unique source control issues of each sub-watershed. Additional, permit-specific reports are provided in *2011 South Florida Environment Report* (SFER) – *Volume III*.

The nonpoint source control programs implemented through each agency address the reduction of pollutants through on-site measures that prevent or reduce pollution at its source, such as agricultural and urban Best Management Practices (BMPs), which, along with construction and other pollution control projects, are needed to achieve mandated pollution reduction levels and water quality standards, including Total Maximum Daily Loads (TMDLs). The three coordinating agencies implement their respective programs through specific rules promulgated by each that are based on statutory authorizations.

Source control program requirements were established by legislation for the Northern and Southern Everglades. The Everglades Forever Act (EFA) [Section 373.4592, Florida Statutes (F.S.)] established source control requirements for the Everglades Construction Project (ECP) basins and the non-Everglades Construction Project (non-ECP) basins in the Southern Everglades with primary responsibility assigned to the SFWMD. The Northern Everglades and Estuaries Protection Program (NEEPP) (Section 373.4595, F.S.) established source control requirements for the Lake Okeechobee and St. Lucie and Caloosahatchee river and estuary watersheds (the Northern Everglades), with varying levels of responsibility accorded to each of the coordinating agencies. The Northern and Southern Everglades source control program implementation areas are depicted in **Figure 4-1**.

Source control is an integral component of Northern and Southern Everglades restoration and protection programs. Program planning for source control occurs through comprehensive watershed plans that are updated at specified intervals. For the Northern Everglades, source control program planning is incorporated into the Lake Okeechobee Watershed Construction Project Phase II Technical Plan (P2TP), the St. Lucie River Watershed Protection Plan (SLRWPP), and the Caloosahatchee River Watershed Protection Plan (CRWPP); all three plans must be updated every three years (see Chapters 10 and 12 of this volume). For the Southern Everglades, source control program planning is incorporated into the Long-Term Plan for Achieving Water Quality Goals in the Everglades Protection Area (Long-Term Plan) (Burns and McDonnell, 2003) (see Chapter 8 of this volume).

There are many commonalities in the approaches to planning, selecting, and implementing source controls for reducing phosphorus in the various watersheds. The goals and objectives of Northern and Southern Everglades source control programs within each sub-region complement and support one another. Lessons learned in phosphorus reduction programs (through BMP research and effectiveness studies, BMP verification efforts, and stakeholder outreach) in one watershed may be applied to others within the context of statutory authorizations, watershed protection program planning, interagency agreements, and coordinating agency administrative rules. This kind of adaptive management is expected to be applied to current and future efforts to limit or reduce nitrogen through source controls in the Northern Everglades in coming years.

NORTHERN EVERGLADES

During WY2010, the coordinating agencies' efforts for the Lake Okeechobee Watershed (LOW) continued to be focused on (1) revising the SFWMD's source control program regulatory rule [Chapter 40E-61, Florida Administrative Code (F.A.C.)], (2) encouraging agricultural landowner enrollment in FDACS-adopted agricultural BMP programs, (3) continued development and adoption of agricultural BMP programs, (4) development of a state-wide stormwater rule, (5) revisions to the state's domestic residuals wastewater regulations, and (6) the development of Northern Everglades Environmental Resource Permit (ERP) basin guidelines.

Revisions to the SFWMD's source control program regulatory rule include incorporating the expanded watershed boundaries required by NEEPP and working out the details of source control program implementation through efforts between the coordinating agencies. As part of the rule revision process, the SFWMD continued to develop a performance measure framework for evaluating the coordinating agencies' collective source control program's effectiveness for the LOW. Until specific performance measures are adopted through a revised Rule 40E-61, the SFWMD's regulatory update for this chapter will consist of reporting total phosphorus (TP) loads observed for each of the nine sub-watersheds in the LOW (**Table 4-1**).

The data used to evaluate the regulatory source control programs in the LOW are in the *Status of Source Controls in the Lake Okeechobee Watershed* section of this chapter and in Appendix 4-1 of this volume. The format of this evaluation changed for the 2011 SFER based on the direction of the performance measure framework development. While this framework is being finalized, data evaluation will still consist of a comparison of current water year TP loads with the historic period of WY1991–WY2005; the WY2010 annual TP load to the LOW was 19 percent lower than the average historical load. Lower Kissimmee, Taylor Creek/Nubbin Slough, Fisheating Creek, Nicodemus Slough, and the South Lake Okeechobee sub-watersheds observed TP loads below their historical averages. The Upper Kissimmee, Lake Istokpoga, Indian Prairie, West Lake Okeechobee, and East Lake Okeechobee sub-watersheds observed TP loads greater than their historical averages.

The District also initiated the development of regulatory nutrient source control programs for the St. Lucie and Caloosahatchee river watersheds in October and December 2009, respectively, as required by NEEPP and the watershed protection plans. The nutrient source control programs for the watersheds will include source control performance measures for nitrogen as well as phosphorus in both the freshwater and tidal portions of both river watersheds. The protection plans outlined a multifaceted approach to reducing pollutant loads by improving the management of pollutant sources within each watershed. One component in reducing loading, as outlined in the protection plans, will be amending SFWMD Rule 40E-61 to implement the regulatory component of nonpoint source control nutrient BMPs as required through the coordinated interagency approach.

The SFWMD's goal is to complete rulemaking and begin rule implementation for the St. Lucie and Caloosahatchee river watersheds in calendar year 2013. Further information on the nutrient source control program for the protection plans is available at www.sfwmd.gov/northerneverglades.

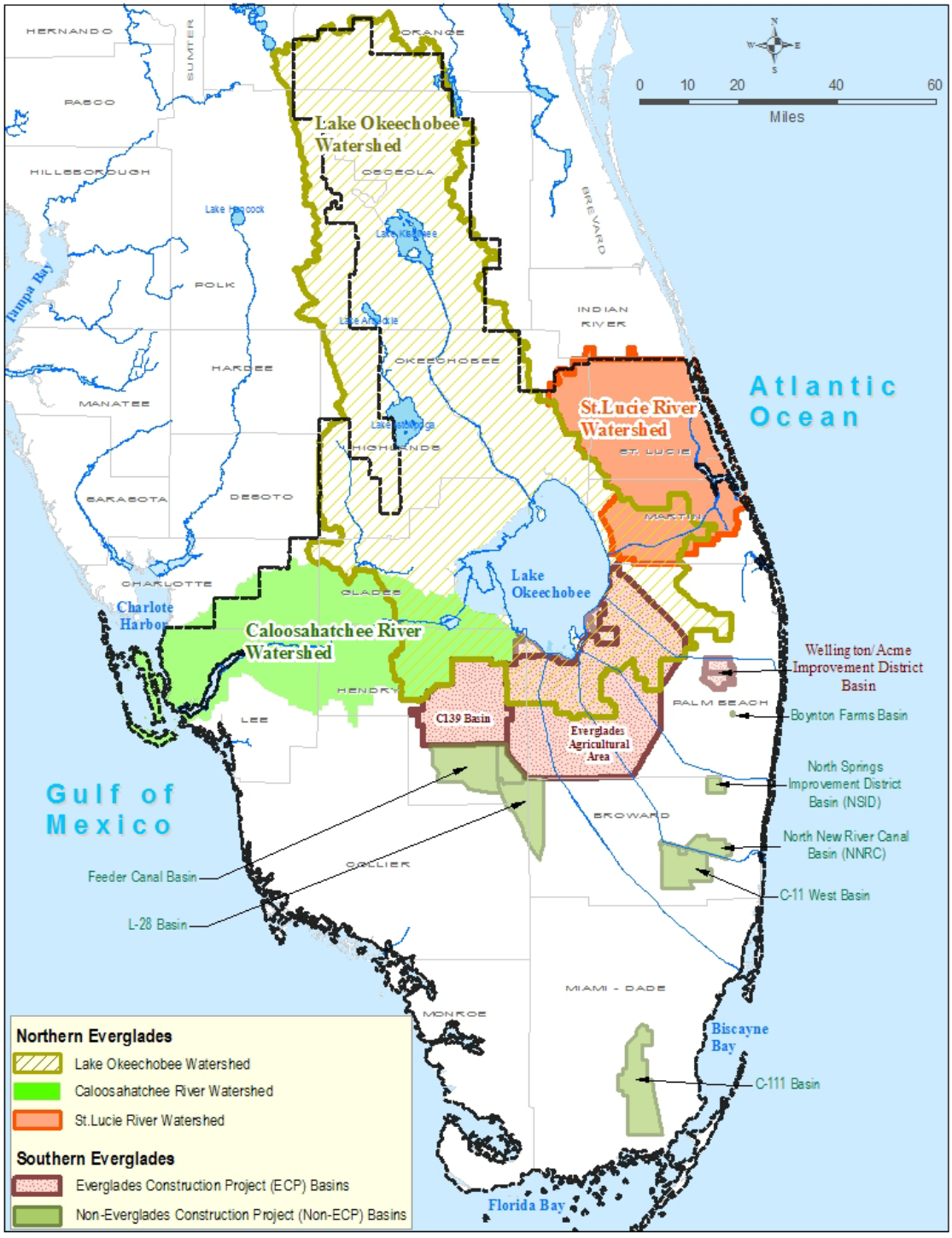

Figure 4-1. The Northern Everglades and Southern Everglades source control program implementation areas.

Water Year 2010 Highlights

Lake Okeechobee Watershed

- The SFWMD began developing performance metrics in which rainfall variability for the combined source control programs is considered. The source control program is expected to include performance metrics that ensure consistent implementation of BMPs, measure actual reduction achieved, and have a mechanism for requiring/triggering improvements should the water quality goals of the program not be achieved.
- A technical evaluation of the LOW Assessment (LOWA) monitoring network was completed for the Taylor Creek/Nubbin Slough Sub-watershed to be used as a methodology for optimizing the monitoring network; optimizing the remaining eight sub-watersheds began.
- The SFWMD conducted rulemaking workshops to collect public input and consulted with stakeholders to identify area-specific issues.
- The SFWMD also continued work on the development of the FDACS data-sharing process to enable the FDACS to notify the SFWMD of landowner implementation progress of FDACS agricultural BMP programs associated with the Notice of Intent provisions of NEEPP.

Caloosahatchee and St. Lucie River Watersheds

- For the Caloosahatchee River Watershed, the SFWMD completed a synoptic monitoring program during the wet season (June–October 2009) of WY2010 for the tributary streams within the freshwater portion of the river.
- For the St. Lucie River Watershed, the SFWMD made plans to conduct a synoptic monitoring program for phosphorus and nitrogen during the wet season of 2010 (WY2011) for the C-23 and C-24 basins. These basins account for 60 percent of the TP load in the St Lucie River Watershed. This monitoring is consistent with the St. Lucie River Watershed Protection Plan objective of implementing a monitoring program to identify priority areas of water quality concern and BMP optimization.
- For both river watersheds, the SFWMD identified teams of staff to develop the basis of source control programs and initiated a contract to assist with the development of the monitoring network and performance measures necessary to gauge the effectiveness of the required source control programs.

Table 4-1. Summary of Lake Okeechobee Watershed (LOW) discharge total phosphorus (TP) flow-weighted (FWM) concentrations and loads for Water Year 2010 (WY2010) (May 1, 2009–April 30, 2010). The LOW is divided into nine sub-watersheds for the implementation of source control programs.

Sub-watershed	Area (acres)	Primary Land Use	TP Load (metric tons)	Unit Area Load (lbs/acre*)
Upper Kissimmee	1,020,717	Non-agriculture	109.37	0.24
Lower Kissimmee	429,283	Agriculture	31.94	0.16
Taylor Creek/Nubbin Slough	197,734	Agriculture	44.01	0.49
Lake Istokpoga	392,147	Agriculture	22.43	0.13
Indian Prairie	294,147	Agriculture	110.33	0.83
Fisheating Creek/Nicodemus Slough	314,888	Agriculture	85.15	0.59
West Lake Okeechobee	199,946	Agriculture	65.94	0.73
South Lake Okeechobee	361,675	Agriculture	20.62	0.13
East Lake Okeechobee	237,867	Agriculture	54.58	0.50

*lbs/acre – pounds per acre

SOUTHERN EVERGLADES

The Southern Everglades update for WY2010 includes (1) SFWMD phosphorus source control efforts in the ECP and non-ECP basins and basin-specific reporting of compliance status, (2) phosphorus levels and monitoring data, and (3) source control strategies as indicators of success. The following basins in the Southern Everglades (**Figure 4-1**) discharge to the Everglades Protection Area (EPA): Everglades Agricultural Area (EAA), C-139, C-51 West, L-8, C-11 West, North New River Canal (NNRC), North Springs Improvement District (NSID), Feeder Canal, L-28, C-111, and Boynton Farms.

Source control updates for each basin are included to describe activities that were performed during WY2010 and to provide the status of long-term efforts relating to Everglades phosphorus source controls. The status of other projects, including research, BMP demonstrations, and construction, are also briefly updated with references to additional information sources. Finally, the future direction for the SFWMD's source control program for the Southern Everglades is discussed with emphasis on meeting long-term water quality goals. During WY2010, source control strategies for each basin were reviewed (and strengthened where necessary) consistent with the requirements of the EFA.

The EAA Basin continues to meet the required performance levels of Chapter 40E-63, F.A.C., with a 41 percent TP load reduction in WY2010 compared to the predicted load based on the pre-BMP baseline period. For the C-139 Basin, WY2010 marks the eighth year of mandatory BMP implementation, and the second year that the basin achieved compliance. The SFWMD continued to monitor the discharges from each non-ECP basin to evaluate the effectiveness of source control strategies and to track the direction of compliance with the TP concentration limits for the C-111 Basin and the water quality trends for the C-11 West, NNRC, Feeder Canal, and L-28 basins. It is expected that the EFA long-term compliance permit (Phase II permit) to be issued to the SFWMD by the FDEP will contain TP limits for the non-ECP basins. The SFWMD expects that the Phase II permit will be issued during WY2011.

Progress continued during WY2010 in developing revisions to the District's source control program regulatory rule (Chapter 40E-63, F.A.C.) for the C-139 Basin. The rule revision process

was initiated during WY2008 when the C-139 Basin failed to meet mandated phosphorus load performance measures outlined in the rule. The revision efforts were ongoing throughout WY2010, and included (1) conducting technical working groups and landowner workshops, (2) evaluating factors impacting compliance, (3) reevaluating BMP plans and scope, and (4) evaluating water quality improvement demonstration project opportunities.

Progress was also made with an integrated regulatory compliance effort to ensure water quality and conservation requirements of District-issued Environmental Resource (regulating the design and operation of stormwater management systems) and Consumptive Water Use permits in the C-139 (ECP) and Feeder Canal (Non-ECP) basins were being adhered to, and to bring landowners into compliance where deficiencies existed. It is anticipated that this integrated regulatory effort will be a successful approach where runoff volume control is required to reduce phosphorus loads from the basin.

Results from TP data collected during WY2010 for each ECP and non-ECP basin are summarized in **Table 4-2**. The ECP basins accounted for 90 percent of the 235.2 metric tons (mt) total runoff load (see Chapter 2 of this volume for WY2010 hydrology).

Table 4-2. WY2010 Everglades Construction Project (ECP) and non-ECP basin discharge TP FWM concentrations in parts per billion (ppb or micrograms per liter) and loads in metric tons (mt).

Southern Everglades Basin[1]	Primary Land Use	FWM TP Concentration (ppb)	TP Load (mt)	Unit Area Load (lbs/acre)
ECP Basins				
Everglades Agricultural Area	Agricultural	127	168.8	0.79
C-139	Agricultural	171	41.9	0.54
non-ECP Basins				
C-11 West[2]	Residential	18	3.9	0.18
North New River Canal	Residential	(no flow)[3]	(no flow)[3]	(no flow)[3]
North Springs Improvement District	Residential	(no flow)[3]	(no flow)[3]	(no flow)[3]
Feeder Canal	Agricultural	73	7.6	0.23
L-28	Agricultural	55	9.2	0.28
C-111	Residential	7	3.8	0.14
Boynton Farms	Agricultural	(NA)[4]	(NA)[4]	(NA)[4]

[1] The ECP basin discharges receive further treatment downstream through the Stormwater Treatment Areas prior to discharge to the Everglades Protection Area (EPA).

[2] The C-11 West Basin flows west to Water Conservation Area 3A through pumps S-9 and S-9A to the EPA, and also flows east through structure S-13A. The reported unit area load (UAL) represents only the portion of TP load directed to the EPA.

[3] No discharges to the EPA during WY2010.

[4] Not available – No instrumentation in place for flow monitoring.

Water Year 2010 Highlights

Everglades Agricultural Area Basin

- The EAA achieved an estimated 41 percent (119 mt) TP load reduction for WY2010 compared with predicted load. The total cumulative reduction in TP loads due to BMP implementation since WY1996 is 2,237 mt, which represents a long-term reduction trend of 53 percent overall.
- Post-permit compliance activities were continued by the SFWMD. BMP inspections were emphasized based on the analysis of farm-level results for WY2009, using a prioritized list based on farm location, water quality history, size, and date of previous inspection.
- Research on improving BMP effectiveness moved forward through a cooperative effort between the District and the EAA Everglades Protection District. The scope of work for continuing farm BMP research under the rule-required EAA BMP Master Research Permit was approved on January 11, 2010.
- Area-specific data collection by the SFWMD continued. Water quality and quantity data of priority phosphorus discharges, such as the East Beach Water Control District, continued to be collected to refine a source control approach to effectively deal with higher-than-expected phosphorus concentrations.
- The District and the FDEP jointly developed performance measures that were incorporated into the FDEP-issued permits to place limits on the water quantity discharged to Lake Okeechobee from the ECP 298 Diversion Areas.

C-139 Basin

- Discharges from the C-139 Basin carried 41.9 mt of TP load resulting in the basin being in compliance for WY2010. Post-permit compliance activities through on-site Level IV BMP inspections and outreach efforts to ensure uniform implementation were conducted by the SFWMD.
- Monitoring and data analyses efforts to identify upstream TP sources and potential water quality improvement projects that can be developed to control those sources were continued by the SFWMD.
- The SFMWD's rule development process progressed, including four public workshops and coordination meetings with individual stakeholders. Technical investigations were conducted to refine the method to determine compliance with EFA requirements.
- The SFWMD continued working cooperatively with the Hendry Soil and Water Conservation District on two BMP demonstration projects for phosphorus reduction in the C-139 Basin. The demonstration project with the University of Florida/Institute of Food and Agricultural Sciences – Southwest Florida Education and Research Center continued. Expanding the knowledge of design criteria affecting phosphorus reduction in an aboveground impoundment by evaluating the water quality treatment effectiveness for phosphorus of a typical impoundment is expected to identify features to optimize performance.
- The SFMWD ensured that technical information continued to be developed to optimize nutrient management BMPs in the basin to prevent unnecessary application of nutrients and losses in farm runoff and seepage.

- An integrated regulatory compliance strategy to ensure that water quality requirements of SFWMD-issued Environmental Resource and Water Use permits for the basin are being met continued. Workshops and one-on-one consultations with landowners were conducted by the SFWMD.

Non-ECP Basins

- TP flow-weighted mean (FWM) concentrations in WY2010 ranged between 7 and 73 parts per billion (ppb). Analysis of TP concentrations in WY2010 indicates a wider variation among non-ECP basins than in WY2009.
- Implementation of phosphorus source controls and Water Quality Improvement Plans in the C-11 West, C-111, NNRC, and NSID basins continued to be coordinated by the SDWMD. The C-11 West Basin and the C-111 Basin TP FWM concentrations were between 7 and 18 ppb. There was no flow from the NNRC, NSID, or Boynton Farms basins to the EPA in WY2010.
- It is anticipated that in WY2011, flow from the C-139 Annex (a sub-basin of the L-28 Basin, approximately 25 percent of the area) will be diverted to Stormwater Treatment Area 6.
- Non-ECP basins discharged approximately 24.5 mt of TP load to the EPA. The Feeder Canal and L-28 basins (comprising primarily agricultural land use) contributed 16.8 mt of TP load, or 69 percent, of the total non-ECP basin load. The SFWMD continued working with landowners in the McDaniel Ranch area (within the Feeder Canal Basin) to ensure appropriate water quality treatment and implementation of BMPs.
- The SFWMD monitored discharges from each non-ECP basin to evaluate progress toward achieving established water quality standards.
- An integrated regulatory compliance strategy in the Feeder Canal Basin to ensure water quality requirements of various SFWMD-issued ERPs, Surface Water Management Permits, and Water Use Permits are met were continued. Implementation of phosphorus source control BMPs was facilitated by the SFWMD.

OVERVIEW OF NORTHERN EVERGLADES SOURCE CONTROLS

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As required by the 2008 Northern Everglades and Estuaries Protection Program (NEEPP) [Section 373.4595, Florida Statutes (F.S.)], the South Florida Water Management District (SFWMD or District), in collaboration with the Florida Department of Environmental Protection (FDEP) and the Florida Department of Agricultural and Consumer Services (FDACS) (the coordinating agencies), and in cooperation with local governments have written (1) the Lake Okeechobee Watershed Construction Project Phase II Technical Plan (P2TP) (SFWMD et al., 2008), (2) the St. Lucie River Watershed Protection Plan (SLRWPP), and (3) the Caloosahatchee River Watershed Protection Plan (CRWPP) (SFWMD et al., 2009). Integral to those plans is a pollutant source control component directed at nutrients. Legislative authorization was provided through NEEPP to expand the regulatory source control programs beyond the Lake Okeechobee Watershed (LOW) to incorporate the St. Lucie and Caloosahatchee river watersheds and to add nitrogen as a nutrient of concern (due to impairment of these rivers' estuaries).

The NEEPP and its mandated plans, which are being implemented, further define the role of the coordinating agencies regarding nonpoint regulatory and incentive-based source control programs for nutrients. Efforts include the District's Lake Okeechobee Works of the District (LOWOD) regulatory source control program [Chapter 40E-61, Florida Administrative Code, (F.A.C.)] (Rule 40E-61), the Environmental Resource Permitting Program, and the development of special basin rules as necessary. The SFWMD's efforts are specific to areas within the SFWMD's boundaries. Complementary to the SFWMD's existing regulatory programs are state-wide overlapping programs implemented by the FDACS and FDEP. The FDACS primarily administers incentive-based nonpoint source agricultural Best Management Practice (BMP) programs. The FDEP oversees various point and nonpoint regulatory and incentive-based source control programs, including those relative to stormwater systems, dairy operations, and domestic wastewater systems. The primary focus of this chapter is nonpoint source control programs specific to controlling nutrients in stormwater discharges.

Overall, limiting phosphorus in the Northern Everglades and nitrogen in the river watersheds through source controls are continuing efforts of the coordinating agencies and include the following activities:

- Implementation of nonpoint source BMPs on agricultural and non-agricultural lands to ensure the amount of nutrients discharged off-site is minimized to the greatest possible extent. This includes amending SFWMD Rule 40E-61 to implement the regulatory component of nonpoint source nutrient BMPs for each of the watersheds indentified as residing within the Northern Everglades.
- Coordination with local governments to implement the nonagricultural, nonpoint-source BMPs within their respective geographic boundaries.
- Implementation of a source control monitoring program to measure the collective performance and progress of the coordinating agencies' programs, support adaptive management within the programs, to identify priority areas of water

quality concern and BMP optimization, and to provide data to evaluate and enhance performance of downstream treatment facilities.

- Assessment of current water management practices within the watershed and development of recommendations for structural, nonstructural, and operational improvements that balance water quality and supply.
- Ensuring that wastewater residuals (within the watershed) do not contribute to nutrient loadings.
- Coordination with the Florida Department of Health to ensure septage disposal within the watershed is under an approved agricultural use plan that limits applications based on nutrient loading limits established in the Lake Okeechobee, Caloosahatchee River and St. Lucie river watersheds.
- Ensuring that entities utilizing land-application of animal manure develop a resource management, system-level conservation plan.
- Utilization of alternative and innovative nutrient control technologies.
- Utilization of federal programs that offer opportunities for water quality treatment including preservation, restoration, or creation of wetlands on agricultural land.
- The coordinating agencies operate in concert through an interagency memorandum of understanding (MOU) so that resources, responsibilities, and efforts can be properly coordinated and aligned. The current MOU is under review to reflect the latest requirements which were further refined in NEEPP including: (1) mechanisms for the development of BMPs that complement existing regulatory programs and a description of how the BMPs will implemented and verified, (2) measures to be taken when water quality problems are detected despite BMP implementation, (3) development of a BMP reevaluation process, and (4) development of programs to provide technical and financial assistance for BMP implementation subject to availability of funds.

A critical component in the success of source control efforts is a comprehensive effort to collect and analyze data to: (1) determine whether individual or a combination of BMPs is effective and to provide insight into new or modified practices, (2) identify priority areas of water quality concern, and (3) provide data to evaluate and enhance performance of downstream treatment facilities. Meeting these data goals requires monitoring efforts at different levels. Monitoring to verify BMP effectiveness is achieved through BMP demonstration projects at representative sites and is made possible through cost-share funds from the coordinating agencies. Sub-regional (within sub-watersheds) monitoring is performed by the SFWMD under efforts such as the Lake Okeechobee Watershed Assessment (LOWA) monitoring network to identify areas of water quality concern. Regional monitoring by the SFWMD provides data to evaluate the collective source control programs' progress toward improving water quality.

The coordinating agencies strive to maintain consistency in the source control strategies between watersheds while tailoring the programs to the specific characteristics and needs of the related ecosystems. As the LOW source control programs have been established and continue to improve, they will be used as models for the development of the programs in the river watersheds.

There are nine sub-watersheds in the LOW for source control implementation (**Figure 4-2**). Planned source control implementation areas for the St. Lucie and Caloosahatchee river watersheds are presented in **Figure 4-3** and **Figure 4-4**, respectively.

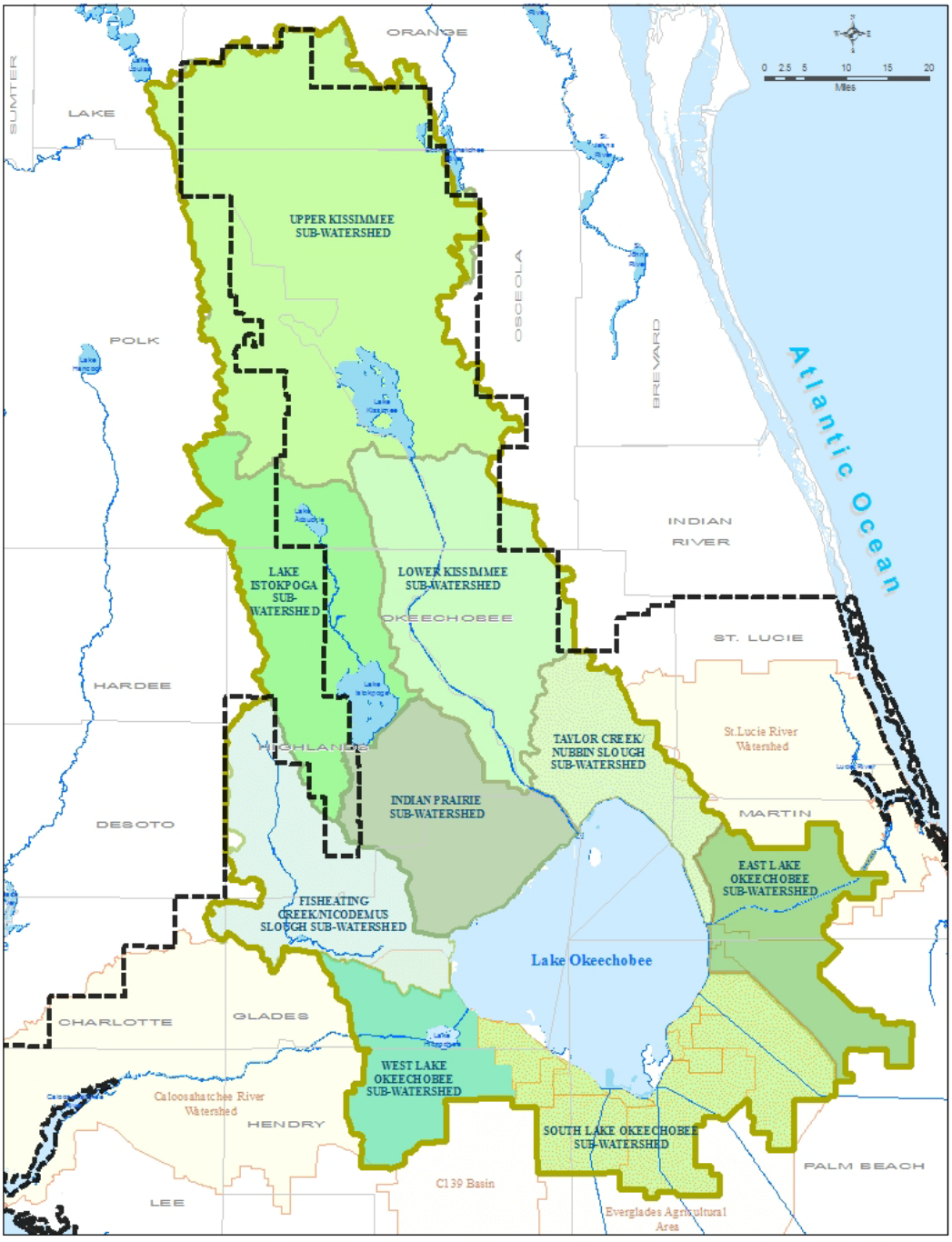

Figure 4-2. The Lake Okeechobee Watershed (LOW) source control program implementation area.

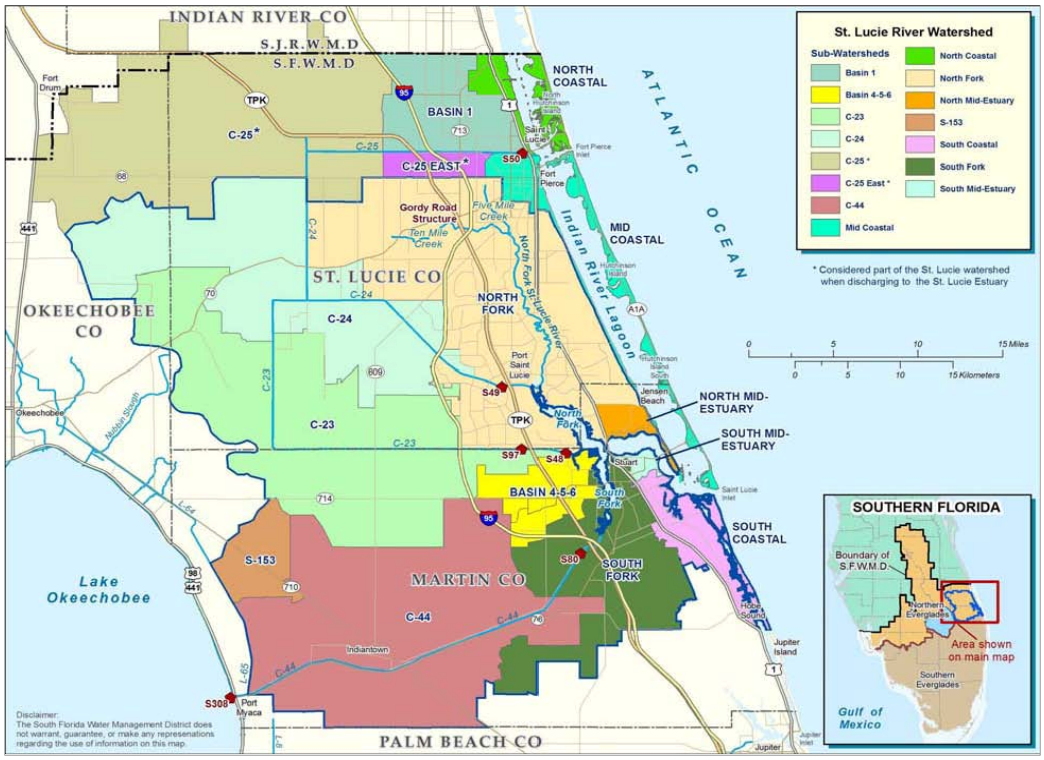

Figure 4-3. The St. Lucie River Watershed source control program implementation area.

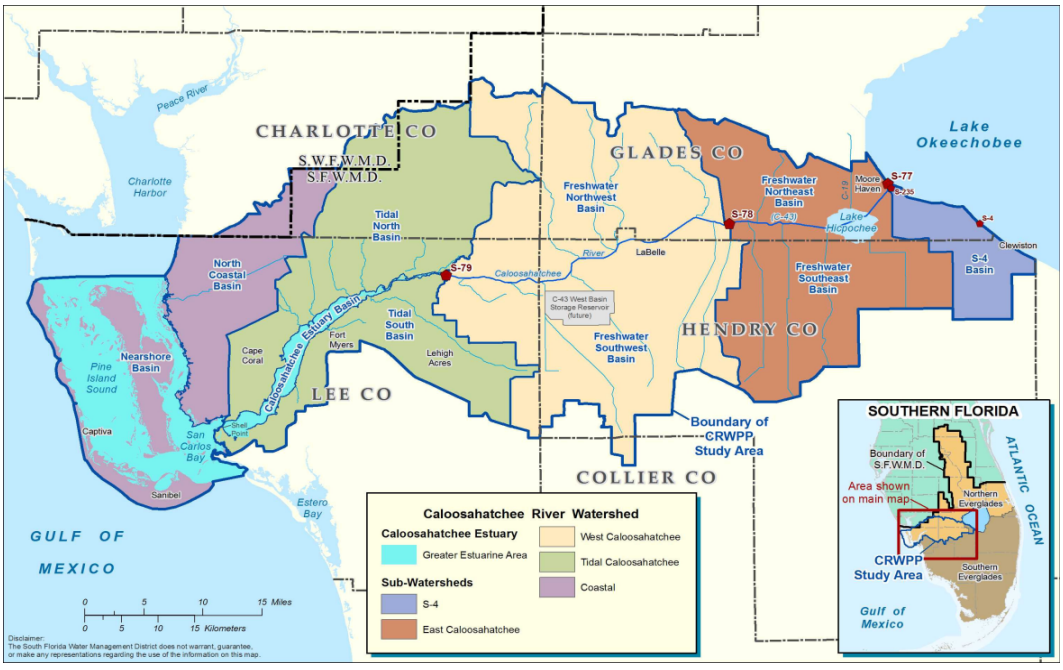

Figure 4-4. The Caloosahatchee River Watershed source control program implementation area.

STATUS OF SOURCE CONTROLS IN THE LAKE OKEECHOBEE WATERSHED

Chad Rucks

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BACKGROUND

The SFWMD's regulatory source control program began in the LOW with the Surface Water Improvement and Management (SWIM) Plan which was required by the 1987 SWIM legislation (373.4595, F.S.). The Lake Okeechobee SWIM plan set forth a phosphorus loading target for Lake Okeechobee of 360 metric tons (mt) as five-year rolling average and the SFWMD (1981) provided the basis for establishing target phosphorus concentrations for each basin flowing into Lake Okeechobee to achieve that target. The SWIM plan called for the SFWMD to adopt a rule to address phosphorus loading to the lake.

The Lake Okeechobee Works of the District (LOWOD) rule (Chapter 40E-61, Florida Administrative Code, F.A.C.) limited the amount of phosphorus that could be discharged from a parcel based on land use. The rule applies to specific land uses (e.g., improved pasture, vegetable farms, hog farms, poultry farms, goat farms, urban stormwater, golf courses, sugar cane, horse farms, nurseries, land spreading of sludge, and sod farms) within the LOW boundary defined in the 1989 rule. The rule listed 14 basins where permitting was initially required. All of the remaining basins in the original boundary are basins where no notice permits are issued by the rule unless the SFWMD's water quality monitoring data indicate that a more formal permit is necessary.

The philosophy behind the rule initiative in 1989 was that landowners were presumed to be in compliance with the rule unless water quality monitoring indicated otherwise. The rule only required a permit applicant to provide a simple statement as to how the permit holder would reduce phosphorus from the permitted property. The permitted discharge target concentrations ranged from 180 parts per billion (ppb) to 1,200 ppb (SFWMD, 1981). Farm-level grab sample monitoring was required and was funded by the SFWMD. Monitoring funds were limited and the number of landowners required to implement additional BMPs for not meeting the TP concentration limit was relatively few. Performance was measured at the parcel level and it was difficult to determine the overall program performance in reducing phosphorus loading.

In 2000, the Florida legislature revised the SWIM statute and it became the Lake Okeechobee Protection Act (LOPA) (Section 373.4595, F.S.), establishing a restoration and protection program for Lake Okeechobee and expanding the program's geographic area. In 2005, LOPA was revised further and the Upper Kissimmee and Lake Istokpoga sub-watersheds were included in the Lake Okeechobee Watershed boundary. The 2005 revisions to LOPA directed that phosphorus load reductions be achieved through a phased program of implementing long-term

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solutions based on the Lake Okeechobee total maximum daily load (TMDL) of 140 mt for total phosphorus (TP) [developed by the Florida Department of Environmental Protection (FDEP) in 2001 and to be attained by 2015]. In 2001, the SFWMD, FDEP, and Florida Department of Agriculture and Consumer Services (FDACS) (coordinating agencies) executed a Memorandum of Understanding to establish agreement on the comprehensive implementation of LOPA. As a result, the FDACS adopted rules to implement a BMP program for agricultural landowners complementary to the SFWMD's LOWOD source control rule for phosphorus reductions and the Environmental Resource Permit (ERP) rule for design of stormwater management systems.

In 2007, LOPA was subsumed by NEEPP, which further refined the responsibilities of the coordinating agencies to achieve TP reduction objectives faster. The objectives included (1) continued implementation of existing regulations and incentive-based BMPs, (2) development and implementation of improved BMPs, (3) improvement and restoration of hydrologic function of natural and managed systems, and (4) use of alternative technologies for nutrient reduction.

After these legislative changes, the SFWMD began the process of revising LOWOD. In WY2004, the SFWMD restructured the LOWOD concentration monitoring network (which had been conducted at the property level) to an upstream monitoring network (LOWA). The LOWA monitoring network is used to capture phosphorus concentrations within sub-watersheds representative of multiple properties and is used to identify areas of water quality concern. Data collected from the LOWA network, along with data from other projects in the SFWMD's ambient monitoring network (see Appendix 4-1 and Chapter 10 of this volume) and Lake Okeechobee inflow sites, are used to evaluate changes in TP concentrations throughout the watershed. If changes are observed, then more intensive monitoring can be performed through LOWA and other monitoring to identify areas of concern.

The SFWMD has also begun the process of revising the LOWOD regulatory source control program rule to be compatible with current initiatives. The goal is to have a regulatory source control program that is an ongoing program of BMPs implemented through the issuance of permits for agricultural and non-agricultural land uses (new and existing). The rule will be a comprehensive program of BMP plan approval, verification of implementation through field visits, and data evaluation; and be complementary to the FDACS and FDEP state-wide source control programs. The SFWMD will develop a performance metric for the collective source control programs. Performance measures ensure consistent implementation of BMPs, measure actual phosphorus reductions, and are a mechanism for requiring improvements if water quality goals are not achieved.

In addition to Rule 40E-61, the SFWMD administers source controls through the ERP Program within its jurisdictional boundaries, which regulates both agricultural and non-agricultural activities that alter surface water flows. Activities include land development projects that influence stormwater runoff in upland areas and dredging and filling in wetlands and surface water areas. The primary objective of the ERP Program is to ensure that alterations in stormwater runoff do not degrade surface water quality, compromise flood protection, or adversely affect the function of wetland systems.

The Lake Okeechobee and Estuary Recovery (LOER) Plan of 2005 called for a water quality basin rule to specifically reduce phosphorus in discharges from new development in the LOER watersheds. While the basin rule was being drafted, the FDEP and the five water management districts in Florida began rule development for a state-wide stormwater rule that is intended to reduce nutrients in runoff from new development. As a result of these efforts, the draft basin rule was revised from a water quality rule to a water quantity rule since NEEPP requires improvements to hydrology and water quality within the area. The revisions to the draft basin rule avoid duplication with the state-wide stormwater rule. The basin rule's intent is to ensure that

new development will not increase the average annual discharge volume of stormwater above existing conditions.

After development of a technical methodology to estimate existing and proposed discharge volumes, a strategy for rulemaking was drafted; however, a review of the existing rules revealed that the intent of the draft basin rule could be accomplished using existing rules. To communicate how the existing rules apply to the draft basin rule intent, a guidance document is planned to be prepared by the SFWMD and reviewed with stakeholders prior to finalization and implementation. The goal is to begin implementation of these basin guidelines within NEEPP area by the beginning of 2011.

The FDEP continues to be the lead agency for the development and adoption of a state-wide stormwater rule. Rulemaking efforts are under way (Chapter 62-347, F.A.C.). In 2008, a Technical Advisory Committee was established to assist the FDEP and the water management districts in developing the first versions of the draft rule. Numerous public meetings have been conducted, and the committee continues to refine the draft rule and related materials in consideration of public comments. Rule adoption is tentatively scheduled for 2011 (see http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater/index.htm).

The rule will provide state-wide regulatory criteria for stormwater treatment systems which are designed and constructed to control stormwater pollutant loads. Stormwater treatment systems are usually components of a surface water management system. Surface water management systems may incorporate methods to collect, convey, store, absorb, inhibit, treat, use, or reuse water to prevent or reduce flooding, over-drainage, environmental degradation and pollution, or otherwise affect the quality and quantity of discharges. The new rule will increase the level of nutrient removal required of stormwater treatment systems serving new development.

The proposed draft rule is technology-based and includes the following components:

- Performance standards or goals (minimum levels of treatment for nutrients)
- Design criteria for BMPs used to treat stormwater that will achieve the performance standard
- A rebuttable presumption that a stormwater treatment system designed in compliance with the BMP design criteria within this rule will not cause or contribute to violations of surface water standards
- Periodic review and updating of BMP design criteria as more information becomes available to increase their effectiveness in removing pollutants

Once adopted, Florida's water management districts and the FDEP will implement the rule under each one's respective programs.

Other complementary nutrient source control programs under the FDEP are implemented state-wide and overlap the SFWMD's regulatory source control programs. In response to nutrient concerns, the FDEP adopted amendments to state-wide rules under Chapter 62-640, F.A.C., which the Environmental Regulation Commission (ERC) approved on May 20, 2010, to improve site accountability and management for biosolids application.

The proposed rule includes changes to:

- Site permitting
- Changes related to NEEPP
- Prohibitions on land application of biosolids in the LOW unless the nutrient balance demonstration is completed by the permittee

- Requirement of Nutrient Management Plans rather than former, more basic Agricultural Use Plans
- Additional requirements for distribution and marketing of biosolids to be distributed as fertilizer

The nutrient balance demonstration would be required to be submitted with the site Nutrient Management Plan at the time of permit application. Also, record keeping and reporting requirements to document compliance with the nutrient balance demonstration would be added to the biosolids regulations.

FDACS plays a significant role in implementing agricultural BMP programs. The NEEPP requires an owner/operator of an agricultural nonpoint source to either implement interim measures or BMPs, or demonstrate compliance with Rule 40E-61 by conducting monitoring which would be prescribed under a SFWMD Rule 40E-61 permit.

FDACS utilizes incentive-based methods to encourage enrollment in agricultural BMP programs. Incentives for agricultural operations to enroll in FDACS BMP programs include (1) a presumption of compliance with state water quality standards, (2) eligibility to participate in cost-share programs that provide monetary assistance with the implementation of BMPs, and (3) avoidance of monitoring requirements under the SFWMD Rule 40E-61 source control program permit. The FDACS develops and adopts BMPs by rule for different types of agricultural operations. Most of the BMPs are outlined in commodity-specific manuals, which can be found at http://www.floridaagwaterpolicy.com/.

Farmers operating in an area where FDACS BMPs are adopted can submit a Notice of Intent under the appropriate rule to implement the adopted BMPs applicable to their operations. The BMP measures and manuals that FDACS has adopted through rules to date (and those under development) and the agricultural lands voluntarily enrolled in FDACS-adopted BMP programs in counties within the Northern Everglades are presented in Appendix 4-1 of this volume.

FDACS has also targeted nutrients in urban discharges through the adoption of the state-wide Urban Turf Fertilizer (UTF) (5E-1) Rule in 2007. The UTF Rule limits phosphorus and nitrogen content in fertilizers that are used for urban turf and lawns. This rule is intended to reduce nutrient loads from urban fertilizer applications by requiring that all fertilizer products labeled for urban use (turf, sports turf, and lawns) only contain the amount of phosphorus and nitrogen that is actually needed to support healthy turfs and lawns. The rule requires that application rates for phosphorus not exceed an application rate of 0.25 pounds (lbs) P_2O_5 (phosphorus pentoxide) per 1,000 square feet (ft^2) per application and not exceed 0.50 lbs per 1,000 ft^2 per year.

The rule also requires that application rates for nitrogen not exceed 0.7 lbs of readily available nitrogen per 1,000 ft^2 per application, with no more than 1 lb total nitrogen per 1,000 ft^2 per application. Under this rule, FDACS expects a 20–25 percent reduction in nitrogen and a 15 percent reduction in phosphorus in every bag of fertilizer sold to the public. The UTF Rule will continue to be enforced in the marketplace by FDACS field inspectors, who routinely verify that only fertilizer products labeled in compliance with the UTF Rule are being offered for sale.

To reach the level of phosphorus load reduction necessary to achieve the total maximum daily loads (TMDLs) for nutrients requires integrated actions at various scales: source, sub-regional, and regional levels. Source control, including BMPs, at the parcel level and water quality improvement projects at the sub-regional level (see Chapter 10 of this volume) are the foundation of the restoration program. The load remaining after implementation of the source control programs will be addressed with regional water quality improvement measures.

LAKE OKEECHOBEE WATERSHED UPDATES

The Lake Okeechobee Watershed encompasses approximately 3.4 million acres and was divided into nine sub-watersheds identified in the Lake Okeechobee Watershed Construction Project Phase II Technical Plan (P2TP) (**Figure 4-5**). Because the performance metric has not yet been developed, the data for each sub-watershed in Water Year 2010 (WY2010) (May 1, 2009–April 30, 2010) are shown with data for total phosphorus (TP) loads from WY1991–WY2010.

In future water years, the data will be analyzed based on performance measures developed for each sub-watershed for the Chapter 40E-61 rule. Rainfall variability may be considered in these performance measures; however, the methodology was not completed for data evaluations in WY2010.

Figure 4-6 presents the ranges of unit area loads (UALs) throughout the LOW. The UAL varied from as little as 0.13 pound per acre (lb/ac) in the Lake Istokpoga and South Lake Okeechobee Sub-watersheds to as high as 0.83 lb/ac in the Indian Prairie Sub-watershed. It should be noted that the UAL presented for the South Lake Okeechobee Sub-watershed only represents loads being discharged into Lake Okeechobee (see **Table 4-1**).

Updates on projects and other ongoing efforts, including rule development, is provided in the *Lake Okeechobee Watershed Source Control Activities* section of this chapter. The updates provided in that section include a description of work completed in WY2010, as well as anticipated activities for WY2011.

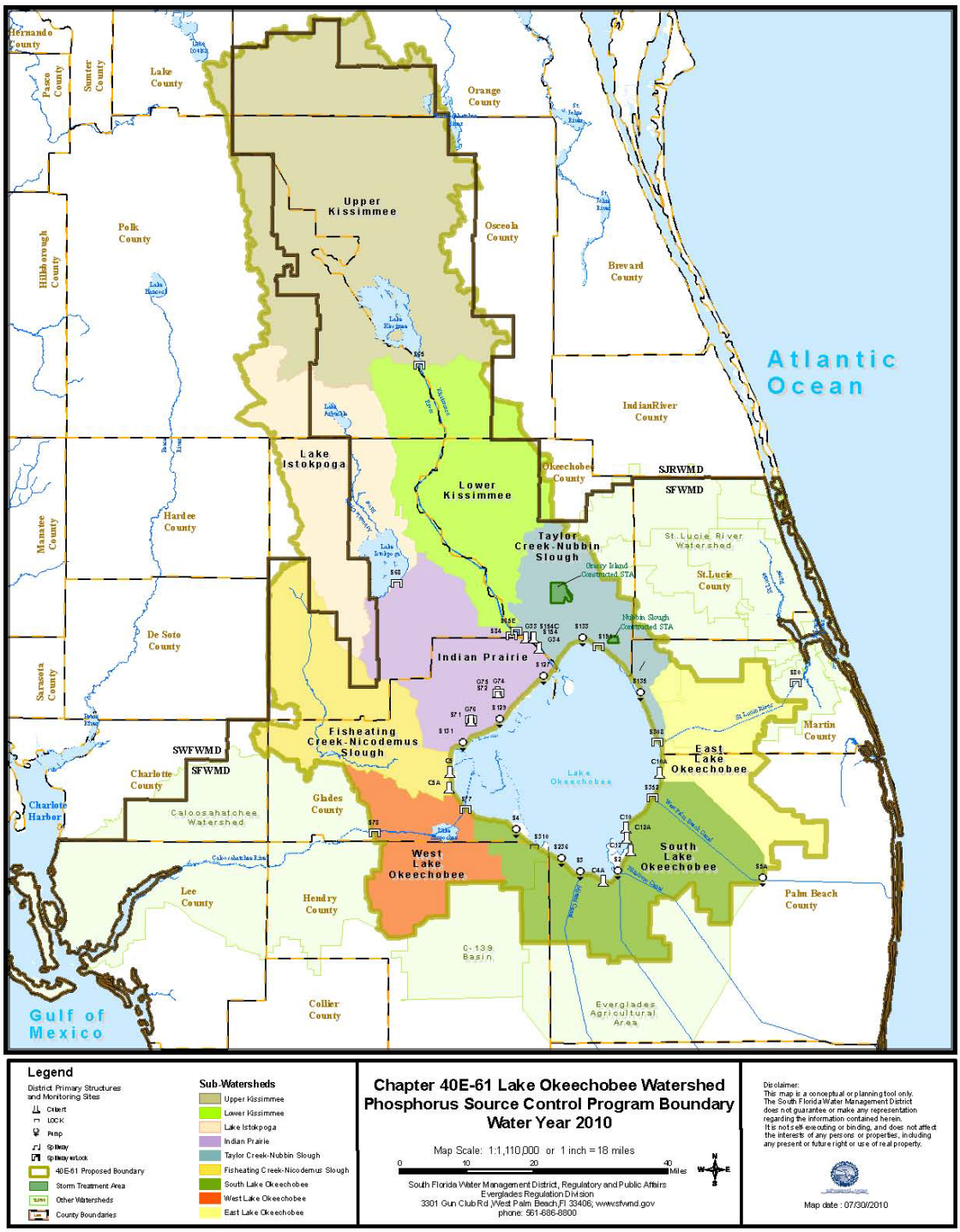

Figure 4-5. The LOW and primary water control structures during WY2010.

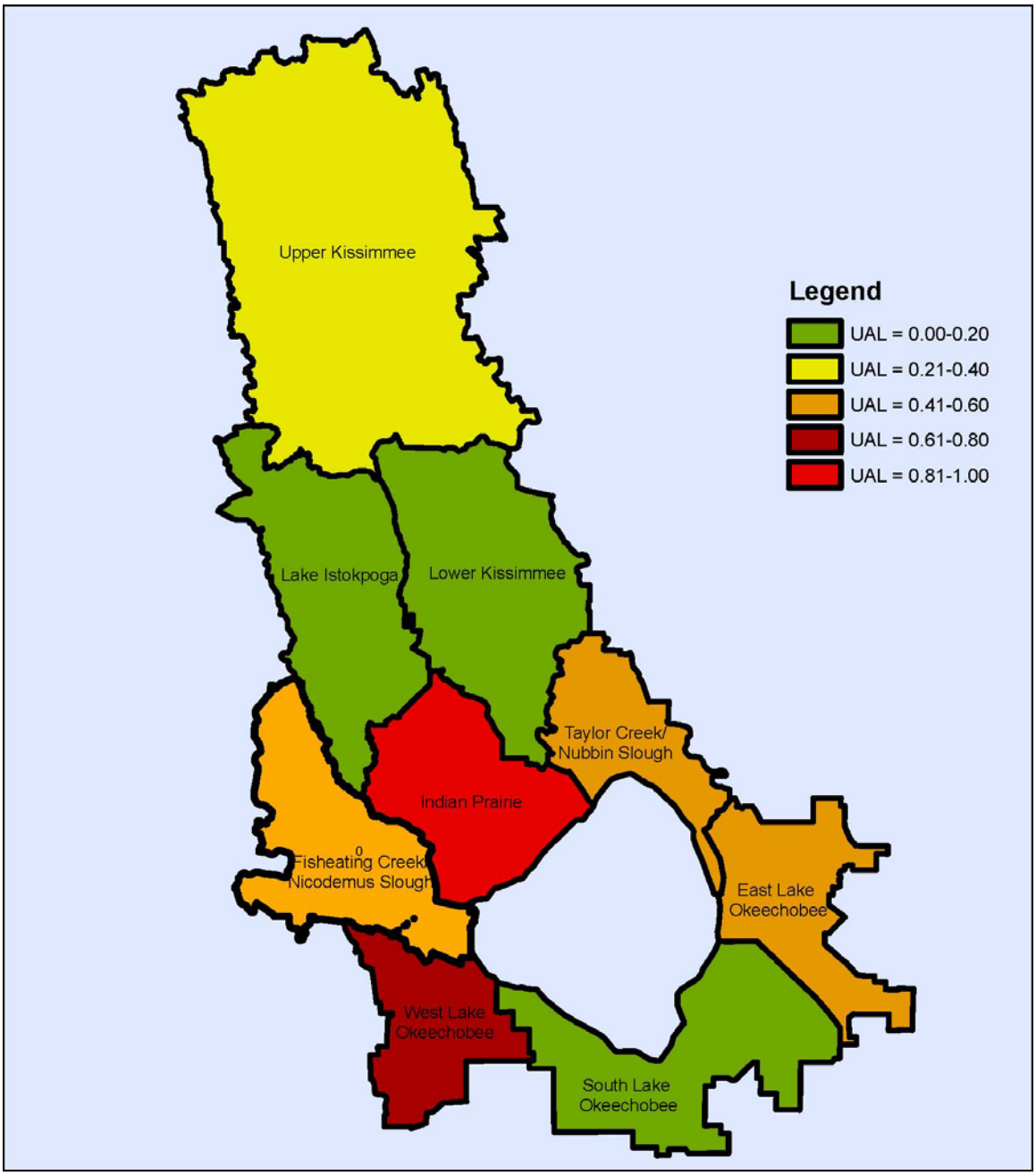

Figure 4-6. Overview of WY2010 unit area loads (UAL) for total phosphorus (TP) in pounds per acre (lbs/acre) within the LOW. [Note: The UAL for the South Lake Okeechobee Sub-watershed only represents loads discharging into Lake Okeechobee.]

Water Year 2010 Total Phosphorus Results for the Lake Okeechobee Watershed

This section provides an update of the LOW's WY2010 TP annual loads. TP loads measured from all land areas located within the watershed are reported in this section, regardless of where the flow is discharged. This includes discharges into the St. Lucie and Caloosahatchee river watersheds. For load estimates concerned solely with the discharges to Lake Okeechobee, see Chapter 10 of this volume.

Table 4-3 presents a summary of WY2010 results, where the observed annual TP loads and TP flow weighted mean (FWM) concentrations are based on data collected during the water year. Unlike the Everglades Agricultural Area (EAA) and the C-139 basins [Everglades Construction Project (ECP) basins], which have adopted performance evaluation protocols, performance measures for the LOW are still being developed. As a whole, based on the WY2010 data, the LOW generated a TP load of 529.73 mt.

Table 4-3. WY2010 TP loads for the Lake Okeechobee Watershed, shown as a total of nine sub-watersheds. The total annual load discharging from the LOW to Lake Okeechobee and the St. Lucie and Caloosahatchee river watersheds was 529.73 mt.[1]

Sub-watershed	WY2010 Observed Annual TP Load (mt)	WY2010 TP FWM Concentration (ppb)
Upper Kissimmee	109.37	68
Lower Kissimmee	31.94	253
Taylor Creek/Nubbin Slough	44.01	434
Lake Istokpoga	22.43	101
Indian Prairie	110.33	434
Fisheating Creek/Nicodemus Slough[2]	85.15	251
West Lake Okeechobee[3]	65.94	164
South Lake Okeechobee	20.62	184
East Lake Okeechobee[3]	39.94	272

[1] This differs from loads presented in Chapter 10 of the *2011 South Florida Environmental Report* (SFER) – *Volume I* because Chapter 10 focuses solely on TP loads entering Lake Okeechobee.

[2] The Fisheating Creek/Nicodemus Slough Sub-watershed includes Fisheating Creek, Culvert 5, and Culvert 5a.

[3] The East and West Lake Okeechobee sub-watersheds loads are calculated by utilizing a mass balance approach.

Upper Kissimmee Sub-watershed

The observed annual TP loads for the Upper Kissimmee Sub-watershed are based on samples collected and flows measured at the S-65 structure. The observed annual TP loads and FWM concentrations for the Upper Kissimmee Sub-watershed since WY1991 are provided in **Figure 4-7**.

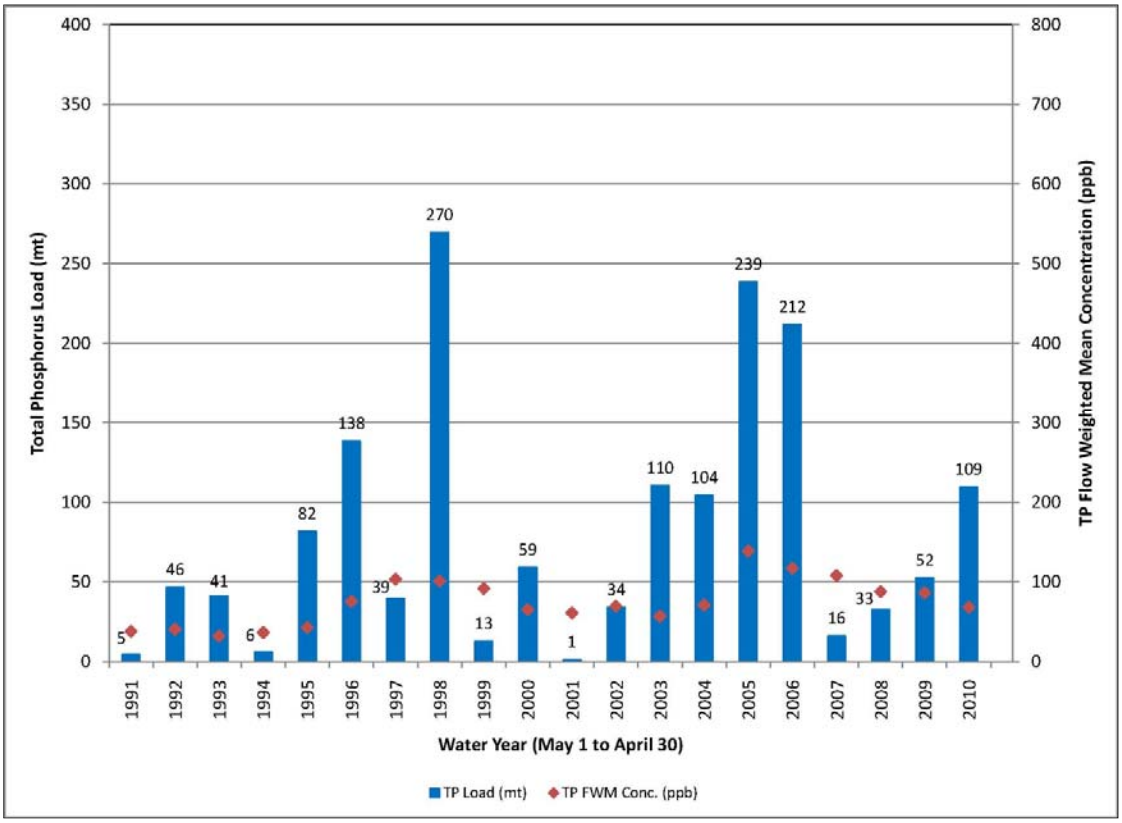

Figure 4-7. Upper Kissimmee Sub-watershed observed TP loads and FWM concentrations in parts per billion.

Lower Kissimmee Sub-watershed

The observed annual TP loads for the Lower Kissimmee Sub-watershed are based on the difference in loads and flows measured at the S-65E and S-65 structures. The observed annual TP loads and FWM concentrations for the Lower Kissimmee Sub-watershed are presented in **Figure 4-8**.

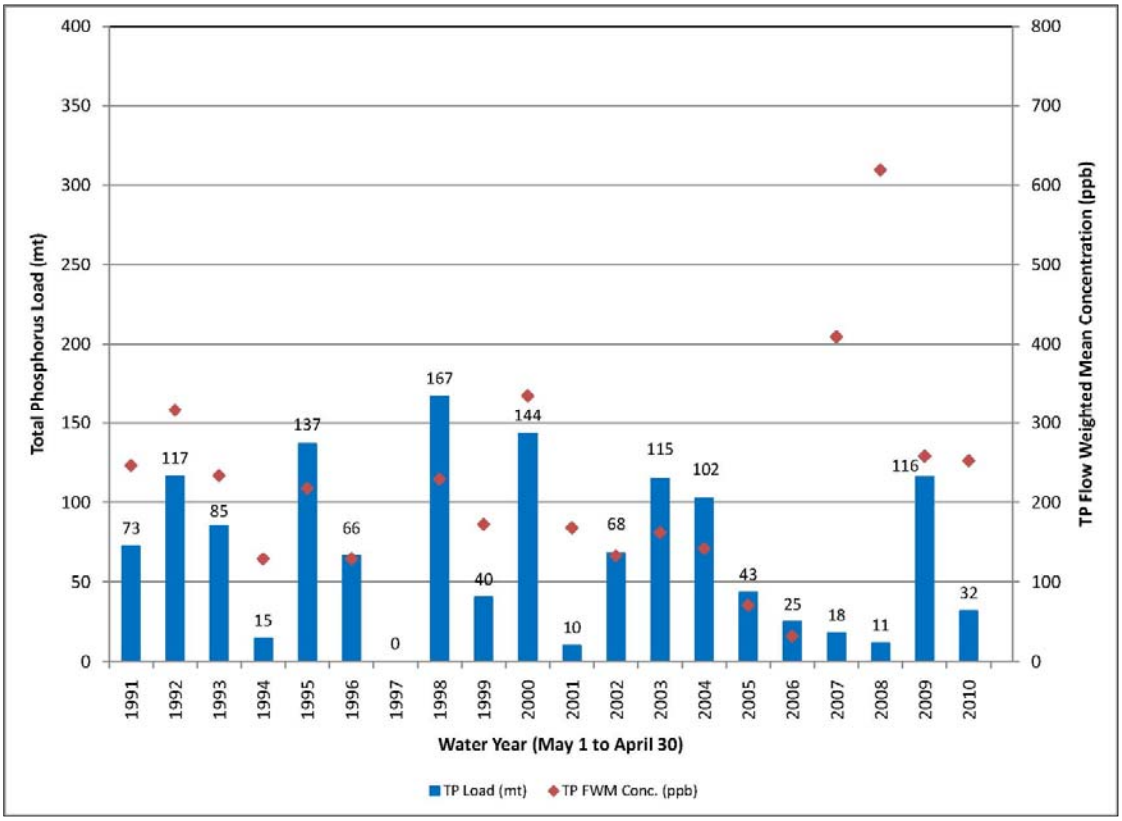

Figure 4-8. Lower Kissimmee Sub-watershed observed TP loads and FWM concentrations.

Taylor Creek/Nubbin Slough Sub-watershed

The observed annual TP loads and FWM concentrations for the Taylor Creek/Nubbin Slough Sub-watershed are based on samples and flows measured at the S-133, S-135, S-154, S-154C, and S-191 structures (**Figure 4-9**).

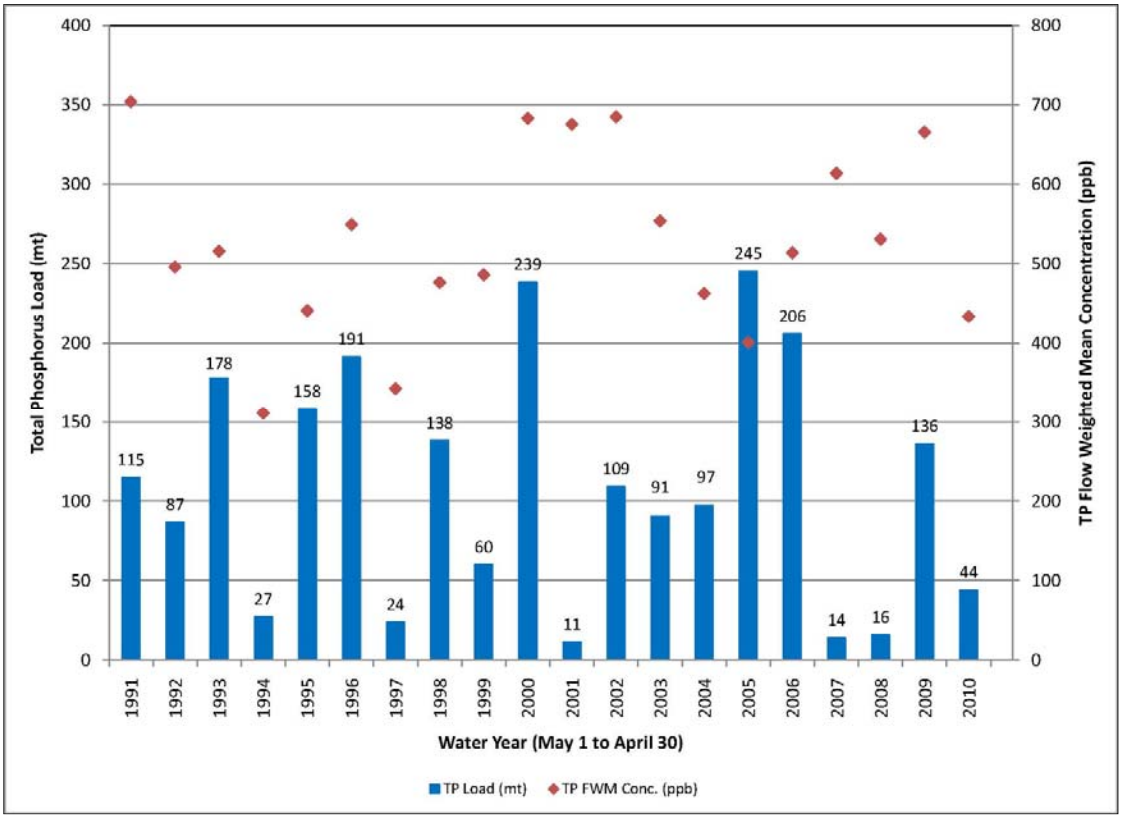

Figure 4-9. Taylor Creek/Nubbin Slough Sub-watershed observed TP loads and FWM concentrations.

Lake Istokpoga Sub-watershed

The observed annual TP loads and FWM concentrations for the Lake Istokpoga Sub-watershed are based on samples and flows measured at the S-68 structure. Data since WY1991 are provided in **Figure 4-10**.

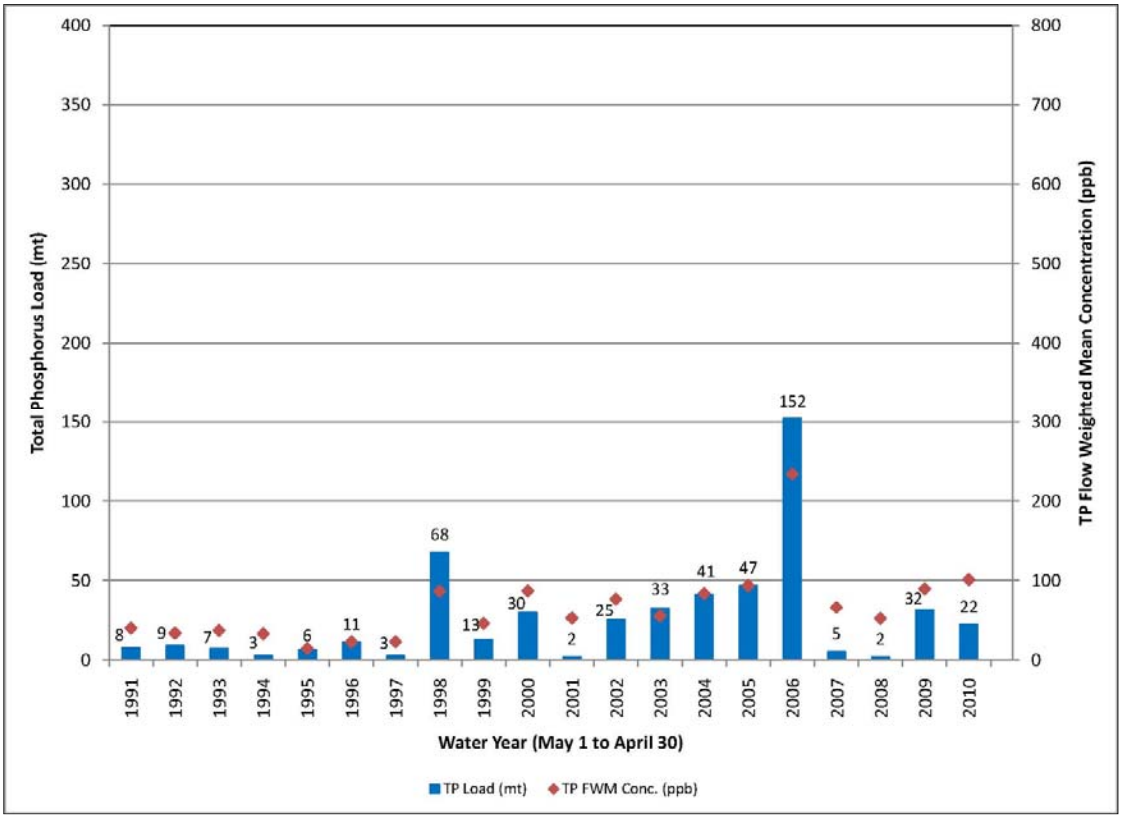

Figure 4-10. Lake Istokpoga Sub-watershed observed TP loads and FWM concentrations.

Indian Prairie Sub-watershed

The observed annual TP loads for the Lake Istokpoga Sub-watershed are based on samples collected and flows measured at the G-33, G-34, G-74, G-75, G-76, S-71, S-72, S-84, S-127, S-129, and S-131 structures. The observed annual TP loads and FWM concentrations for the Indian Prairie Sub-watershed (since WY1991) are provided in **Figure 4-11**.

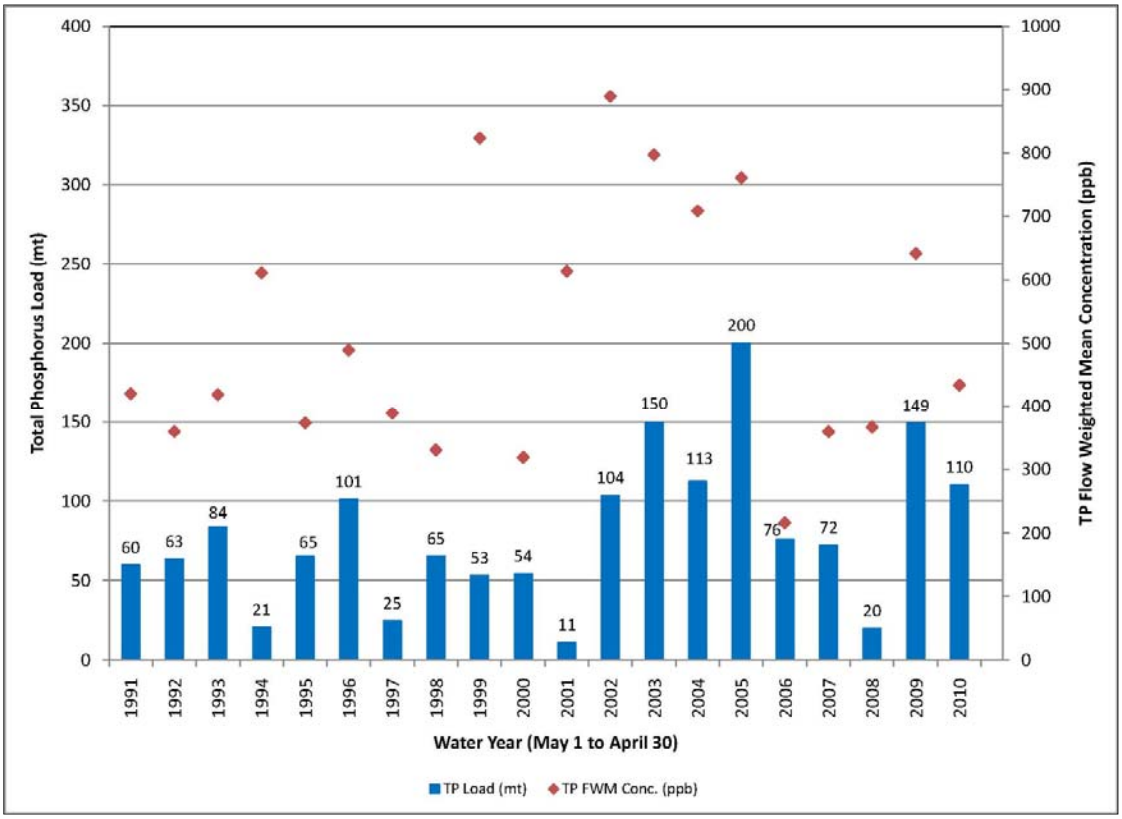

Figure 4-11. Indian Prairie Sub-watershed observed TP loads and FWM concentrations.

Fisheating Creek/Nicodemus Slough Sub-watershed

The observed annual TP loads for the Fisheating Creek/Nicodemus Slough Sub-watershed are based on samples and flows measured at the C-5 and C-5A structures. The observed TP loads and FWM concentrations for the Fisheating Creek/Nicodemus Slough Sub-watershed (since WY1991) are provided in **Figure 4-12**.

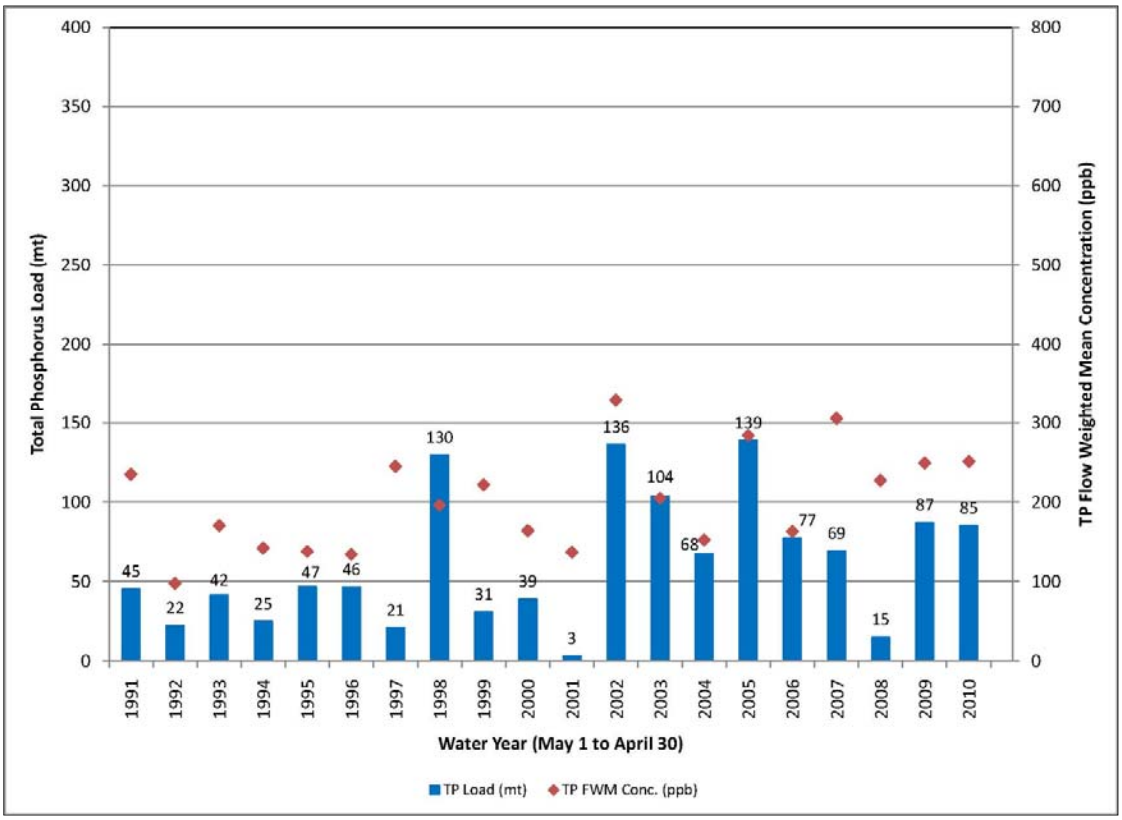

Figure 4-12. Fisheating Creek/Nicodemus Slough Sub-watershed observed TP loads and FWM concentrations.

West Lake Okeechobee Sub-watershed

In the West Lake Okeechobee Sub-watershed, the observed TP loads are based on samples and flows measured at the S-77 (to Lake Okeechobee) and S-78 (through the Caloosahatchee River) structures. The observed annual TP loads and FWM concentrations for the West Lake Okeechobee Sub-watershed are provided in **Figure 4-13**.

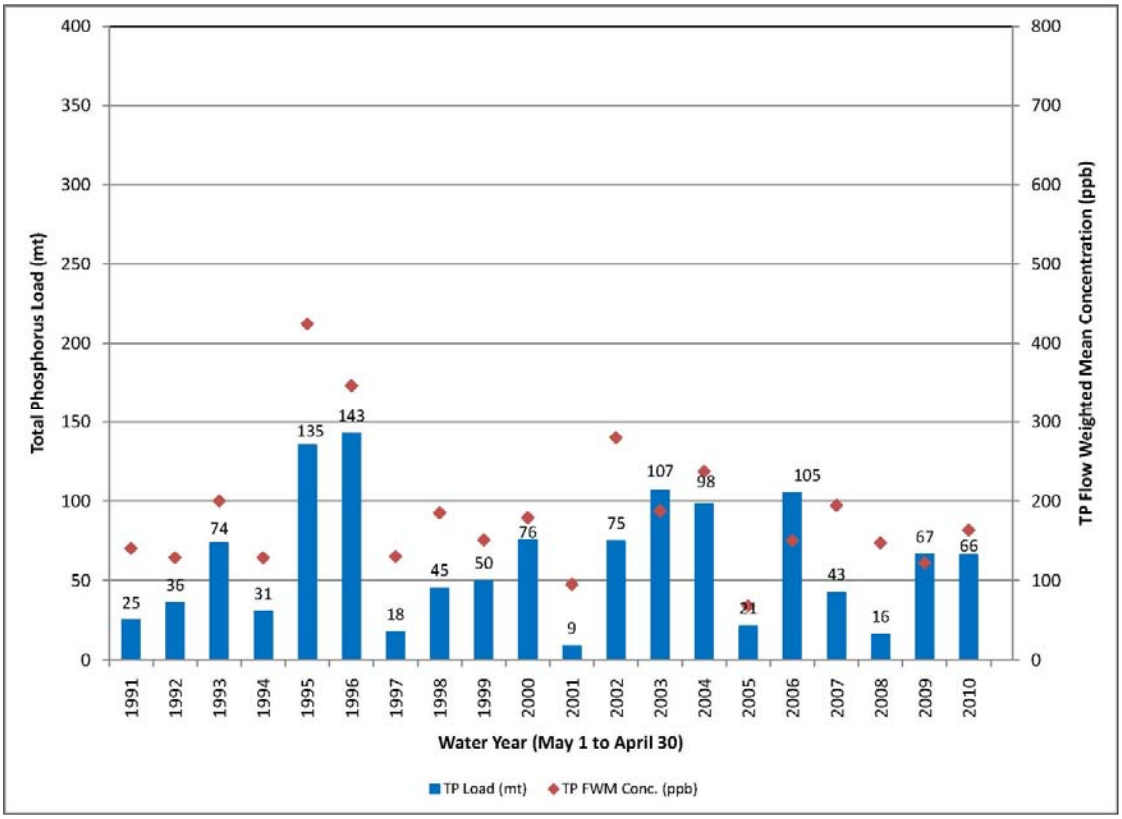

Figure 4-13. West Lake Okeechobee Sub-watershed observed TP loads and FWM concentrations.

East Lake Okeechobee Sub-watershed

The observed annual TP loads for the East Lake Okeechobee Sub-watershed are based on samples and flows measured at the S-308C (to Lake Okeechobee), C-10A, and S-80 (to the St. Lucie River) structures. TP loads and FWM concentrations for the East Lake Okeechobee Sub-watershed are provided in **Figure 4-14**.

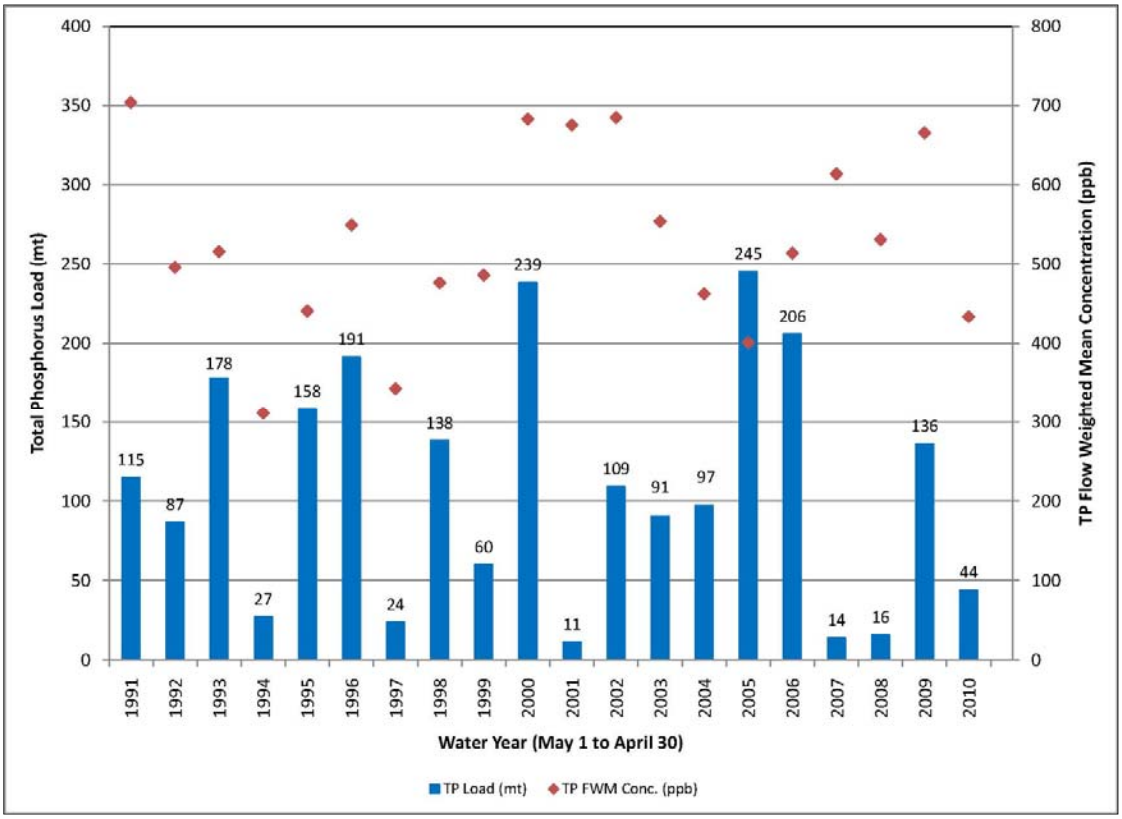

Figure 4-14. East Lake Okeechobee Sub-watershed observed TP loads and FWM concentrations.

South Lake Okeechobee Sub-watershed

The observed annual TP loads for the South Lake Okeechobee Sub-watershed are based on samples and flows measured at the C-12A, C-10, C-12, S-2, S-3, S-4, S-236, C-310, C-4A, and S-5A structures. [Note: The S-4 and the Industrial Canal (C-310) are within the South Lake Okeechobee Sub-watershed, but are not part of the EAA.] The observed annual TP loads and FWM concentrations for the South Lake Okeechobee Sub-watershed (based on water year) are provided in **Figure 4-15**. The TP loading data presented for this sub-watershed consider only discharges into Lake Okeechobee.

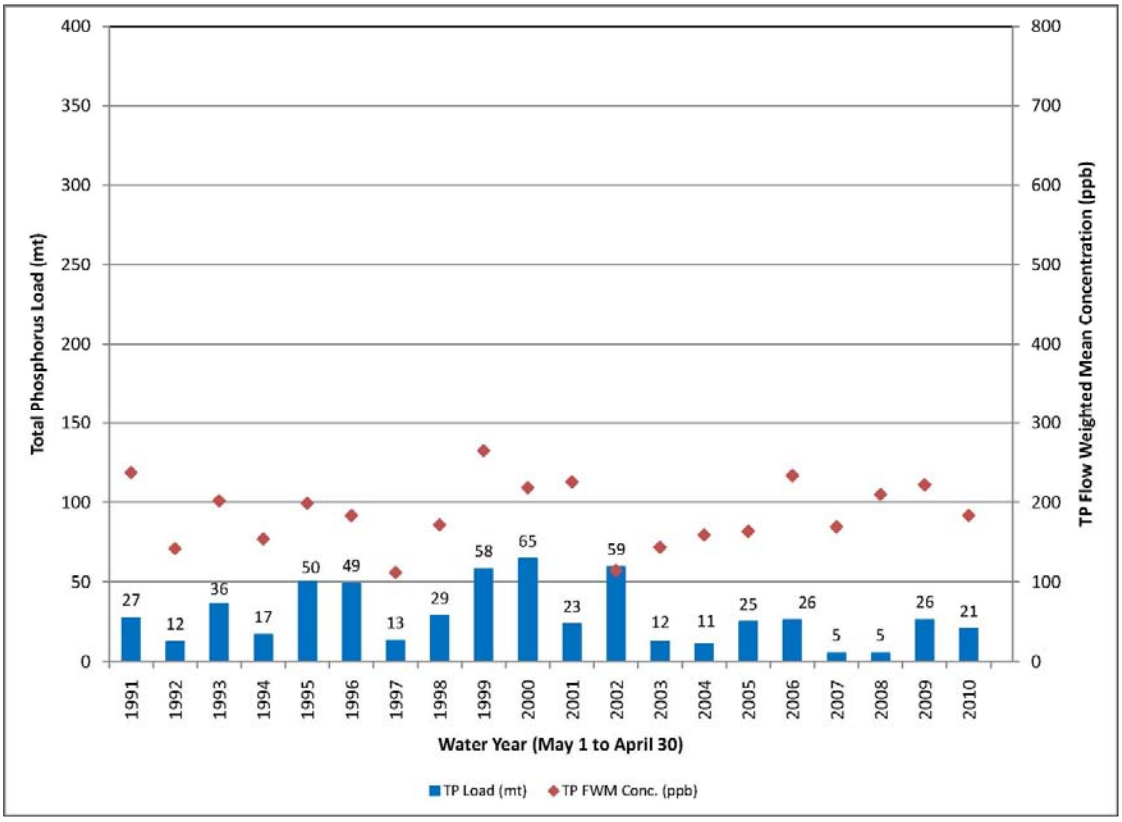

Figure 4-15. South Lake Okeechobee Sub-watershed observed TP loads and FWM concentrations.

LAKE OKEECHOBEE WATERSHED SOURCE CONTROL STRATEGY

The current objective is to implement effective nutrient source controls through the efforts of the coordinating agencies and requires the establishment of criteria and performance metrics that ensure runoff to the tributaries and canals that discharge into Lake Okeechobee allow the agencies to meet the goals of NEEPP.

The SFWMD's current initiatives are focused on revising the Rule 40E-61 and developing the basin guidelines for the ERP program to meet this objective. These initiatives include:

- Implement phosphorus source control program utilizing BMPs within the LOW.
- Recognize agricultural land uses that are participating in the FDACS BMP program under Chapter 5M-3, F.A.C., by a certain deadline as meeting the intent of the SFWMD's rule (to prevent duplication of effort).
- Establish a timeline for implementation of BMPs within the watershed.
- Establish a load or concentration-based performance measures for the collective source control programs implemented by the coordinating agencies.
- Define the monitoring network necessary to (1) monitor compliance with the established performance measures, (2) identify priority areas of water quality concern and BMP improvement, and (3) provide data to evaluate and enhance performance of downstream treatment facilities.
- Establish a plan for improving the collective source control programs implemented by the coordinating agencies should the expected water quality criteria not be met.
- Ensure that the rule is consistent with the Lake Okeechobee Watershed Protection Plan.
- Include incentives for permittees to participate in TP reduction demonstration projects that will provide valuable data for expanding, accelerating, and improving the implemented BMPs to meet water quality objectives and for further refinement of the source control program as necessary.
- Complete ERP basin guidelines.

The FDEP current initiatives include:

- Continuing the state-wide stormwater rule development with the water management districts.
- Continuing rule development to revise Florida's domestic wastewater residuals regulations.

The FDACS current initiatives include:

- Increasing the number of agricultural lands enrolled in FDACS-adopted BMP programs.
- Continuing to develop and adopt additional BMP rules.

Lake Okeechobee Watershed Source Control Activities

Summary of Water Year 2010 Activities

The main focus of Lake Okeechobee Watershed source control programs in WY2010 was to (1) conduct rulemaking to incorporate the most recent legislative changes into the coordinating agencies' respective rules, (2) conduct monitoring to evaluate effectiveness and identify areas of concern, and (3) increase BMP implementation. During WY2010, the coordinating agencies continued to process permits or Notice of Intents under existing rules and made progress toward amending their respective rules as required by the legislative changes and identifying high priority areas of existing water quality concern for BMP implementation. Updates of the coordinating agency activities that have taken place during WY2010 include:

1. **Regulatory Program Rule Development/Lake Okeechobee Source Control Program Permitting.** The SFWMD continued to issue permits for phosphorus source control plans under the current rule. The SFWMD also continued rule development efforts to amend Chapter 40E-61, F.A.C., to reflect changes following NEEPP. Stakeholder meetings were held to collect public comments for rule development efforts.
2. **Performance Measure Development.** The SFWMD continued development of performance measures for the collective source control programs in the LOW.
3. **Technical Evaluation of the Lake Okeechobee Watershed Assessment Monitoring Network.** The SFWMD completed the evaluation of the LOWA Monitoring Network in WY2010 for the Taylor Creek/Nubbin Slough Sub-watershed. Evaluations of the remaining sub-watersheds will be completed internally during WY2011 and WY2012, resulting in a process for ongoing annual evaluations. The purpose of this SFWMD evaluation is to analyze historical TP data to determine the most efficient system of sample collection and data analysis. Other objectives of this evaluation are to develop a scientific process to identify areas of concern within the watershed and to manage the dynamic sampling network.
4. **FDACS BMP Enrollment by Lake Okeechobee Watershed Agricultural Landowners.** The FDACS continued to enroll agricultural landowners in adopted BMP programs. To enroll, farmers operating in an area covered by FDACS BMPs submit a Notice of Intent under the appropriate rule to implement the adopted BMPs applicable to their operations.
5. **Adoption of Agricultural State-wide Agricultural BMPs by the FDACS.** The FDACS continued the development of BMPs with the adoption of Citrus, Lake Okeechobee Watershed, Container Nurseries, and Conservation Plans BMP programs.
6. **State-wide Stormwater Rule and Applicant's Handbook Development.** The FDEP and state water management districts developed a draft Stormwater Treatment Rule (Chapter 62-347, F.A.C.) with regulatory criteria for stormwater treatment systems that will control pollutant loads. The FDEP continued to work on refining the draft rule and the applicant's handbook.
7. **Domestic Wastewater Residuals Regulations Revisions.** The FDEP's proposed amendments to Chapter 62-640, F.A.C., were adopted by the Environmental Regulation Commission on May 20, 2010.

Anticipated Activities for Water Year 2011

1. **Performance Measure Technical Support Document.** During WY2011, the SFWMD, along with contractors Gary Goforth, Inc., and L. Hornung Consulting, Inc., plan to prepare a technical support document for the performance measures to be used in the LOW.

2. **Regulatory Program Rule Revision.** Efforts will continue to revise Chapter 40E-61, F.A.C., including holding public workshops. As required by Chapter 120.54, F.S., an analysis of the costs of the Lake Okeechobee Watershed Source Control Program rule will be completed.
3. **Northern Everglades ERP Basin Guidelines.** The SFWMD is preparing a guidance document to communicate how the existing rules apply to the draft NEEPP basin rule. The intent is to ensure that new development will not increase the average annual discharge volume of stormwater above existing conditions.
4. **Continued FDACS BMP Enrollment by Agricultural Landowners.** FDACS will continue to enroll agricultural lands within the three Northern Everglades watersheds in an FDACS-adopted BMP program.
5. **Additional FDACS BMP Program Development and Adoption.** FDACS will continue efforts to adopt additional BMP programs that will encompass operational types such as equine/horse farms and specialty fruit and nut.
6. **Continued FDACS BMP Cost-Share Programs.** FDACS will continue to fund cost-share programs for BMP implementation as funds are available.

FUTURE EFFORTS FOR THE LAKE OKEECHOBEE WATERSHED

The boundaries of the Lake Okeechobee Watershed source control program were expanded with the adoption of NEEPP, and include areas not previously regulated by the SFWMD for phosphorus source controls. Future efforts will involve incorporating an adaptive management process for optimizing the source control programs' effectiveness. This process is expected to utilize an optimized monitoring network that will assist in prioritizing resources available to those areas with the greatest water quality concern in order to enhance the performance of downstream treatment facilities.

It is anticipated that future BMP improvement efforts will be guided by the overall phosphorus loads from each sub-watershed and how those loads compare against performance measures. Further refinement of BMPs during the optimization process may be possible down to the summary basin level if TP loading data are available. It is anticipated that after BMPs are implemented under the revised Lake Okeechobee Watershed source control program rule, this chapter of the *South Florida Environmental Report* (SFER) – *Volume I* will report on the progress of load reductions from BMPs at both the sub-watershed and summary basin level.

STATUS OF SOURCE CONTROLS IN THE ST. LUCIE AND CALOOSAHATCHEE RIVER WATERSHEDS

Carmela Bedregal and Agnes Ramsey

The collective source control efforts by the coordinating agencies in the St. Lucie and Caloosahatchee River watersheds will be similar to those described for all of the Northern Everglades watersheds in the *Overview of Northern Everglades Source Controls* section of this chapter.

The development of the SFWMD's regulatory nutrient source control programs for each river watershed (to develop and implement rule revisions for Chapter 40E-61, F.A.C.) was initiated in late 2009 in response to NEEPP legislation. The St. Lucie and Caloosahatchee river watershed regulatory nutrient source control programs will be implemented in four phases, (1) water quality monitoring, (2) data management and assessment, (3) BMP effectiveness performance measure development, and (4) rulemaking.

Phases 1 through 3 consist of assessing the suitability of the existing water quality monitoring program and historic data for measuring the performance of a regulatory source control program, and developing performance measures to set benchmarks for evaluating the effectiveness of the collective source control programs. These phases are intended to support efforts to "maximize reductions in nutrient loads to the estuaries" as described in the watershed protection plans, and contribute to achieving phosphorus and nitrogen TMDLs once they are established. Phase 4 consists of amending Rule 40E-61, F.A.C., to include the St. Lucie and Caloosahatchee river watershed regulatory nutrient source control programs.

Upon implementation, the St. Lucie and Caloosahatchee river watershed regulatory nutrient source control programs are expected to:

- Implement a phosphorus source control programs utilizing BMPs for all lands within the river watersheds.
- Recognize agricultural lands that are enrolled in the FDACS BMP program under Chapter 5M-3, F.A.C., by a certain deadline as meeting the intent of the SFWMD's rule.
- Establish a timeline for implementation of BMPs within the river watersheds.
- Establish load- or concentration-based performance measures for the collective source control programs implemented by the coordinating agencies in the river watersheds.
- Define the network necessary to monitor compliance with the established performance measures, to identify priority areas of water quality concern and BMP improvement, and to provide data to evaluate and enhance performance of downstream treatment facilities.
- Establish a plan for improving the collective source control programs implemented by the coordinating agencies should the expected water quality criteria not be met.
- Ensure that the river watershed regulatory phosphorus source control programs are consistent with data presented in the respective protection plans.

- Include incentives for permittees to participate in phosphorus and nitrogen reduction demonstration projects that will provide valuable data for expanding, accelerating, and improving the implemented BMPs to meet water quality objectives and for further refinement of river watershed regulatory nutrient source control programs as necessary.

During WY2010, the SFWMD initiated Phase 1 (water quality monitoring) and Phase 2 (data management and assessment) of the plan for development of river watershed regulatory nutrient source control programs.

FUTURE EFFORTS FOR THE ST. LUCIE AND CALOOSAHATCHEE RIVER WATERSHEDS

It is anticipated that the coordinating agencies will continue to develop and implement source control programs in the river watersheds that will address phosphorus and nitrogen impacts. The SFWMD will continue to develop the regulatory nutrient source control programs for each river watershed and rulemaking may begin in 2013.

FDACS efforts identified for the LOW will apply to lands within the St. Lucie and Caloosahatchee river watersheds as well. Future efforts for the river watersheds will involve incorporating adaptive management processes for optimizing source control program effectiveness. This process is expected to utilize an optimized monitoring network that will assist in prioritizing resources available to those areas with the greatest water quality concern in order to enhance the performance of downstream treatment facilities.

OVERVIEW OF SOUTHERN EVERGLADES SOURCE CONTROLS

Ximena Pernett and Steve Sarley

Contributors: Carmela Bedregal, Carlos Adorisio, Pamela Wade, Stuart Van Horn and Jonathan Madden

The Southern Everglades source control program is one of the strategies to achieve water quality standards in the Everglades Protection Area (EPA). The Everglades Forever Act (EFA) Section 373.4592, F.S., outlines the SFWMD's responsibilities and schedules to implement basin-specific solutions to control phosphorus at the source. The strategy includes (1) implementation of BMPs for phosphorus reduction, (2) regulatory programs, (3) voluntary programs, (4) educational programs, and (5) integration with local and regional water quality projects.

The EFA mandates specific performance levels for controlling phosphorus in discharges from the ECP basins (the EAA and C-139 basins) in the Southern Everglades. For the non-Everglades Construction Project (non-ECP) basins, the EFA requires the FDEP to issue long-term compliance permits to the SFWMD to regulate phosphorus levels in discharges, and it is expected these permits will include TP limitations. Supplemental information for the ECP and non-ECP basins is provided in Appendices 4-2 and 4-3 of this volume, respectively.

The SFWMD is required to implement, monitor, optimize, and report on the progress of the Everglades phosphorus source control strategy for each basin on an annual basis in accordance with the EFA. In accordance with the EFA, BMP implementation guidelines are outlined in a SFWMD regulatory rule (Chapter 40E-63, F.A.C.) for the ECP basins (available at www.sfwmd.gov/rules) and through the FDEP Permit No. 06, 502590709 for the non-ECP basins. SFWMD Rule 40E-63 is also known as the Everglades Works of the District (EWOD) regulatory program.

The long-term Everglades water quality goal is for all discharges to the EPA to achieve and maintain water quality standards in the EPA, including compliance with the TP criterion established in Rule 62-302.540, F.A.C. This means projects with a combination of source control strategies, for example, Stormwater Treatment Areas (STAs) (see Chapter 5 of this volume) and alternative treatment technologies (see Chapter 10 of this volume). Projects like these are expected to be integrated with other regional water management projects in a comprehensive approach. Controlling phosphorus at the source is a critical component of water quality improvement efforts in the Everglades restoration program.

The SFWMD has identified all basins with discharges tributary to the EPA in which phosphorus source control programs are to be implemented (see **Figure 4-1**). The background and details of the source control programs for these basins, including the requirements for (1) implementing BMP plans, Discharge Monitoring plans, and Water Quality Improvement Plans (WQIPs), (2) research and demonstration projects, (3) data evaluation, (4) compliance methodologies and determinations, (5) and educational and outreach activities, have been extensively reported in previous SFERs.

To ensure compliance with the EFA, the SFWMD must comply with specific source control requirements stipulated in permits issued by the FDEP (these are the ECP and the non-ECP permits). Both permits incorporate a comprehensive approach for controlling phosphorus,

including implementation of BMPs utilizing regulatory, cooperative, and educational programs. The SFWMD is required by permit to report on the results of these programs annually. This chapter and related (Volume I and Volume III) appendices serve as the reporting mechanisms to fulfill this requirement.

The source control strategy for the basins tributary to the ECP relies on an EFA-mandated regulatory program that requires BMP implementation and specific phosphorus load limits in discharges from the basins. Continued implementation of the BMP mandatory programs in the EAA and C-139 basins, continued implementation of the WQIPs for the non-ECP basins, and achievement of the required levels of performance in TP loading from these basins are necessary for the SFWMD to achieve the phosphorus criterion in the EPA and fulfill its obligations under the EFA and the federal Everglades Settlement Agreement (Settlement Agreement dated July 26, 1991, entered in Case No. 88-1886-CIV-MORENO, U.S. District Court for the Southern District of Florida, as modified by the Omnibus Order entered in the case on April 27, 2001). During WY2010, the SFWMD continued to implement the primary source control activities listed in **Table 4-4** on a basin-specific basis. Detailed updates on these activities are provided in the *Status of Source Controls in the ECP Basins* and *Status of Source Controls in the Non-ECP Basins* sections of this chapter.

ECP BASINS

ECP permits require the SFWMD to construct, maintain, and operate the ECP in the EAA and C-139 basins. These permits regulate the construction and operation of the STAs and require the SFWMD to provide reasonable assurance that the EAA and C-139 basins are complying with a mandated phosphorus source control program for discharges to the STAs. The ECP permits also require the SFWMD to assess other tributary basins to the STAs through water quality monitoring to determine if additional regulatory programs are needed.

The source control program for ECP basins is defined in Rule 40E-63. BMP plans are approved through the regulatory program and are implemented by individual permittees. The rule defines the criteria that a BMP plan must meet to be approved. The regulatory program relies on technical information developed by others (e.g., university, industry, non-profit organizations, etc.) and is focused on implementation within the framework of Rule 40E-63. Although the SFWMD provides regulatory incentives and cost-sharing for BMP research and demonstration projects, the BMP regulatory program is not a research program. A discussion of what constitutes an acceptable BMP plan, along with observations made regarding EAA BMP plans is presented in the 2009 SFER – Volume I, Appendix 4-1.

This chapter provides WY2010 TP results for the ECP basins and an update on the progress of their regulatory required activities. Chapter 5 of this volume provides an update on STA performance, compliance, and optimization as required by the ECP permit.

NON-ECP BASINS

Seven basins that discharge directly to the EPA are not part of the ECP. Five of these basins have discharge structures that are operated and maintained by the SFWMD and are permitted under the non-ECP permit: C-11 West, North New River Canal (NNRC), Feeder Canal, L-28, and C-111. These discharge structures are the S-9 and S-9A (C-11 West), G-123 (NNRC), S-190 (Feeder Canal), S-140 (L-28), and S-18C, S-332D, and S-174 (C-111). There are two remaining non-ECP basins that are capable of discharging directly to the EPA through structures that are not owned or operated by the SFWMD: North Springs Improvement District (NSID) and Boynton Farms. Under the EFA, the SFWMD has implemented source control programs in each of these basins through development of WQIPs equivalent to those required under the non-ECP permit. Discharges from these basins are extremely limited (see the *Status of Source Controls in the Non-ECP Basins* section of this chapter for details).

The non-ECP permit requires the implementation of basin-specific WQIPs to ensure progress toward ultimately achieving established water quality standards in discharges from each of the non-ECP basins. The WQIPs are being implemented to control TP at the source and include (1) voluntary BMPs, (2) training and educational initiatives, (3) cooperative agreements, (4) modification of stormwater system permits to include water quality and operational criteria, (5) basin-specific regulatory programs, and (6) full integration with ongoing and future CERP and other local construction projects.

The non-ECP permit regulates the operation and maintenance of water control structures within the control of the SFWMD that discharge into, within, or from the EPA and are not included in the ECP. As required by the EFA, the Phase II non-ECP permit will require compliance with the TP limits for the C-111, C-11 West, NNRC, Feeder Canal, and L-28 basins. As part of the WQIPs, the C-139 Annex (within the L-28 Basin) will be redirected to Stormwater Treatment Area 6 and, in WY2011, is expected to be re-designated as an ECP basin. This chapter provides an update of the WQIPs for each non-ECP basin. The *Status of Source Controls in the Non-ECP Basins* section of this chapter presents TP data to evaluate the success of the WQIPs and to evaluate each non-ECP basin's progress toward achieving established water quality standards and compliance with anticipated TP limitations. While this chapter focuses on TP reduction in non-ECP basin discharges to the EPA, this volume's Chapter 3A and associated appendices provide an evaluation of water quality as required by non-ECP permit conditions. A summary of source control activities for ECP and non-ECP basins is presented in **Table 4-4**.

Table 4-4. Summary of ECP and non-ECP source control activities for WY2010.

Watershed or Basin	Water Quality Improvement and Related Projects	BMP Development and Implementation	Education and Training
Everglades Construction Project (ECP)			
Everglades Agricultural Area (EAA)	Supplemental Long-Term Plan Projects	Permit-required Best Management Practices (BMPs); EAA – Everglades Protection District (EPD) BMP Research	On-site BMP Verifications; University of Florida/Institute Food and Agricultural Sciences (UF/IFAS) BMP Training Workshops; Development of UF/IFAS Extension Materials
C-139	Supplemental Long-Term Plan Projects, C-139 Regional Feasibility Study	Permit-required BMPs; C-139 BMP Demonstration and Effectiveness Grant Program; C-139 Basin Vegetable Production Demonstration Project; Evaluation of an aboveground impoundment (AGI) for reducing farm-scale phosphorus discharge in South Florida Demonstration Project	On-site BMP Verifications; Compliance Workshops with Landowners
non-Everglades Construction Project (non-ECP)			
C-11 West	Broward County Water Preserve Area [Comprehensive Everglades Restoration Plan (CERP)]; South Broward Drainage District and Central Broward Water Control District Improvements	Broward Everglades Working Group (BEWG) Comprehensive Pollution Reduction Action Plan; Urban, Equine, and Golf Course BMPs; Environmental Resource Permit (ERP)-required BMPs	Educational Public Service Announcements (PSAs); Know-The-Flow Workshops; website development
North New River Canal (NNRC)	Water Conservation Areas 2 and 3 Diversion (CERP)	BEWG Comprehensive Pollution Reduction Action Plan; Urban, Equine, and Golf Course BMPs	Educational PSAs; Know-The-Flow Workshops; website development
North Springs Improvement District (NSID)	Hillsboro Site 1 Impoundment (Fran Reich Preserve) (CERP)	BEWG Comprehensive Pollution Reduction Action Plan; BMP Cooperative Agreement; Golf Course BMPs; ERP-required BMPs	Educational PSAs; Know-The-Flow Workshops; website development

Table 4-4. Continued.

Watershed or Basin	Water Quality Improvement and Related Projects	BMP Development and Implementation	Education and Training
(non-ECP *continued*)			
Feeder Canal	Big Cypress/L-28 Interceptor Modifications (CERP); Seminole Tribe Water Conservation Plan (WCP) Project; McDaniel Ranch Surface Water Management System, C-139 Regional Feasibility Study	Western Basins BMPs required under existing regulatory programs	On-site BMP verifications; BMP education and training workshops; one-on-one compliance efforts
L-28	Stormwater Treatment Area 6 Expansion (ECP); C-139 Annex Diversion; Seminole Tribe WCP Project; Miccosukee Tribe Water Management Plan Project, C-139 Regional Feasibility Study	C-139 Annex BMP implementation (ERP-required)	On-site BMP verifications
C-111	C-111 Project; C-111 Spreader Canal (CERP); Combined Structural and Operational Plan	Mobile Irrigation Lab	Website development
Boynton Farms	Palm Beach County Agricultural Reserve Water Reservoir (CERP)	Alternatives Evaluation including structural BMP and diversion options; ERP-required BMPs	Coordinate with landowners to promote BMP education and training

STATUS OF SOURCE CONTROLS IN THE ECP BASINS

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BACKGROUND

For the EAA and C-139 basins, the EFA mandates a regulatory source control program to implement BMPs to control phosphorus at the source and a monitoring program to assess program effectiveness [Section 373.4592(4)(f), F.S.]. The EFA further mandates that SFWMD Rule 40E-63 is to outline the specific methodology and permissible TP loading levels for both basins based on historical data or baseline periods defined in the EFA. For the EAA, the legislature provided a tax incentive credit against the EAA agricultural privilege tax for any phosphorous load reductions achieved in excess of 25 percent in order to encourage BMP performance and maximize load reductions. Achieving TP load requirements from these tributary basins is critical to the success of the ECP because the STAs were designed based on historical data and an expected range of inflow TP loads. It is primarily the source control program's mandated implementation of BMPs in the EAA and C-139 basins that regulate TP loads in discharges from the basins prior to inflow to an STA. Along with the design characteristics of the STAs, performance of an STA in achieving further load reductions to meet EPA water quality standards is reliant on the level of phosphorous discharged to the STA for treatment.

The EAA Basin is required to achieve a 25 percent reduction of the TP loads discharged when compared to the pre-BMP baseline period as defined in EWOD. The specific compliance methodology to assess if the 25 percent reduction goal is being met is also outlined in Rule 40E-63. For the EAA Basin to meet compliance requirements, the actual TP load is evaluated against two criteria. For the first criterion, the actual annual TP load cannot exceed an estimated annual target load in three consecutive years. In other words, if the EAA Basin does not achieve the minimum 25 percent estimated load reduction at least once every three years, then compliance is not achieved. For the second criterion, compliance will not be achieved for any individual year if the actual TP load exceeds the limit load (upper 90 percent confidence level for the target load).

If the EAA Basin is determined to be out of compliance based on the target or limit criteria, then, in accordance with the rule, the data collected by the individual permittees under an approved Discharge Monitoring Plan for each farm are used as a secondary compliance method. This secondary method assesses individual farm TP load contributions and individual farm compliance. However, there is not a provision in the rule for use of TP load data from individual farms for determining compliance when the basin-level TP load reduction requirement is met. The SFWMD collects monitoring data from the EAA Basin at discharge locations to evaluate the overall effectiveness of the BMPs in achieving and maintaining compliance with the TP load reduction requirement. EAA landowners collect monitoring data for individual farm discharges (conditioned upon SFWMD-approved Discharge Monitoring plans).

For the C-139 Basin to be in compliance, it must also meet target and limit levels. However, in contrast to the EAA, which has a load reduction requirement of 25 percent, the C-139 Basin mandate is to maintain the historical loads observed during the baseline period.

The EFA states that if the basin is out of compliance, actions required from individual landowners are conditioned on the proportional share of the TP load discharged from the basin. A secondary compliance determination (specified in Rule 40E-63) for individual landowners in the C-139 Basin is an optional farm-level compliance and monitoring program. The specific procedures for determining EAA and C-139 basin compliance, basin-level data collection efforts, and farm-level discharge monitoring plans are outlined in EWOD, Appendices A and B.

Investigation to improve the selection, design criteria, and implementation of BMPs is ongoing and occurs through different mechanisms based on the factors specific to each basin. This ECP source control section provides a WY2010 update on compliance with TP loading limits and source control strategies for the EAA and C-139 basins. The compliance update includes WY2010 phosphorus results, monitoring program updates, short-term and long-term variations, and investigative issues. The source control strategies update includes program accomplishments, ongoing activities, and planned initiatives.

EVERGLADES AGRICULTURAL AREA BASIN UPDATE

During WY2010, the TP loads discharged from the EAA Basin decreased by 41 percent compared to the predicted load from the pre-BMP baseline period adjusted for hydrologic variability associated with rainfall. This represents the fifteenth consecutive year the EAA Basin was in compliance. Because the EAA Basin has been in compliance each year since the program's inception, the secondary compliance method at the farm level has not been necessary. Representative monitoring locations for determining WY2010 compliance with the TP load reduction requirement are shown in **Figure 4-16**.

Water Year 2010 Phosphorus Results

This section provides an update on the observed WY2010 TP loads in comparison to the basin's EFA mandated load limits as defined by Rule 40E-63. Additional detailed information on the EAA Basin-level monitoring program and summaries of sub-basin flows, related TP loads, and TP FWM concentrations are presented in Appendix 4-2 of this volume.

Table 4-5 provides a summary of the WY2010 results for the observed and predicted TP loads where the observed load is the measured load based on samples collected during the water year, and the predicted load is the pre-BMP baseline period load adjusted for the hydrologic variability associated with rainfall. The target loads (predicted reduced by 25 percent) are calculated based on the 50^{th} percentile confidence level value for predicted loads, while limit loads are calculated based on the 90^{th} percentile confidence level value. The alternate confidence levels accommodate for possible statistical error in the model. Limit loads provide for a higher confidence level so that a single year of exceedance verifies noncompliance. Target loads are evaluated based on exceedance for three consecutive years. The comparison for WY2010 shows that the EAA Basin achieved a 41 percent TP load reduction.

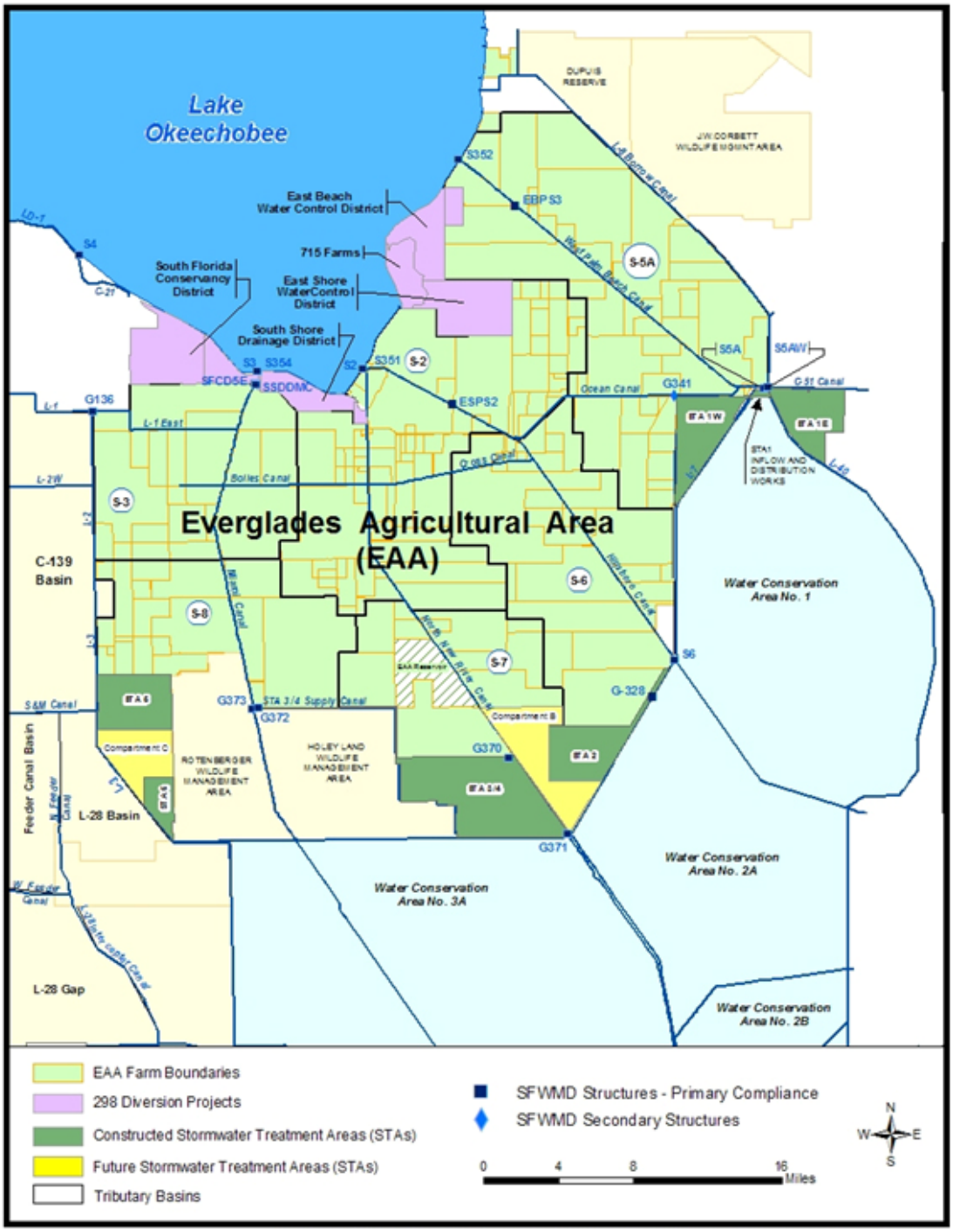


Figure 4-16. The Everglades Agricultural Area (EAA) Basin and primary compliance water control structures for the basin boundaries during WY2010.

Table 4-5. Results of WY2010 EAA Basin TP compliance calculations.

WY2010 EAA TP Load in Metric Tons (mt)	
Predicted TP load (adjusted for WY2010 rainfall amounts and monthly distribution relative to baseline period)[1]	288 mt
Target TP load (Predicted TP load reduced by 25%)	216 mt
Limit TP load (upper 90% confidence limit for target load)	302 mt
Observed WY2010 TP load from the EAA with BMPs implemented	169 mt
WY2010 TP load reduction (relative difference between observed and predicted TP loads)	**41%**
Three-year average TP load reduction	**55%**

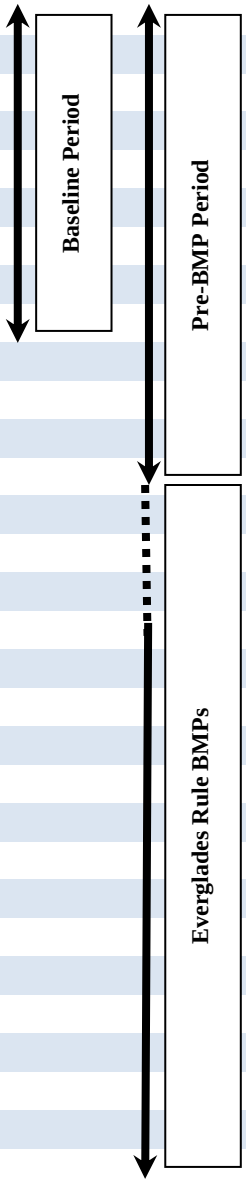
WY2010 EAA TP Concentration in Parts per Billion (ppb)	
Observed annual average EAA TP concentration prior to BMP implementation (WY1980–WY1988)[1]	173 ppb
Observed WY2010 TP concentration from the EAA with BMPs implemented	127 ppb
Three-year (WY2008–WY2010) FWM TP concentration	123 ppb

[1]The baseline period of record is October 1978–September 1988 in accordance with EFA requirements. Under Rule 40E-63, compliance is based on whole water year periods (May 1–April 30) that fall within the October 1978–September 1988 range, that is, WY1980–WY1988 (May 1, 1979–April 30, 1988).

Table 4-6 summarizes the data for all calculated water years. This table presents observed and predicted TP data and annual rainfall and flow measurements. Additionally, the TP values presented are attributable only to the EAA Basin (farms, cities, and industries) and do not represent the cumulative TP being discharged through the EAA boundary structures from all sources. The limit load is defined as the upper 90th percentile confidence level for the target load and accounts for statistical variability in the rule-mandated prediction model.

Table 4-6. WY1980–WY2010 EAA Basin TP measurements and calculations.

Water Year	Observed TP Load (mt)	Predicted TP Load[1] (mt)	% TP Load Reduction[2]	Annual Rainfall (inches)	Annual Flow (kac-ft)	Baseline and BMP Status Timeline
1980	167	154	-9%	53.50	1,162	
1981	85	98	13%	35.05	550	
1982	234	255	8%	46.65	781	
1983	473	462	-2%	64.35	1,965	
1984	188	212	11%	49.83	980	
1985	229	180	-27%	39.70	824	
1986	197	240	18%	51.15	1,059	
1987	291	261	-12%	51.97	1,286	
1988	140	128	-9%	43.43	701	
1989	183	274	33%	39.68	750	
1990	121	120	-1%	40.14	552	
1991	180	219	17%	50.37	707	
1992	106	179	41%	47.61	908	
1993	318	572	44%	61.69	1,639	
1994	132	160	17%	50.54	952	
1995	268	388	31%	67.01	1,878	
1996[3]	162	503	68%	56.86	1,336	
1997	122	240	49%	52.02	996	
1998	161	244	34%	56.12	1,276	
1999	128	249	49%	43.42	833	
2000	193	425	55%	57.51	1,311	
2001	52	195	73%	37.28	667	
2002	101	227	55%	49.14	1,071	
2003	81	125	35%	45.55	992	
2004	82	229	64%	46.76	961	
2005	182	444	59%	50.98	1,190	
2006	153	270	44%	50.08	1,035	
2007	150	182	18%	37.23	727	
2008	94	167	44%	46.95	619	
2009	129	407	68%	43.7	877	
2010	169	288	41%	61.9	1079	



[Notes: kac-ft = thousands of acre-feet. Dashed vertical line indicates the period for which BMPs were not fully implemented from WY1992–WY1995.]

[1] Predicted TP load represents the baseline period load adjusted for rainfall variability.

[2] Percent TP load reduction values for WY1980–WY1988 represent the compliance model calibration period.

[3] 1996 was the first year of compliance measurement for the EAA Basin.

As shown in **Figures 4-17** and **4-18**, if the EAA Basin had only met the minimum requirement of a 25 percent reduction in TP load for the 15 years that the program has been fully implemented, 1,049 mt of phosphorus would have been prevented from leaving the basin. Instead, the EAA Basin has exceeded the minimum requirements by preventing 2,237 mt (53 percent reduction overall) of TP from leaving the basin as runoff. This comparison is based on what would have been expected under the same hydrologic conditions during the pre-BMP baseline period.

The EAA Basin percent TP load reduction trend is presented in **Figure 4-19**. The solid line shows the three-year trend of percent load reduction. The diamond (♦) symbol represents the annual measurements. An upward trend in the solid line in **Figure 4-19** denotes a reduction in loads; that is, an overall long-term improvement in the water quality of EAA Basin runoff discharges.

TP concentrations are calculated in addition to load; however, concentrations are not evaluated to determine EAA Basin compliance. The annual concentrations and three-year trends presented are annual FWM values calculated by dividing the total annual cumulative TP load by the total annual cumulative flow. **Figure 4-20** shows the TP concentration trends for the EAA discharges.

Supplemental evaluation of the EAA data at the basin, sub-basin, and permit level is presented in Appendix 4-2 of this volume. The supplemental evaluation includes compliance calculation details, monitoring data and water quality summary, discussion of short-term and long-term variations in basin loads, permit-level data, and agricultural privilege tax incentive credit information.

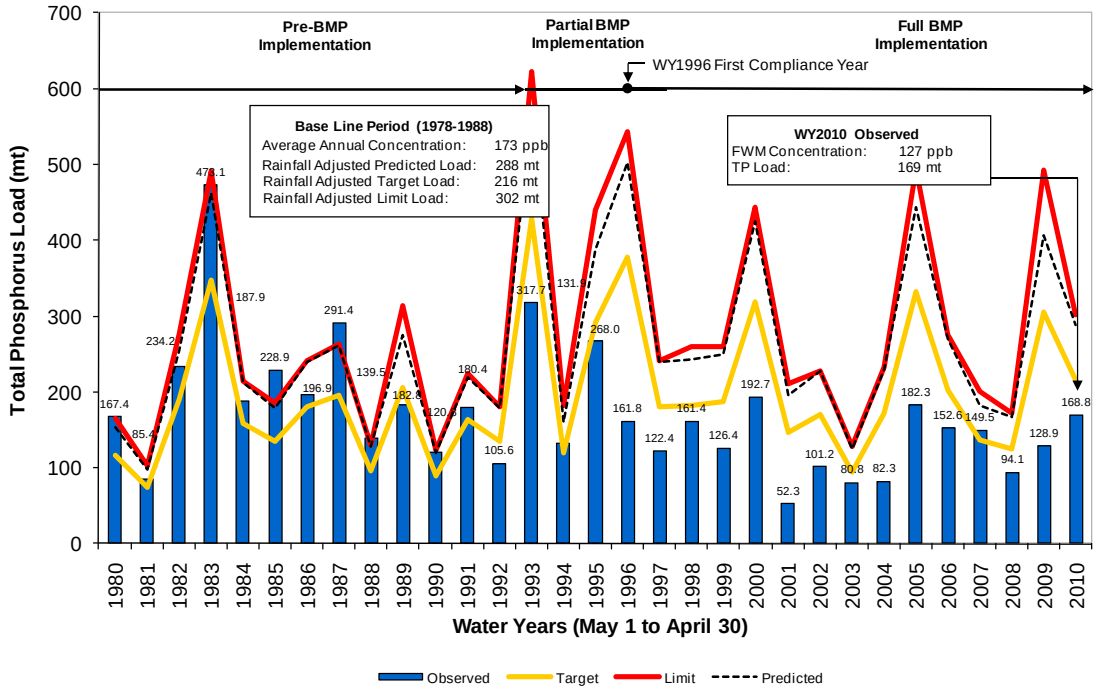


Figure 4-17. EAA Basin TP loads observed (measured) and predicted (calculated).

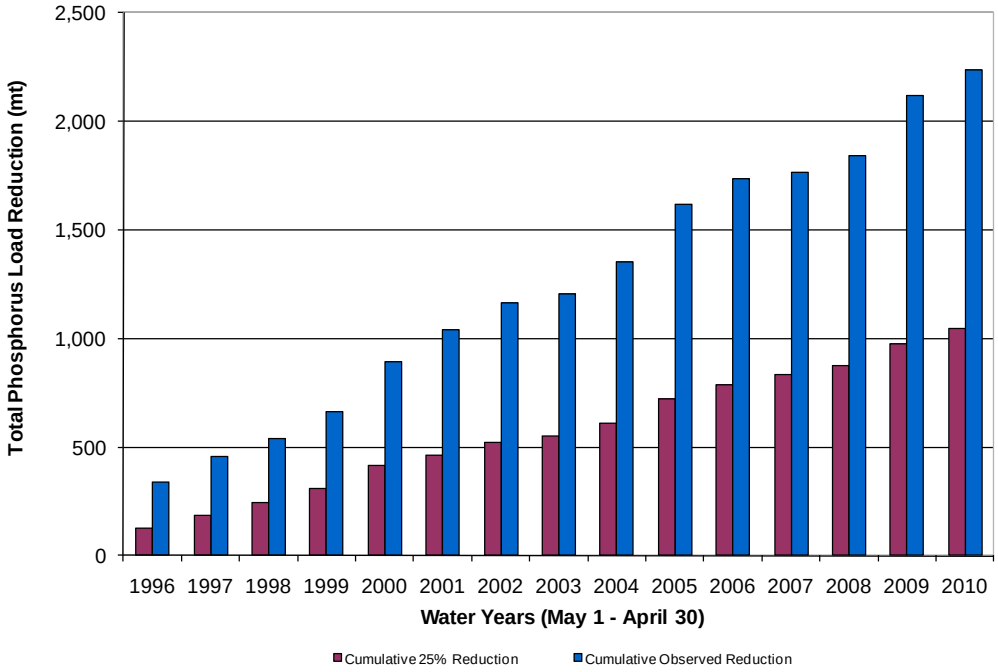


Figure 4-18. EAA Basin cumulative observed percent TP load reduction trend shown alongside the reduction target for each water year.

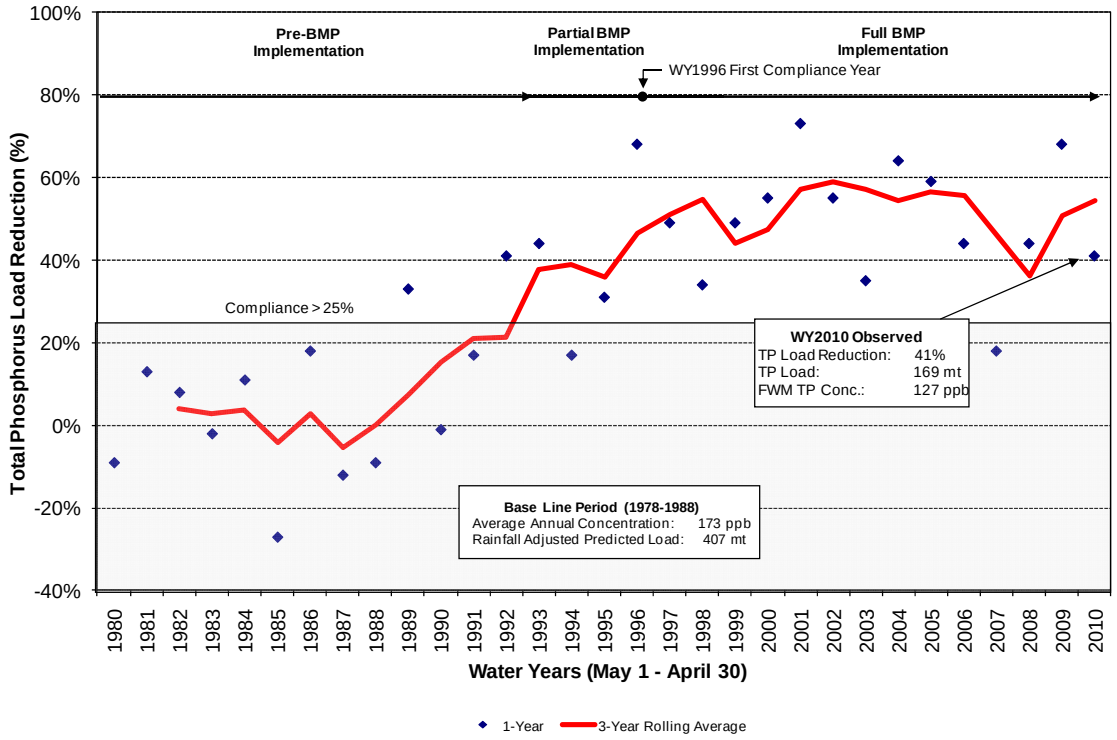


Figure 4-19. EAA Basin percent TP load reduction trend with period of record (POR) comparisons.

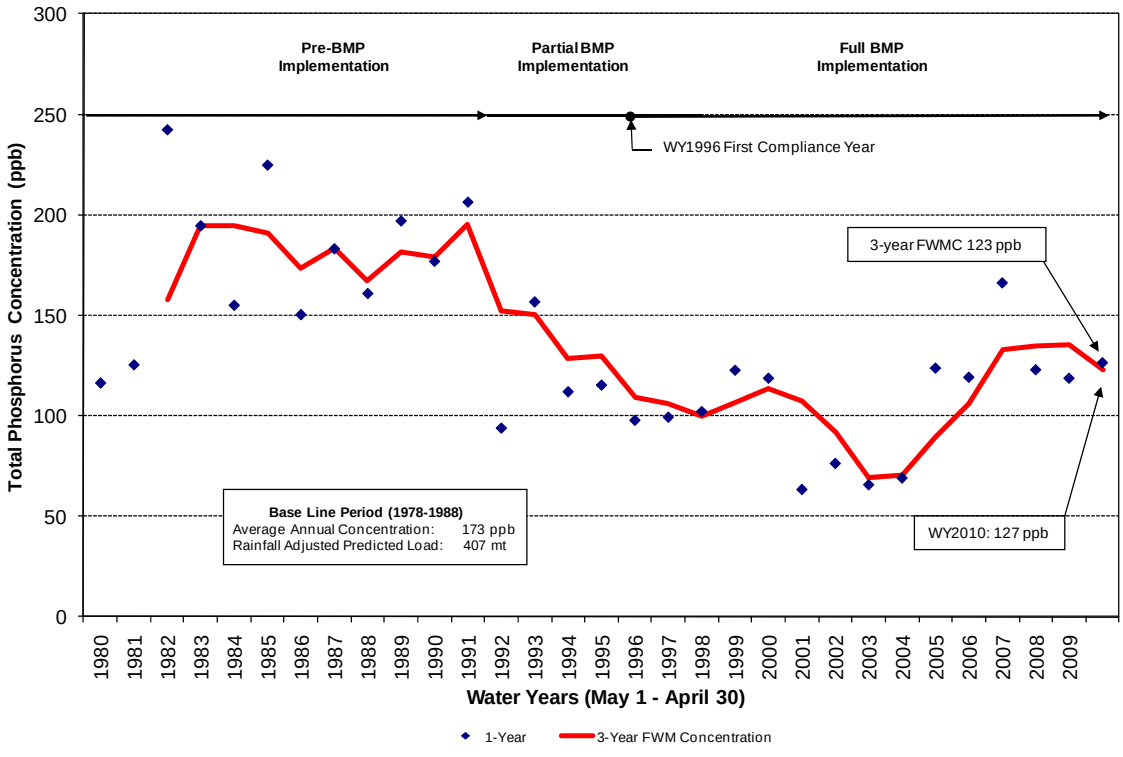


Figure 4-20. EAA Basin TP FWM concentration trends with POR comparisons.

EAA BASIN SOURCE CONTROL STRATEGY

The source control strategy for the EAA Basin primarily relies on an EFA-mandated regulatory program for BMP implementation for which compliance determinations began in WY1996. Rule 40E-63 requires a permit for a BMP plan for each crop or land use within each sub-basin or farm. In addition, through an adaptive management process, the regulatory program ensures that mandatory BMP implementation and performance measures continue to be applicable in response to regional changes and new tributaries to the Everglades.

The BMP plans are comprehensive, generally consisting of nutrient management, water management, and sediment controls. Changes to the BMP plans require the SFWMD's approval. Permittees are also required to collect water quality and quantity data at farm discharges (permit level) through approved discharge monitoring plans. Refer to 2009 SFER – Volume I, Appendix 4-1 for more information on comprehensive BMP plans and BMP plan examples, and Appendix 4-2, Table 6, for permit-level data for the EAA. Water quality data collected at the permit level are used as general indicators of individual BMP plan performance and used as a secondary means of compliance if the EAA is not in compliance at the basin level, but cannot be related directly to individual BMPs or considered in isolation of other potential factors affecting performance.

The original guidance document for the design of BMPs and implementation of BMP plans in the EAA is the Procedural Guide for the Development of Farm-Level Best Management Practice Plans for Phosphorus Control in the Everglades Agricultural Area, Version 1.1, developed by the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) (Bottcher et al., 1997). Additional research has been conducted to improve BMP effectiveness and design by the UF/IFAS pursuant to the EFA and Rule 40E-63 requirements and via the Everglades Agricultural Area – Everglades Protection District (EAA–EPD) Master Research Permit. Investigation to improve the selection, design criteria, and implementation of BMPs is ongoing. Updates to documentation for individual BMPs are available at: http://edis.ifas.ufl.edu (as of July 2010). Searching this site for "EAA BMP" provides documents including design criteria for construction (as applicable), operation of BMPs, and farm management applicable to the EAA. The SFWMD refers to these updated technical sources when conducting BMP field verifications and advising permittees on revising BMP plans. The update on source control activities describes the current investigations to enhance the body of knowledge on BMPs in the EAA. The SFWMD's current emphasis is on working cooperatively with the EAA–EPD to develop a scope of work for future research so that BMP effectiveness can be further enhanced.

In addition to the EAA–EPD research, BMP research is conducted by individual consultants for the EAA–EPD outside the oversight of the permit by individual landowners, other agencies, or UF/IFAS. Results from these research projects can result in recommendations to adjust BMP implementation, but consideration is given to site-specific conditions on a farm-by-farm case.

As indicated in the UF/IFAS Procedural Guide, the industry definition for a BMP is an "on-farm operational procedure designed to reduce P losses in drainage waters to an environmentally acceptable level." Based on Rule 40E-63, permittees are required to revise their BMP plan to enhance performance if the basin as a whole is not in compliance and the secondary performance measure at the individual farm level are both not met. However, since the EAA Basin has been in compliance with required phosphorus loading levels, implementation of more effective BMP practices has not been mandatory.

In addition, the strategy in the EAA Basin includes supplemental source control projects for the purpose of maintaining or improving the current level of performance. The SFWMD conducts upstream data collection at tributaries and supplementary analyses of non-agricultural and

agricultural sources with the potential to affect basinwide performance to determine the most effective source control strategies. Cooperation of landowners and special interests is necessary for the successful implementation of source controls beyond those required by the regulatory program.

EAA Basin Source Control Activities

Summary of Water Year 2010 Activities

During WY2010, the SFWMD implemented the ongoing EFA-mandated regulatory BMP program and made progress on the supplemental projects as detailed in the 2008 SFER – Volume I, Chapter 4. The following is an update on these activities:

1. **BMP Regulatory Program.** At the end of WY2010, there were 470,324 acres under 31 EWOD permits in the EAA. Tracking of the acreage where BMPs are fully implemented is essential to assess BMP program effectiveness. This is because BMP performance is measured based on the comparison of phosphorus loading levels from different water year periods with the assumption that major factors affecting runoff (rainfall and acreage) are the same for each period. Post-permit compliance activities continued in these farm basins through on-site BMP verifications. BMP verifications were prioritized based on farm location, water quality history, size, and date of previous verification.
2. **298 Diversion Projects.** Prior to calendar year 2001, the diversion areas discharged exclusively to Lake Okeechobee and therefore were not part of the EAA baseline period. From 2001–2005, diversion projects were completed to direct most of the flows from these areas to the south for treatment in STAs and discharge to the EPA. These are areas of overlap between the Northern and Southern Everglades source control programs — the source control programs established in these basins must achieve the discharge requirements of both the Lake Okeechobee TMDLs and the ECP. Defining a separate method for evaluating the impact of BMPs on TP loads in these recent tributaries (diversion areas) to the EPA is required by the EFA. Two phosphorus reduction performance goals continue in effect for these areas: to reduce the TP loads discharged from the areas by 25 percent, and to reduce the phosphorus loads discharged to Lake Okeechobee from the areas by 80 percent. The existing data for the 298 Diversion Projects and the state lease known as 715 Farms are evaluated each calendar year to assess compliance and to provide consistency with the source control program in the EAA.
3. **EAA TP Load Reduction Compliance Model.** A project to review EAA BMP rule models to determine how upcoming changes to EAA facilities due to Comprehensive Everglades Restoration Plan (CERP)/Everglades Expedited Restoration Projects would affect the TP load compliance and BMP replacement water models was initiated in September 2007. The objectives of the EAA TP Load Reduction Compliance Model are to review the algorithms contained in Rule 40E-63 and review the models implemented to assess compliance. Through consultant contract, the SFWMD is continuing to refine and document several potential components identified to improve and adapt to future configurations. Formalization of any conclusions or recommended action with respect to the EAA TP Load Reduction Compliance Model will depend upon analysis incorporating the final planned projects. Necessary changes will be incorporated into Rule 40E-63 through the rulemaking process.
4. **BMP Research.** In addition to the regulatory program, the EFA and Rule 40E-63 require EAA landowners, through the EAA–EPD, to sponsor a program of BMP research, testing, and implementation that monitors the efficacy of established BMPs in improving water quality in the EPA. The master permit for BMP research, testing, and implementation is the mechanism through which the SFWMD regulates research on BMP effectiveness and

outreach. Meaningful findings that can be incorporated into agricultural practices are essential to meet and maintain the performance goals of the ECP and to optimize the regulatory program. The master permit is issued to the EAA–EPD, and research is conducted by UF/IFAS in Belle Glade. The activities under the EAA–EPD Master Permit for WY2010 were as follows:

- Three BMP training workshops were conducted from September 2009–April 2010 for growers in the EAA with a total of 173 participants.
- After the SFWMD's final approval of the proposed modification to the scope of work, the following activities have been conducted: (1) initial survey of EAA farms located within the S-5A and S-6 sub-basins, (2) a draft report on farm selection submitted for the SFWMD's approval, and (3) all equipment needed for flow and phosphorus concentration monitoring and analysis were purchased. Installation of field equipment was pending at the time of this report.

5. **East Beach Water Control District (EBWCD) Data Collection and Analysis.** Upstream water quality data were collected January through September in 2008 and 2009 to gain additional insight on phosphorus speciation and sources within this area. Fifteen monitoring sites were previously selected based on contributing area, land use, and conveyance system configuration (Phase I). It was anticipated that the two periods of monitoring would provide sufficient data during varied dry and wet conditions to characterize water quality so that identification of the major nutrient sources within the basin could be determined. Analysis of the data has been initiated and preliminary conclusions indicate elevated levels of nutrients vary in location and timing throughout the year. Concentration spikes associated with rainfall-driven runoff have been identified in some areas as well as relatively continuous elevated levels potentially associated with groundwater sources. Continued evaluation will focus on identifying the most significant upstream contributions impacting the annual load discharged from EBWCD to the West Palm Beach Canal within the EAA's S-5A sub-basin. Concurrently with the project, the SFWMD signed a contract with the South Florida Conservancy District to spray floating aquatic vegetation at the EBWCD monitoring sites to ensure standard data collection procedures have been met.

Water Year 2011 Anticipated Activities

1. **BMP Regulatory Program.** The SFWMD's post-permit compliance activities are slated to continue. BMP verifications are expected to be emphasized based on the analysis of farm-level results for WY2010 using a prioritized list based on farm location, water quality history, size, and date of previous verification.
2. **298 Diversion Projects.** The SFWMD plans to continue the process of gathering stakeholders' input to (1) implement a compliance methodology for the diversion areas, (2) evaluate effectiveness of BMPs in the diversion areas discharging to the EPA to meet requirements of the EFA, and (3) ensure consistency with Lake Okeechobee water quality goals associated with NEEPP.
3. **BMP Research.** It is anticipated that the EAA–EPD will initiate implementation of the research on phosphorus loading from EAA farms based on improved floating aquatic vegetation and canal management practices, as well as conduct BMP training workshops and create publications. The following activities are being proposed for calendar year 2011: (1) site selection of eight study farms, (2) installation of monitoring equipment, (3) calibration period, and (4) an annual report.
4. **EAA TP Load Reduction Compliance Model.** Refinement of the EAA TP Load Reduction Compliance Model and documentation of the overall evaluation is scheduled to be completed by the SFWMD. The work will address many existing questions associated with the model's

calculation methodologies as well as assist in preparations for future changes to the EAA system operation. Tools have been developed to facilitate improvements to and testing of the regulatory model to fit future project configurations.

5. **Data Collection and Analysis in the S-5A, S-2 and S-6 Sub-basins.** Sediment data collection at the West Palm Beach and Hillsboro canals is expected be conducted through the contract signed between the SFWMD and UF/IFAS. The primary objective of the project is to characterize the sediments in the eastern EAA sub-basins at two major canals (West Palm Beach and Hillsboro canals) during wet and dry seasons, with a final report expected in WY2011.

C-139 BASIN UPDATE

During WY2010, the TP loads discharged from the C-139 Basin were below the predicted load from the pre-BMP baseline period adjusted for rainfall. This is the second year the basin was in compliance.

Rule 40E-63 allows for the option of a permit-level discharge monitoring plan to be considered as a secondary compliance methodology should the C-139 Basin be determined to be out of compliance. None of the permits issued to date include an optional Discharge Monitoring Plan; therefore, only C-139 Basin-level data are reported in this chapter. The C-139 Basin and the representative monitoring locations during WY2010 for determining compliance with TP load reduction are shown in **Figure 4-21**.

Water Year 2010 Phosphorus Results

This section provides an update on the observed WY2010 TP loads in comparison to the basin's EFA-mandated load limits as defined by Rule 40E-63. In an effort to focus on the BMP source controls efforts, individual flows, related TP loads, and FWM concentrations are presented. Supplemental evaluation of the C-139 Basin data is presented in Appendix 4-2 of this volume. The supplemental evaluation includes compliance calculation details, monitoring data, and a water quality summary as well as discussion of short-term and long-term variations in basin loads.

Table 4-7 provides a summary of the results of the WY2010 compliance analysis for total observed and predicted TP loads, where the predicted load is the pre-BMP baseline period load adjusted for differences in rainfall volume. Compliance is determined by comparing the observed TP load for the current water year to the predicted target load from the pre-BMP baseline period. Target loads are calculated based on the 50^{th} percentile confidence level under the current year's rainfall conditions, while limit loads are calculated based on the 90^{th} percentile. The alternate confidence levels accommodate for possible statistical errors in the model. A single-year exceedance of limit loads verifies noncompliance, while target loads are in noncompliance only when exceeded for three consecutive years.

The observed, predicted target, and predicted limit TP data for the C-139 Basin, along with the annual rainfall and flow measurements are presented in **Table 4-8**. The table presents these data since WY1980, which include the intermediate years after the baseline was selected and before BMP implementation was started. The TP values presented in **Table 4-8** are attributable only to the C-139 Basin.

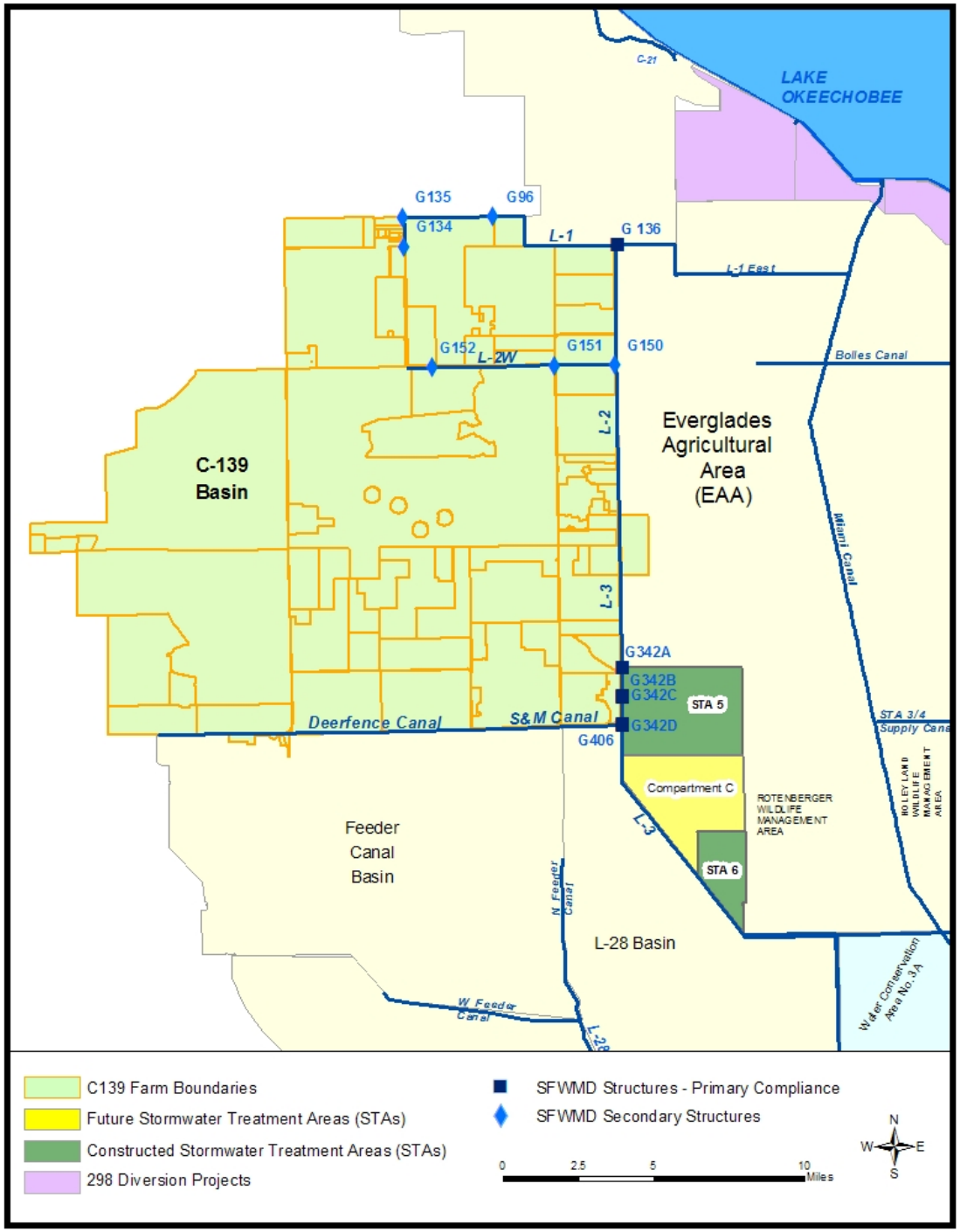


Figure 4-21. The C-139 Basin and primary compliance water control structures for the basin boundary during WY2010.

Table 4-7. Results of WY2010 C-139 Basin TP compliance calculations.

WY2010 C-139 Basin TP Load	
Target (Predicted) TP load (adjusted for WY2010 annual rainfall amount)	53.6 mt
Limit TP load (upper 90th percentile confidence level for target load)	97.8 mt
Observed WY2010 TP load from the C-139 Basin with BMP implementation (Level IV)	41.9 mt

WY2010 C-139 Basin TP Concentration	
Observed annual average C-139 Basin TP concentration prior to BMP implementation (WY1980–WY1988)[1]	227 ppb
Observed WY2010 TP concentration from the C-139 Basin with BMP implementation at Level IV	171 ppb
Three-year (WY2008–WY2010) flow-weighted mean TP concentration	200 ppb

[1]The baseline period of record is October 1978–September 1988 in accordance with EFA requirements. Under Rule 40E-63, compliance is based on whole water year periods (May 1–April 30) that fall within the October 1978–September 1988 range, that is, WY1980–WY1988 (May 1, 1979–April 30, 1988).

Table 4-8. WY1980–WY2010 C-139 Basin TP measurements and calculations.

Water Year	Observed TP Load (mt)	Predicted Target TP Load[1] (mt)	Predicted Limit TP Load[1] (mt)	Annual Rain (inches)	Annual Flow (kac-ft)	Baseline and BMP Status Timeline
1980	34.7	42.1	75.9	56.39	172	
1981	4.1	3.6	7.1	31.06	51	
1982	6.1	8.8	16.1	38.61	44	
1983	148.1	115.2	222.2	71.98	344	
1984	40.4	20.2	36.0	47.19	156	
1985	14.6	19.6	35.0	46.88	63	
1986	17.0	19.3	34.5	46.71	110	
1987	37.7	55.0	100.5	60.19	149	
1988	28.2	21.6	38.4	47.96	94	
1989	14.2	11.0	19.8	40.69	73	
1990	5.5	9.8	17.8	39.62	46	
1991	5.0	20.8	37.0	47.53	45	
1992	12.3	27.9	49.7	51.04	100	
1993	26.3	39.4	70.8	55.49	137	
1994	21.8	30.2	53.9	52.03	136	
1995	61.9	53.8	98.1	59.85	272	
1996	48.5	55.2	100.9	60.24	236	
1997	45.9	40.1	72.2	55.74	165	
1998	35.6	42.9	77.4	56.65	170	
1999	35.6	29.9	53.4	51.92	136	
2000	52.4	36.4	65.4	54.46	202	
2001	17.1	6.4	11.9	35.70	56	
2002	65.9	35.8	64.2	54.23	200	
2003	77.3 [3]	39.1	70.3	55.40	224	Level I BMPs[2]
2004	69.0	25.4	45.3	49.90	204	Level II BMPs
2005	40.3	27.1	48.3	50.68	168	Level III BMPs
2006	106.9	34.6	62.0	53.79	333	Level IV BMPs
2007	29.1	7.3	13.5	36.85	77	Level IV BMPs
2008	5.4	12.4	22.3	41.95	39	Level IV BMPs
2009	52.3	13.7	24.6	42.96	165	Level IV BMPs
2010	41.9	53.6	97.8	59.81	199	Level IV BMPs

Baseline Period

Pre-BMP Period

[1] Using the rainfall adjustment, target loads are calculated based on the 50th percentile confidence level value for predicted loads under the year's rainfall conditions, while limit loads are calculated based on the 90th percentile confidence level.

[2] First year of compliance measurement was WY2003.

In **Figure 4-22**, each bar represents the actual (observed) annual TP tonnage from the C-139 Basin in each water year, and the lines represent the annual predicted TP target and limit loads after being adjusted for rainfall by the rule-mandated method. **Figure 4-23** shows the TP FWM concentration of discharge from the C-139 Basin by both individual yearly concentration values and the three-year moving average. However, compliance in the C-139 Basin is determined by TP load discharged from the basin, not concentration.

In accordance with Rule 40E-63, the observed runoff TP load leaving the C-139 Basin is measured at the primary compliance sites G-136, representing the northern outflow boundary (L-1 canal) and G-342A–D [inflow structures to Stormwater Treatment Area 5 (STA-5), Flow-ways 1 and 2] and G-406, representing the southern boundary (L-2/L-3 canal). Although STA-5 has been expanded to include Flow-way 3, the G-406 structure will remain as a compliance boundary for the C-139 Basin. The rationale for maintaining G-406 as a boundary condition is based on two main issues: (1) moving the boundary from G-406 to numerous inflow points to the expanded treatment areas below the structure could result in introducing bias into the runoff calculations and could mask the true performance of the BMP program, and (2) it would introduce additional complexities to disaggregate the C-139 Basin and C-139 Annex discharges, which will co-mingle south of G-406 prior to entering the expanded treatment areas.

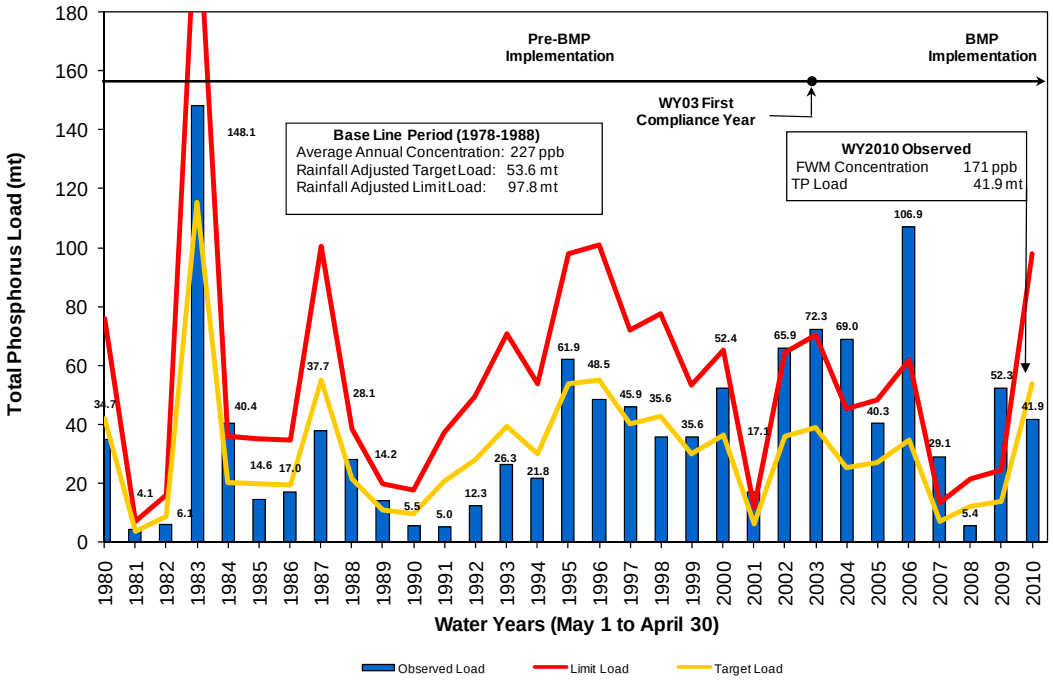


Figure 4-22. C-139 Basin TP loads observed (measured) and predicted (calculated).

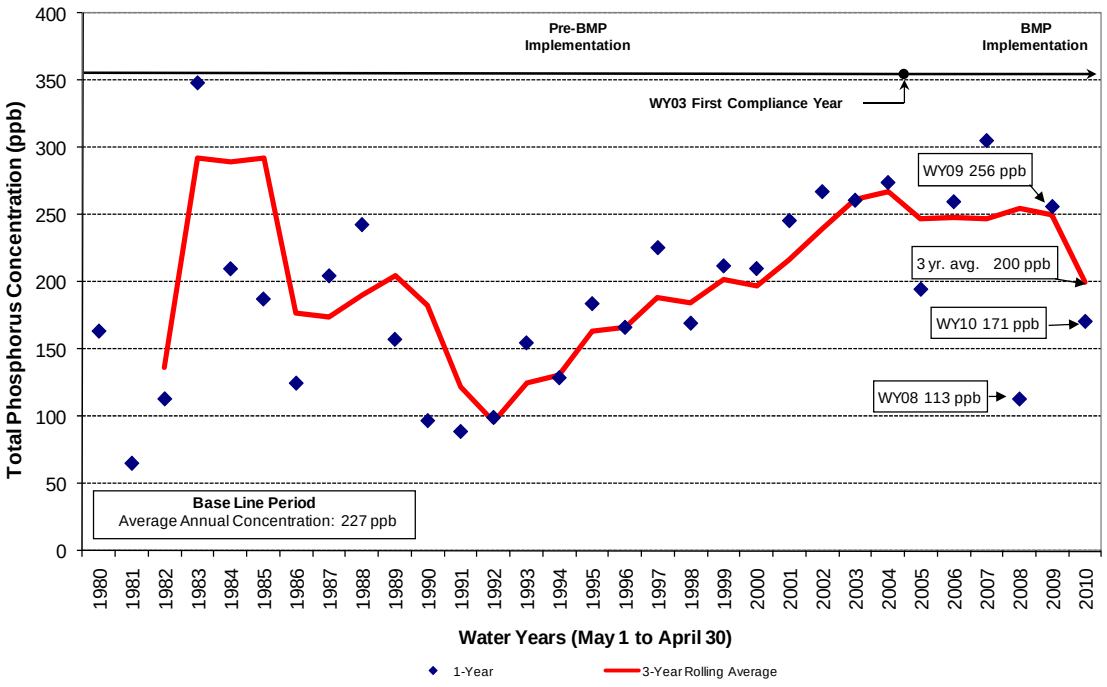


Figure 4-23. C-139 Basin TP FWM concentrations and three-year moving averages.

C-139 BASIN SOURCE CONTROL STRATEGY

The source control strategy for the C-139 Basin has primarily relied on the EFA-mandated regulatory program with increasing levels of BMP implementation based on compliance status with basin phosphorus load levels (targets and limits). The first year of BMP implementation and compliance determination was WY2003. BMP implementation levels and compliance actions since program inception are summarized in **Table 4-9**. Full implementation of BMPs at Level IV during WY2006 is considered to be at the level where basin TP loads could be maintained at historical levels.

During WY2010, C-139 Basin permittees were required to continue implementation of Level IV BMPs, the maximum level provided by the rule. WY2010 was the fourth full water year where Level IV BMPs were implemented. The implementation of comprehensive BMP plans, such as those implemented in the EAA, has been identified as the next BMP improvement step in the C-139 Basin to consistently achieve compliance with required phosphorus levels and is being proposed through the rule development process. Additional provisions are being proposed to require further BMP improvement if the C-139 Basin does not meet required phosphorus load levels in future water years. Future improvements will be based on results from upstream water quality and quantity monitoring data obtained from the monitoring network defining upstream sub-basin areas.

Table 4-9. WY2003–WY2010 C-139 Basin BMP implementation summary.

Compliance Water Year	BMP Level	Compliance with Rule	Compliance Action
WY2003	Initial Implementation of Level I – 15 points	No	Go to Level II Full Implementation in November 2003
WY2004	Implement Level II – 15 points with site verification visits	No	Go to Level III Full Implementation in November 2004
WY2005	Implement Level III – 25 points with site verification visits	No	Go to Level IV Full Implementation in November 2005
WY2006	Implement Level IV – 35 points with site verification visits	No	Initiate Rule Development
WY2007	Continue Level IV	No	Continue Rule Development Process
WY2008	Continue Level IV	Yes	Continue Rule Development Process
WY2009	Continue Level IV	No	Continue Rule Development Process
WY2010	Continue Level IV	Yes	Continue Rule Development Process

The BMP program for the C-139 Basin was modeled after the BMP permit plans developed for the EAA, although with an emphasis on a phased approach and inclusion of BMPs applicable to C-139 Basin practices (e.g., for cow/calf operations) based on comments provided by stakeholders at the time of the original rulemaking in 2002. However, as described in the *C-139 Basin Source Control Activities* section of this chapter, ongoing rule development proposes the addition of criteria for approval and improvement of BMP plans to meet TP loading requirements.

To verify BMP implementation and opportunities for improvement, the SFWMD conducts BMP inspections on a regular basis. Field inspections have verified that the majority of permittees have adopted BMPs in their day-to-day operations, and that the maximum level is generally met. However, there is much that has been learned and room for improvement, for instance:

- Many growers apply phosphorus amounts that generally exceed UF/IFAS standard recommendations for the soil content and crops without site-specific technical documentation to optimize the amounts applied.
- Although several aboveground surface water impoundments (AGIs) have been built to provide increased detention as required by ERPs and Surface Water Permits (ERP/SW), little information is available on the effectiveness of these reservoirs to attenuate the soluble reactive phosphorus (SRP) species. SRP is the predominant component of TP discharge from C-139 Basin farms.
- Emphasis on verifying compliance with ERP/SW permits is required to ensure mandated AGIs are built and operational.
- Pasture areas generally flow via open-gravity connections with few infrastructure improvements to maximize detention and attenuation.
- There is little information on historically accumulated soil phosphorus in pastures and activities to prevent release into the watershed.

Developing basin-specific BMP plans that better address site conditions, such as water management, soils, water conservation, and phosphorus, is necessary. Recommendations are made during BMP field verifications and one-on-one outreach; however, development of technical information for BMP implementation and water quality data to assess BMP effectiveness are necessary.

The SFWMD funds demonstration projects to provide growers with the technical tools for more effective implementation of BMPs and the assurance that these practices will not negatively impact to their crops are crucial for success. Initiatives to fund BMP demonstration projects continued in WY2010.

Future improvements to performance are also anticipated through changes to the regulatory program, and an amended Part IV of Rule 40E-63 is expected to be adopted in September 2010. The proposed rule will include requirements for implementation of all defined categories of BMPs (nutrient management, water management, sediment controls, and pasture management) for all properties, as applicable. A comprehensive BMP plan will serve to control the different types of phosphorus species (particulate or dissolved), sources, and transport mechanisms through which phosphorus leaves a farm or ranch.

Since permittees in the C-139 Basin are not required to collect water quality and quantity data to characterize farm-level discharges, the SFWMD initiated (in WY2006) a phased installation of water quality and quantity monitoring instrumentation to collect data for upstream areas throughout the basin as part of its efforts to understand upstream contributions and devise more effective source control strategies. Differentiating the relative contribution of the hydrologic

sub-basins within the C-139 Basin, the timing of releases, and phosphorus species is crucial for determining effective source control strategies. During WY2010, the remaining instrumentation sites were completed. The available data show that concentrations of phosphorus species vary within the basin, indicating potential benefits of implementing water quality improvement activities according to location and land use. Sub-region monitoring and data analysis is expected to support water quality improvement activities within the C-139 Basin under the amended rule.

C-139 Basin Source Control Activities

Summary of Water Year 2010 Activities

During WY2010, the SFWMD continued to strengthen the mandatory regulatory program for the following C-139 Basin source control initiatives as detailed in the 2009 SFER – Volume I, Chapter 4:

1. **BMP Regulatory Compliance Program.** Mandatory BMP inspections continued by the SFWMD during WY2010 and a total of 60,031 acres were inspected. There were several meetings with C-139 Basin stakeholders for proposed rule modifications. Revisions to the rule under consideration have focused on (1) enhancing the compliance methodology to more accurately reflect the conditions in the C-139 Basin, (2) developing improved BMP strategies to achieve compliance with required phosphorus levels, and (3) expanding the knowledge base on BMP research for phosphorus and other constituents of concern for the regulatory program.
2. **Integrated Permit Compliance.** The integrated permit compliance effort was initiated by the SFWMD with a landowner workshop in April 2007. While EWOD permit BMP implementation addresses nutrient controls, Surface Water Management (SWM) addresses water quality treatment, attenuation, and storage, and Consumptive Water Use (CWU) authorizations address water use and conservation. SWM and CWU permits supplement the phosphorus control efforts of Rule 40E-63. The integrated regulatory approach generally consists of a review of all permits, consultation with permittees, and a request for submission of outstanding items or a timeline for addressing them. A total of three follow-up consultations, representing 26,085 acres (15.5 percent) of the basin, were conducted in WY2010.
3. **C-139 Basin Vegetable Production Demonstration Project (Long-Term Plan Project C-139 Basin – Source Controls, Fiscal Year 2009 (FY2009) (October 1, 2008–September 30, 2009)–FY2011).** Phase II of the SFWMD project continued during WY2010. A semiannual report for the data collected during fall 2009 through winter 2010 was completed in WY2010. Weather conditions during winter 2010 greatly impacted the planting, growth, and yield crops in the demonstration project. Ten consecutive days with temperatures at or below freezing occurred January 4–13, 2010, causing a reduction in the number of harvest per crop, crop quantity per harvest, and crop quality or fruit size.
4. **C-139 Basin Monitoring Network (Long-Term Plan Project C-139 Basin – Source Controls, FY2006–FY2010).** Automatic sampling stations collecting TP concentration and flow are installed in the C-139 Basin to isolate runoff from the sub-regions identified in Phase I of the C-139 Basin Phosphorus Water Quality and Hydrology Analysis document. Efforts were made by the SFWMD to install and calibrate these sites during WY2006–WY2010. As of WY2010, a total of eight stations have been installed and calibrated, and sample collection has begun. The data collected are being analyzed under the C-139 Phosphorus Transport and Cycling Project (see item No. 6 of this section).
5. **C-139 Basin Upstream Synoptic Monitoring Project.** As part of monitoring initiatives, the SFWMD continued collecting water samples at 10 sites that represent locations upstream of

basin regulatory compliance points. These sampling locations give snapshots of phosphorus concentrations throughout the watershed in the wet season (April through October). The samples are collected weekly if flowing. In WY2010, weekly samples from May 1–September 30, 2009, and April 1–30, 2010, were collected. The parameters tested were TP, total dissolved phosphorus (represents total soluble phosphorus or TSP), and orthophosphorus (represents SRP). In addition, flow measurements coincident with the grab sample collections were collected. WY2010 data are being analyzed and compared with data collected for WY2006–WY2009 under the C-139 Basin Phosphorus Transport and Cycling Project (see item No. 6 of this section).

6. **C-139 Basin Phosphorus Transport and Cycling Project.** The SFWMD plans to analyze the data (quality and quantity) collected through the C-139 Basin Monitoring Network (C-139D) and the C-139 Basin Upstream Synoptic Monitoring Project (C-139B), as well as the C-139 Basin Regulatory Compliance Monitoring Program. The objectives of the project are to get recommendations to continue improving the effectiveness of the regulatory source control program and optimize existing monitoring. A final report is expected in WY2011.
7. **C-139 Basin Phosphorus Water Quality and Hydrology Analysis.** The Watershed Assessment Model (WAM) has been used to evaluate the impact of alternative land use and management practices associated with the implementation of BMPs and load reduction projects. In April 2009, a panel of five experts completed a peer-review of WAM and several recommendations were made (Graham et al., 2009). The recommendations were (1) to improve documentation of the WAM model, (2) ensure that scientifically sound calibration and validation procedures are followed using established and objective goodness-of-fit measures, and(3) test the model. The SFWMD plans to create (1) a project work plan, (2) WAM documentation, (3) WAM interface, data, and code structure documentation and review, (4) model calibration and validation, and (5) final documentation and presentation. For the model calibration and validation task, the C-139 Basin has been selected since the WAM-View version of the model has data collected up to 2005. This task will include the model simulation for a period up to 2009, model upgrade under ESRI's® ArcGIS® platform, and better calibration and verification results to meet the criteria outlined by the panel.
8. **Technical Evaluations of Factors Affecting Compliance.** SFWMD evaluations to increase understanding of the relationships that drive TP loading and annual compliance for the C-139 Basin in combination with an amendment of Rule 40E-63 are anticipated to result in an improved regulatory BMP program in the C-139 Basin. The analysis compared several periods of similar rainfall — but contrasting runoff flow and TP load — continued through WY2009. Based on this analysis, an alternative to the existing compliance methodology has been proposed for future assessment of C-139 Basin TP load performance though the rulemaking process. The proposed methodology accounts for the variety of intra-annual rainfall patterns being observed in a method much like the EAA. Intra-annual periods have been compared and contrasted and the impact to basin TP load evaluated. WY2010 data support the concepts incorporated to the proposed rule amendment, and the details of this investigation are included in Appendix 4-2 of this volume. Another component of the technical evaluations is interpreting data for BMP improvement within the basin and applying this knowledge to other ongoing source control projects and activities. This will be accomplished primarily through the C-139 Basin Phosphorus Transport and Cycling Project.
9. **C-139 Basin Regional Feasibility Study.** A SFWMD regional feasibility study, encompassing the C-139 Basin, the Feeder Canal Basin, and the L-28 Basin began in September 2008. The feasibility study is intended to address two significant water resources issues in this region: (1) water quality of discharges to downstream waters, and (2) balancing annual climate patterns with flood, natural resources (wetlands) protection, and water availability. The following activities were completed during WY2010: (1) the determination

of specific canal cross-sections, (2) ground-truthing of the current Light Detection and Ranging topography dataset, (3) installation and monitoring of specific surface water elevation determinations, (4) the installation and monitoring of a network of nested-pair groundwater monitoring wells, (5) the calibration/validation of an integrated ground water/surface (MIKE SHE/MIKE11) model and, (6) the preliminary development of a variety of alternatives to be further analyzed in Phase II of the study.

10. **BMP Demonstration Grant.** Activities continued during the second year of the cooperative agreement between the Hendry Soil and Water Conservation District (HSWCD) for development of BMP demonstration projects in the C-139 Basin. The following activities were conducted under the selected projects:
    - **Surface Water Optimization.** Small internal berms and relocation of the outfall gravity structure away from the inflow structures were the modifications done to an AGI to better use existing storage and ensure sufficient detention time. A 12-month monitoring period is under way and bimonthly reports have been submitted to the SFWMD with the collected data.
    - **Chemical Precipitation Treatment.** This project is divided into a laboratory phase and a field implementation phase. The laboratory phase identified the coagulants that exhibit the best removal efficiencies to then be tested in the field. These coagulants are aluminum chloride and aluminum sulfate. Construction of the on-farm chemical precipitation system was completed during WY2010. The excess runoff that cannot be retained or recycled in the water management system will flow to a borrow pit that provides an additional 5.6 acre-feet (ac-ft) of retention and detention on-farm, and serve as a flocculation pond when the chemical treatment is applied. The routing of water through the borrow pit will maximize the travel path for retention time, slow velocity, and acts as a sediment sump, as water must flow from deeper to shallower areas within the pit to discharge off-site via gravity. Water quality and quantity data collection is under way and will continue for 12 months.
11. **Evaluation of Aboveground Impoundment for Reducing Phosphorus in Discharges.** The SFWMD's BMP demonstration projects progressed. All monitoring system components to track the nutrient inputs and outputs of the AGI were installed and operational in July 2009, marking the beginning of the 12-month monitoring period. Also, soil samples and topographic data at selected locations within the impoundment were collected to (1) determine the phosphorus retention, (2) quantify storage volume, and (3) analyze the effects of topography on water and phosphorus dynamics and retention in the impoundment.

Anticipated Activities for Water Year 2011

1. **BMP Regulatory Program.** SFWMD level IV BMP verifications and outreach efforts are planned to continue at the minimal frequency of one inspection per farm annually. This frequency is necessary to maintain program involvement by stakeholders and to ensure adequate implementation of the new requirements of amended Rule 40E-63.
2. **Integrated Permit Compliance.** The SFWMD will continue this coordinated initiative to bring landowners in the C-139 Basin in compliance with ERP and CWU permits.
3. **C-139 Basin Vegetable Production Demonstration Project (Long-Term Plan Project C-139 Basin – Source Controls, FY2009–FY2011).** The SFWMD will continue Phase II during WY2011.
4. **BMP Demonstration Grant Program.** During the third monitoring cycle, data collection is expected to conclude and final reports describing project implementation and analysis of BMP measured effectiveness are planned for completion.

5. **C-139 Basin Phosphorus Transport and Cycling Project.** Recommendations to improve the effectiveness of the regulatory source control program and optimize the existing monitoring programs are expected in WY2011. Analysis of the SFWMD's WY2011 water quality and quantity data collected under the basin compliance, upstream monitoring network, and synoptic sites programs will be conducted in WY2011.
6. **Technical Evaluations of Factors Effecting Compliance.** Pending adoption of the rule revisions, rainfall adjustment (by incorporating monthly rainfall statistics) to normalize base period loads to current water year conditions may better account for timing of rainfall throughout the year. The anticipated result is a performance measure which more accurately depicts the effectiveness of the source controls at the basin level.
7. **C-139 Basin Phosphorus Water Quality and Hydrology Analysis.** For this SFWMD project, the final report with the results of the calibration and validation of the model for the C-139 Basin is expected to be completed in WY2011. After that, the model is slated to be used to test BMP improvements involving water management and nutrient management to achieve additional water quality improvements in the basin.
8. **Evaluation of AGI for Reducing Phosphorus in Discharges.** The following activities are anticipated in WY2011: (1) water quality and quantity data collection, (2) phosphorus content in plant samples in the AGI, (3) a tracer study to quantify residence time, (4) a final report for the current phase, and (5) three presentations to disseminate project findings and results.
9. **C-139 Basin Regional Feasibility Study.** The SFWMD scope of work for Phase II will be developed and executed in WY2011. The objectives of this phase will be to (1) propose and further develop several alternative projects and/or water resource optimization strategies, (2) develop a pre-screening model/procedure to narrow the list of alternatives, (3) continue with the nested-pair monitoring well data collection, (4) recalibrate and validate the MIKE SHE/MIKE11 model developed in Phase I with the additional data collected, (5) select four alternative scenarios and analyze with the model and, (6) prepare planning level cost estimates for the alternatives. The final report of Phase II is expected in WY2011.

OTHER ECP BASIN UPDATES

This subsection discusses source control efforts in other ECP basins. These include the L-8, C-51 West, and Village of Wellington Acme basins. While a portion of stormwater runoff from each of these basins is discharged either to tide through the S-155A structure to the C-51E Basin and Lake Worth Lagoon or to Lake Okeechobee, drainage from each of these basins is also discharged, either directly or via an adjacent basin, to an STA.

L-8 Basin

The L-8 Basin occupies approximately 166 square miles in northwestern Palm Beach County. L-8 Basin discharges are directed to Lake Okeechobee, the City of West Palm Beach M-Canal, the C-51 West canal, and to the S-5A basin. The L-8 Basin can also discharge directly to the inflow basin at Stormwater Treatment Area 1-E (STA-1E), but during WY2010, discharge did not occur.

C-51 West Basin

The C-51 West Basin occupies approximately 80 square miles in east central Palm Beach County. The basin discharges are directed to tide and to STA-1E. The basin includes five sub-basins: the Pine Tree Water Control District, the Village of Wellington (VOW) Acme Improvement District (Acme Sub-basin, comprising Acme Sub-basins A and B), the Loxahatchee Groves Water Control District, and portions of the Northern Palm Beach County Improvement

District and the Indian Trails Improvement District. In addition, the basin receives discharge from the L-8 and S-5A basins to the west and the C-51 East Basin to the east.

The SFWMD monitors water quality in the C-51 West Basin to ensure phosphorus loads generated within this basin do not affect the performance of STA-1E. If necessary, the SFWMD may implement additional source control efforts in this basin.

Acme Sub-Basins of C-51 West

The Acme Sub-basin occupies approximately 30 square miles east of Water Conservation Area 1 (WCA-1) and south of the C-51 West canal in east central Palm Beach County. Direct untreated flows from the ACME1 and ACME2 structures into WCA-1 no longer occur. Therefore, since WY2009, the Acme Basin has been designated as a sub-basin of C-51 West.

Appendix 4-3, Figure 7a of this volume, summarizes the daily rainfall and the monthly rainfall (average of stations WCA1ME, LOXWS, WPBFS-R, and S-5A), in WY2010 for the ACME1 and ACME2 structures. Appendix 4-3, Figure 7b, summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume to Water Conservation Area 1 for the ACME1 and ACME2 structures from WY1998–WY2007.

A summary of the upstream water quality data used to identify high phosphorus areas and a map of the Acme Basin showing these data are available in Appendix 4-3 of this volume.

During WY2010, the implementation of the WQIPs for Acme Sub-basin B continued, as detailed in the 2009 SFER – Volume I, Chapter 4. Following is an update on each of these activities:

1. **Acme Sub-Basin B Discharge Projects.** Construction of the permanent ACME7 pump station was completed in WY2008. The second phase of this project will incorporate 365 acres within Section 24, west of the Acme Basin, for future use as a wetland area with floodwater storage capability and environmental features. The wetland area is planned to store and improve the quality of stormwater runoff from the Acme Sub-basin B before its eventual discharge to the C-51 West canal. Construction of this second phase began in WY2010, and is scheduled for completion in WY2011. More detail on this project is available at www.evergladesplan.org.
2. **DinoSoil Treatment Pilot Study.** The VOW initiated a DinoSoil treatment pilot study to determine, through extensive water quality testing, the product's effectiveness in reducing phosphorus concentrations within Acme Sub-basin canals. Water quality testing associated with the project is ongoing.

FUTURE DIRECTIONS FOR THE ECP BASINS

There are several SFWMD-planned activities for the ECP basins in the future to improve the effectiveness of the regulatory source control programs.

EAA Basin

The EAA basin's performance compelled the following planned activities:

- Completing water quality technical evaluations on priority areas to determine if site-specific strategies are necessary to maintain basinwide performance
- Working cooperatively with the EAA–EPD to ensure that a scope of work for BMP research is finalized
- Completing the process of establishing BMP performance measures for Closter Farms and the 298 Diversion projects

C-139 Basin

Through the integrated permit compliance and other supplementary projects that have encouraged awareness, the C-139 Basin may be overcoming the lag between source control implementation and achieving TP loading performance levels as required by the EFA. WY2010 results reflected a second year of hydrological drought in the region. Enhancement of the BMP mandatory program through rulemaking and continued emphasis on supplementary projects will be necessary to continue to ensure long-term compliance. Planned activities include:

- **Complete Rulemaking.** As mandated by Rule 40E-63, rule development was initiated for the C-139 Basin during WY2008 and will be completed in WY2011. The regulatory model based on historical levels is being reexamined concurrent with rule development. The model is expected to be refined to account for regional system changes and assumptions that were not considered of concern when the model was developed. The SFWMD plans to seek participation from other cooperating agencies for BMP development and implementation.
- **Continued Funding of BMP Demonstration Projects.** Based on availability of funding, the direction continues to be toward providing regulatory and funding incentives to spearhead landowner-driven BMP demonstration projects to improve effectiveness.
- **Continued Data Collection.** Supplementary water quality and quantity data at the regional level (hydrologic sub-basins) will continue to be used for a better understanding of upstream contributions, program effectiveness, and assist with focused remedial action under a revised rule.
- **Applying Lessons Learned and Evaluating the Applicability of the Latest Technology.** Technical findings on water quality analysis, hydrology, modeling, and BMP demonstration and research are planned to be applied for better understanding of basin conditions, both through adaptive management and regional solutions.

C-51 West and L-8 Basins

Planned activities in the C-51 West Basin include the completion of the Village of Wellington's Section 24 wetland recreation area that is planned to store and improve the water quality of stormwater runoff from the Acme Sub-basin B before its eventual discharge to the C-51 West canal, and continuation of the water quality testing program for the associated DinoSoil treatment pilot study. In the L-8 Basin, it is expected that phosphorus source control BMPs will be implemented when the amendments to Chapter 40-61, F.A.C., are completed.

STATUS OF SOURCE CONTROLS IN THE NON-ECP BASINS

Steve Sarley, Youchao Wang and Carlos Adorisio

Contributor: Cordella Miessau

BACKGROUND

The non-ECP basins have historically contributed approximately 12 percent of the TP load discharging to the EPA compared to the 88 percent contribution by the ECP basins. As required by the EFA, these basins have adhered to source control programs and water quality monitoring since WY1998. Specifically, the non-ECP permit requires the implementation of basin-specific WQIPs to ensure progress toward ultimately achieving established water quality standards in discharges from each of the non-ECP basins. These WQIPs include (1) voluntary BMPs, (2) training and educational initiatives, (3) cooperative agreements, (4) modification of stormwater system permits to include water quality and operational criteria, (5) basin-specific regulatory programs, and (6) full integration with ongoing and future CERP and other local construction projects. The WQIPs for each non-ECP basin (see 2009 SFER – Volume I, Chapter 4) are consistent with the EFA.

The water quality in non-ECP basin discharges is monitored to track the success of the WQIPs in each basin and to assess progress in achieving established water quality standards. The distribution of loads from the non-ECP basins to the EPA by water year is presented in **Figure 4-24**, and the location of non-ECP basins and associated structures that discharge into the EPA are depicted in **Figure 4-25**.

As required by the EFA, the non-ECP permit is expected to be modified to require compliance with the TP limits for the Feeder Canal, L-28, C-111, C-11 West, and NNRC basins. This proposed permit requirement resulted from the EFA requirement that discharge limits for long-term compliance permits allowing phosphorus discharges into the EPA be established.

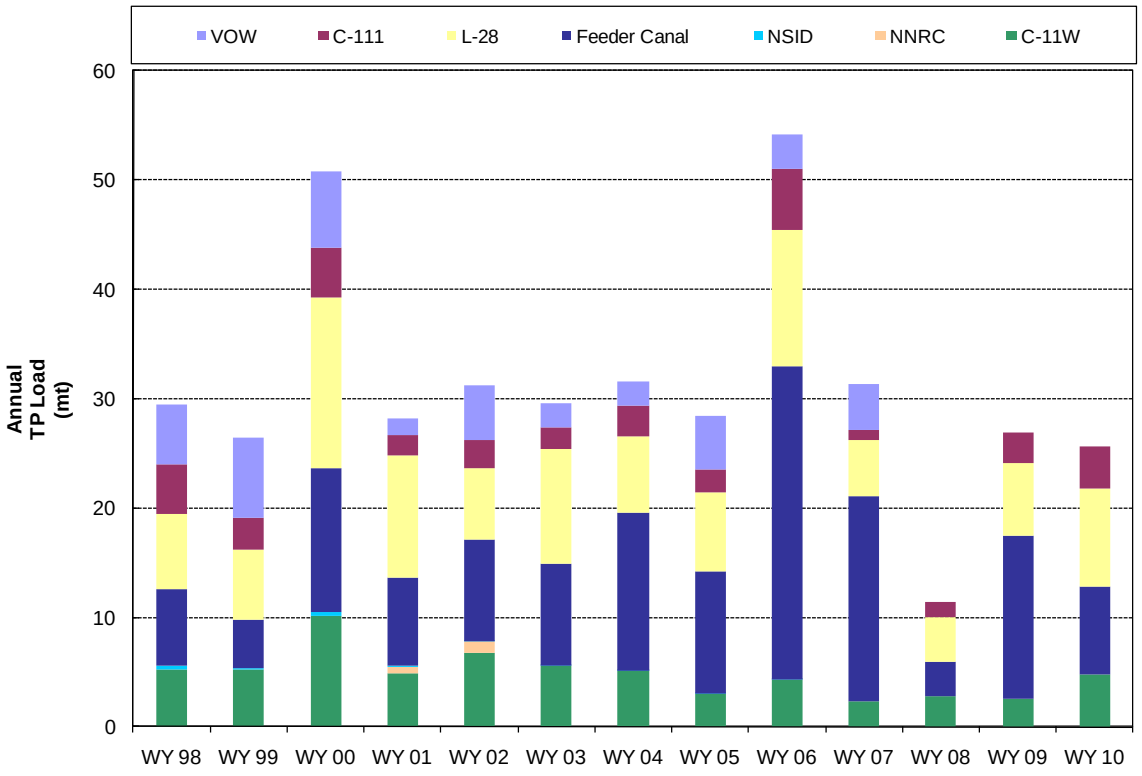


Figure 4-24. Non-ECP basin TP loads into the Everglades Protection Area (EPA) for WY1998–WY2010. [Note: Village of Wellington (VOW) Acme basins no longer discharge directly to the EPA.]

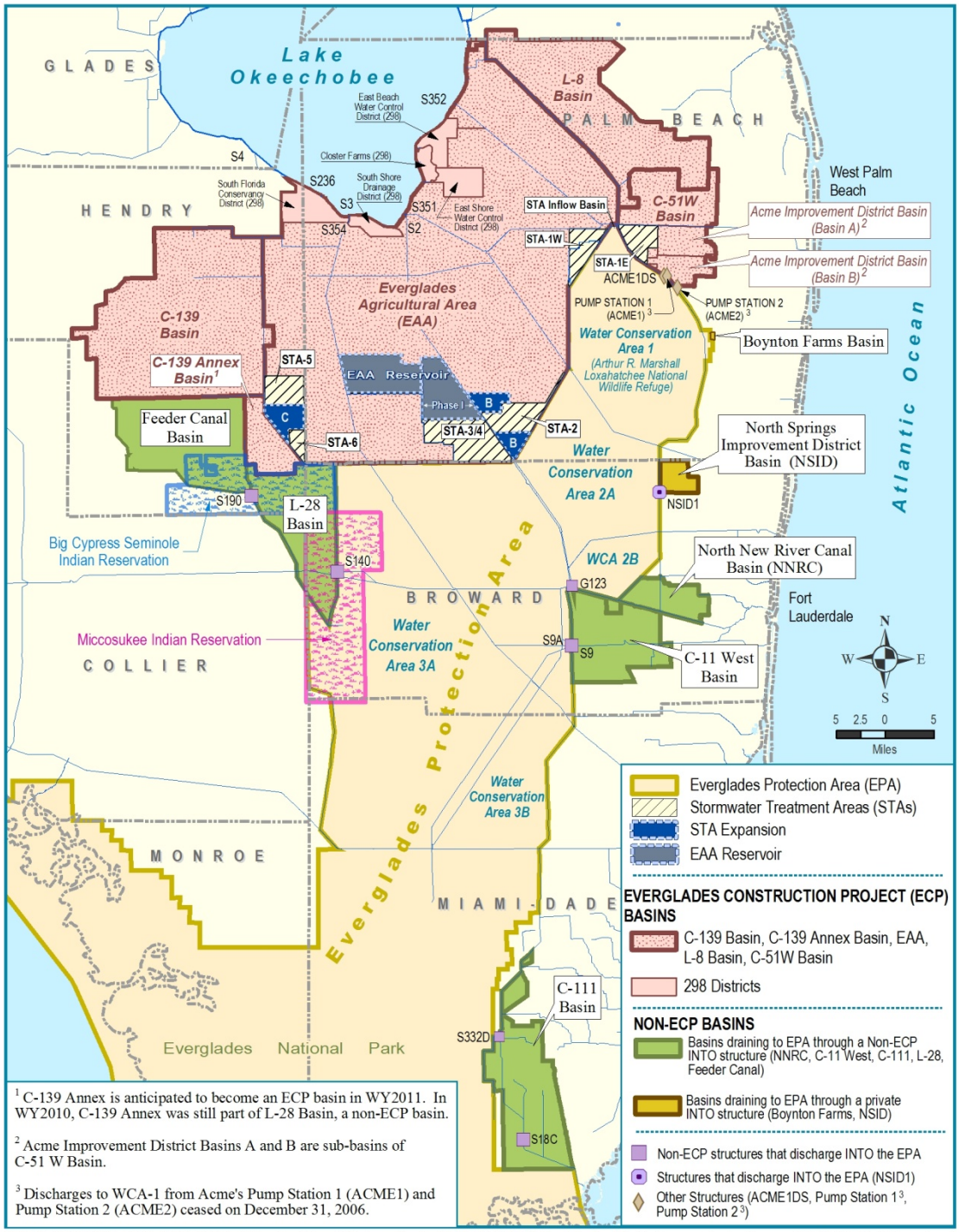


Figure 4-25. The non-ECP basins and primary compliance water control structures discharging to the EPA.

FEEDER CANAL BASIN UPDATES

Water Year 2010 Phosphorus Results for the Feeder Canal Basin

The Feeder Canal Basin, located in Hendry County, is divided into three major areas: (1) the McDaniel Ranch area or North Feeder Sub-basin (four landowners), with a total area of 23,150 acres; (2) the West Feeder Sub-basin (about 30 private owners) with a total area of 31,900 acres; and (3) a portion of the Big Cypress Seminole Indian Reservation. There are also four large parcels embedded within the boundaries of the reservation that are not part of the reservation. The canals and structures within this basin provide flood protection and conveyance of runoff to Water Conservation Area 3A (WCA-3A) for water supply and environmental use. Discharges occur at the lower southeastern corner of the basin through the S-190 structure into the L-28 interceptor canal and, eventually, into WCA-3A.

Figure 1a of Appendix 4-3 (of this volume) summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall (based on rainfall measured at stations S-190, Alico, and BCSI), and flow volume in WY2010 for the S-190 structure. Figure 1b of Appendix 4-3 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the S-190 structure from WY1998 through WY2010. The S-190 FWM TP concentration and TP load for WY2010 were 73 ppb and 7.62 mt, respectively. This TP concentration is approximately 46 percent lower than WY2009's TP concentration of 137 ppb (see Appendix 4-3 of this volume). The WY2010 TP concentration exceeds the 50 ppb levels expected based on activities described under the current WQIP and the EFA.

Upstream water quality data to identify high phosphorus areas within the Feeder Canal Basin are collected from the North Feeder Sub-basin (McDaniel Ranch area) and the West Feeder Sub-basin. Maps showing the upstream water quality sampling sites are provided in Appendix 4-3 of this volume.

FEEDER CANAL BASIN SOURCE CONTROL STRATEGY

During WY2010, the source control strategy for the Feeder Canal Basin continued as summarized in the 2010 SFER – Volume I, Chapter 4.

Feeder Canal Basin Source Control Activities

Summary of Water Year 2010 Activities

During WY2010, the SFWMD and stakeholders continued the implementation of the WQIPs for the Feeder Canal Basin, as detailed in the 2010 SFER – Volume I, Chapter 4.

1. **Rulemaking.** The SFWMD's strategy in this basin has relied partly on voluntary implementation of phosphorus source control BMPs. This strategy has not resulted in widespread participation by landowners. Further, the WQIPs have not resulted in basin discharges at S-190 achieving a TP concentration of 50 ppb or less. Therefore, as required by the December 10, 2007, revision to the Long-Term Plan for Achieving Water Quality Goals in the Everglades Protection Area, during WY2009 the SFWMD started preliminary activities necessary for implementation of a BMP regulatory program for the Feeder Canal Basin. These activities continued during WY2010.
2. **Seminole Tribe Water Control Plan (WCP) Project.** The SFWMD continues to track the progress of this project. The project includes four Water Resource Areas, designed to improve water quality, restore wetland hydrology, increase water storage capacity, and enhance flood protection within the reservation. As of June 2010 (WY2011), only one of the

four Water Reserve Areas had been constructed. The U.S. Army Corps of Engineers (USACE) is constructing the reserve areas, and the project is sponsored by the Seminole Tribe of Florida.

3. **McDaniel Ranch.** The McDaniel Ranch SWM system has been substantially completed. The SFWMD continued working with the landowners to certify the system and to ensure appropriate water quality treatment and implementation of BMPs.
4. **Integrated Permit Compliance.** The SFWMD continued meeting with landowners to ensure compliance with required permits and to facilitate implementation of phosphorus source control BMPs.
5. **Upstream Monitoring.** The SFWMD continued collecting surface water grab samples at six locations within the West Feeder Canal Sub-basin. A summary of the water quality results, collected from September 2005 through October 2009, is included in Appendix 4-3, Table 5, of this volume. The tested parameters are TP, total dissolved phosphorus, and orthophosphorus (represents SRP). The results of this monitoring program were analyzed for optimization. The analysis evaluated the sample parameters, the sampling frequency, and the location. Based on the analysis, monitoring locations were reduced from six locations to two locations, starting in April 2010.
6. **Hydrologic and Hydraulic Analysis of PC-17A Structure.** In December 2009, the SFWMD initiated a hydrologic and hydraulic study of the PC-17A structure. The study will evaluate the conveyance capacity of the structure. If the structure's conveyance capacity is found to be inadequate, alternatives in the form of operational changes and/or structural changes to offset structure deficiencies will be evaluated.

Anticipated Activities for Water Year 2011

1. **Rulemaking.** The SFWMD plans to continue developing the technical support documents necessary for the implementation of a regulatory source control program for the Feeder Canal Basin, including the development of compliance methodology to evaluate program performance. Statutory changes are necessary before rulemaking can be initiated.
2. **McDaniel Ranch.** The SFWMD expects to continue working with McDaniel Ranch area owners to ensure discharges from this area meet a TP concentration of 50 ppb or less.
3. **Integrated Permit Compliance.** The SFWMD plans to continue meeting with landowners to ensure compliance with the required permits as well as to facilitate implementation of phosphorus source control BMPs.
4. **Upstream Water Quality Monitoring.** The SFWMD expects to continue monitoring the water quality data of the remaining monitoring locations in the West Feeder Canal Sub-basin to identify areas of water quality concern and plan future activities improvement.

L-28 BASIN UPDATES

Water Year 2010 Phosphorus Results for the L-28 Basin

The L-28 Basin is located within portions of Broward, Hendry, and Collier counties and is entirely occupied by four landowners: the C-139 Annex (U.S. Sugar Corporation), the Big Cypress Seminole Indian Reservation, the Miccosukee Indian Reservation, and the Big Cypress National Preserve. The surface water management system in the L-28 Basin provides drainage and flood protection in addition to providing water supply to WCA-3A when necessary. The L-28 borrow canal is the primary drainage canal conveying stormwater runoff to the S-140 structure, which discharges directly into WCA-3A. A substantial reduction of flows from the L-28 Basin is

expected starting in WY2011 as a result of the diversion of C-139 Annex flows into Stormwater Treatment Area 6 (STA-6).

Figure 2a of Appendix 4-3 summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall, and flow volume in WY2010 for the S-140 structure. Figure 2b of Appendix 4-3 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the S-140 structure from WY1998 through WY2010. The S-140 FWM TP concentration and TP load for WY2010 were 55 ppb and 9.21 mt, respectively. This TP concentration and load includes flow and TP loads from the C-139 Annex Sub-basin.

Upstream water quality data for the C-139 Annex Sub-basin and the Big Cypress Seminole Reservation and maps are available in Appendix 4-3 of this volume.

L-28 BASIN SOURCE CONTROL STRATEGY

During WY2010, the source control strategy for the L-28 Basin continued as summarized in the 2010 SFER – Volume I, Chapter 4.

L-28 Basin Source Control Activities

Summary of Water Year 2010 Activities

During WY2010, the SFWMD and stakeholders continued the implementation of the WQIPs for the L-28 Basin as detailed in the 2010 SFER – Volume I, Chapter 4.

1. **C-139 Annex Diversion.** The C-139 Annex ERP modification authorizing operation of the new discharge structure to divert flows to STA-6 was issued in May 2010 (WY2011). The permit issued by the SFWMD requires implementation of BMPs and maintaining the C-139 Annex TP loads in discharges into STA-6 at or below historical discharge levels. It also authorizes a three-year study to compare the TP levels in discharges from the C-139 Annex to STA-6 with TP levels in discharges from the historical C-139 Annex outfall (USSO). During the three-year study, discharges through USSO will continue but at a reduced flow rate. Depending on the results of the study, the TP load requirements in discharges from the C-139 Annex to STA-6 may be modified.
2. **L-28 Weir Demonstration Project.** At the request of the Miccosukee Tribe, the SFWMD is funding a demonstration project to rehydrate approximately 8,000 acres of historic Everglades within the triangular area of the L-28 Basin south of Interstate Highway 75 (I-75). The project includes the construction of a weir on the L-28 borrow canal, just south of I-75, to reduce stormwater drainage from the triangular area to the S-140 pump station. Construction was completed in December 2009 and the demonstration project is ongoing.

Anticipated Activities for Water Year 2011

C-139 Annex Diversion. Operation of the C-139 Annex's new pump station is scheduled to start in WY2011.

C-111 BASIN UPDATES

Water Year 2010 Phosphorus Results for the C-111 Basin

The C-111 Basin is located in the southernmost portion of Miami-Dade County adjacent to Everglades National Park (ENP or Park). Canals in this basin provide drainage and flood protection, water supply, and prevent saltwater intrusion into local groundwater. Discharges from this basin are directed to the ENP, specifically to Taylor Slough (by way of the L-31N and

L-31W borrow canals – non-ECP into structures S-332D) and the ENP's panhandle (by way of the C-111 canal – non-ECP into structure S-18C).

Figure 3a of Appendix 4-3 summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall (average of stations S-177, S -18C, and S-332), and flow volume in WY2010 from the C-111 Basin to the ENP. Figure 3b of Appendix 4-3 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the C-111 Basin to the ENP from WY1998–WY2010. The S-18C and S-332D combined FWM TP concentration and TP load for WY2010 were 7 ppb and 3.77 mt, respectively.

Water quality data and maps for upstream structures S-176, S-178, and S-332B, as well as the within structures S-175 and S-332, are presented in Appendix 4-3.

C-111 BASIN SOURCE CONTROL STRATEGY

During WY2010, the source control strategy for the C-111 Basin continued as described in the 2010 SFER – Volume I, Chapter 4.

C-111 Basin Source Control Activities

Summary of Water Year 2010 Activities

During WY2010, the SFWMD and stakeholders continued the implementation of the WQIPs for the C-111 Basin as detailed in the 2010 SFER – Volume I, Chapter 4.

1. **Mobile Irrigation Lab.** The SFWMD sponsored the Mobile Irrigation Lab in the C-111 Basin, in partnership with the FDACS and South Dade Soil and Water Conservation District, to help local growers improve irrigation practices. The main sources of training and education in this basin continue to be the University of Florida's Tropical Research and Education Center and IFAS.
2. **C-111 Project.** Construction of the North Detention Area of the C-111 Project is on hold because the USACE and the SFWMD have not agreed on how to value the land acquired by the SFWMD for construction of the final northern detention area (between S-332B north and the STA).
3. **C-111 Spreader Canal Western Project.** The purpose of Phase I of the project is to improve water quantity, timing, and distribution in the ecological system of the Southern Everglades and Model Lands including downstream estuaries and Florida Bay. Phase I, scheduled for completion in June 2011, comprises the following components: the Frog Pond Impoundment, Aerojet Canal, plugging of the C-110 and L-31 E canals, and a proposed S-198 structure. However, the S-198 structure is not under construction. The SFWMD has completed preparation of the Basis of Design Report for the C-111 Spreader Canal Western Project and design drawings were completed in August 2009.
4. **Combined Structural and Operational Plan (CSOP).** The CSOP remains on hold because of a change in the allowable maximum L-29 canal stage associated with the Tamiami Trail component of the Modified Water Deliveries to Everglades National Park Project.

Anticipated Activities for Water Year 2011

Mobile Irrigation Lab. This SFWMD-supported program is planned to continue if funds are approved.

C-111 Spreader Canal Western Project. The SFWMD plans to continue Phase I components of the C-111 Spreader Canal Western Project.

C-11 WEST BASIN UPDATES

Water Year 2010 Phosphorus Results for the C-11 West Basin

Of the three Broward County non-ECP basins, only the C-11 West Basin regularly discharges to the EPA. Discharges from this basin comprise stormwater runoff and groundwater seepage returns through structures S-9 and S-9A into WCA-3A. The S-9A pump structure became operational in early 2003, and a divide structure (S-381) was completed in early 2005 (C-11 West Critical Project). This construction project changed the operation of the water management system by separating and returning seepage water with less phosphorus to WCA-3A, thereby decreasing the pumping frequency at the larger S-9 structure.

Figure 4a of Appendix 4-3 summarizes the daily rainfall and the monthly TP load, TP FWM concentration, rainfall (average of stations S-9 and S-124), and flow volume in WY2010 for structures S-9 and S-9A. The S-9 and S-9A combined FWM TP concentration and TP load for WY2010 were 18 ppb and 3.86 mt, respectively. Figure 4b of Appendix 4-3 summarizes the annual TP load, TP FWM concentration, rainfall, and flow volume for structures S-9 and S-9A from WY1998–WY2010.

The TP FWM concentration for the C-11 West Basin from WY1998–WY2003 was 21 ppb. During this period, only the S-9 pump station discharged seepage and stormwater runoff from the basin into the EPA. The TP FWM concentration for C-11 West Basin from WY2004 (right after completion of the S-9A pump structure) through WY2010 was 16 ppb. During this period, the S-9 pump station discharged mostly stormwater runoff from the basin into the EPA, and the S-9A pump station discharged mostly seepage from the basin into the EPA.

A summary of the upstream water quality data used to identify high phosphorus areas within the basin and a map of the C-11 West Basin showing these data are available in Appendix 4-3 of this volume.

C-11 WEST BASIN SOURCE CONTROL STRATEGY

During WY2010, the source control strategy for the C-11 West Basin continued as summarized in the 2009 SFER – Volume I, Chapter 4.

C-11 West Basin Source Control Activities

Summary of Water Year 2010 Activities

During WY2010, the SFWMD and stakeholders continued the implementation of the WQIPs for the C-11 West Basin, as detailed in the 2010 SFER – Volume I, Chapter 4.

1. **Broward Everglades Working Group.** The SFWMD continued its support of Broward County water quality improvement initiatives within the C-11 West Basin through its participation in the working group. The SFWMD continued to assist Broward County in revising and implementing the C-11 West Basin Pollution Reduction Action Plan of April 2006. The Action Plan is a compilation of C-11 West Basin stakeholder action plans developed to reduce phosphorus discharges to WCA-3A. The Action Plan can be found at: http://www.sfwmd.gov/sta.
2. **Broward County Water Preserve Area CERP Project.** This project's completion is expected to result in significantly reduced flows to WCA-3A and consequent reduction in the TP load to WCA-3A. More detail on this project is available at: www.evergladesplan.org.
3. **South Broward Drainage District (SBDD) Improvements.** Improvements to SBDD S-12, located at the SBDD canal 12 discharge to the C-11 West canal, were completed. The

improvements include the replacement of an open culvert between canal 12 and the C-11 West canal, with a gated structure that will increase the pre-treatment volume in the SBDD system. Remaining unrestricted outfalls to the C-11 West canal (one in the S-8 Basin, one in the S-9/S-10 Basin) are scheduled for completion during WY2011.

4. **Memorandum of Agreement.** The SFWMD entered into a Memorandum of Agreement with SBDD and the Town of Southwest Ranches that provides for enhanced flood protection for Southwest Ranches, and additional water quality testing and BMP implementation within the S-9/S-10 Basin.
5. **Central Broward Water Control District (CBWCD) Improvements.** The CBWCD continues providing public outreach and education within the basin.
6. **Educational Public Service Announcements (Long-Term Plan Project C-11 West Basin, FY2007–FY2008).** The SFWMD's airing of public service announcements, both English and Spanish language versions, is currently being implemented through the Broward County Non-ECP Basin Public Information and Education contract (see No. 8 of this section).
7. **Everglades Website Development.** Links to the SFWMD's Everglades4Ever website (www.sfwmd.gov/everglades4ever) and Broward County's NatureScape website (www.broward.org/naturescape) continue to be provided on the websites of most Broward County stakeholders. Broward County has assisted the SFWMD, through the Broward County Non-ECP Basin Public Information and Education contract, in expanding website link coverage to those Broward County municipality websites that had not previously provided links to the SFWMD's Everglades4Ever website. The Everglades4Ever website targets residents in general and includes references to water quality, water conservation, and Everglades restoration initiatives being undertaken throughout South Florida.
8. **Broward County Non-ECP Basin Public Information and Education Contract (Long-Term Plan Project Broward County Source Controls, FY2008–FY2010).** The SFWMD and Broward County continued implementation of cost-share agreement initiatives, focusing on public information and educational outreach on water conservation and water pollution prevention topics within Broward County non-ECP basins. The three-year agreement started in June 2008, and includes initiatives to educate golf course operators, property managers, landscaping personnel, and residents through Know-The–Flow workshops, informational brochures, televised bilingual (English and Spanish) public service announcements, expanded website linkage to the SFWMD's Everglades4Ever website, and other educational venues. The county offered 30 Know-The-Flow workshops to property managers, homeowner associations, local government agencies, and other interested parties during WY2010. In addition, the county developed a golf course certification program that provides recognition to those golf courses located in the county's non-ECP basins that have successfully implemented golf course BMPs as described in the FDEP's golf course manual.

Anticipated Activities for Water Year 2010

Broward County Non-ECP Basin Public Information and Education Contract. The SFWMD and Broward County are developing a Scope of Work for a new three-year contract to continue the public information and educational outreach efforts provided in the FY2008–FY2010 contract.

Broward Everglades Working Group. The SFWMD will continue working with Broward County to expand the participation of stakeholders in the C-11 West Basin to support Broward County water quality improvement initiatives within the basin.

NORTH NEW RIVER CANAL BASIN UPDATES

Water Year 2010 Phosphorus Results for the North New River Canal Basin

The NNRC basin in Broward County is able to discharge to the EPA, specifically WCA-3A, through structure G-123, although such discharge seldom occurs. The structure is primarily used for water supply to WCA-3A, although it is sometimes necessary to use this structure for flood control during major storm events. In December 2001, the SFWMD implemented operational changes to the system to enable the basin to provide water supply to the Water Conservation Areas. There were no significant flow volumes discharged from G-123 during the past eight water years, and there was no discharge from the NNRC basin to the EPA during WY2010.

Figure 5a of Appendix 4-3 summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall (average of stations S-124 and S-125), and flow volume in WY2010 for the G-123 structure. Figure 5b of Appendix 4-3 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the G-123 structure from WY2001–WY2010. A summary of the upstream water quality data used to identify high phosphorus areas within the basin and a map of the NNRC basin showing these data are available in Appendix 4-3.

NNRC BASIN SOURCE CONTROL STRATEGY

During WY2010, the source control strategy for the NNRC basin continued as summarized in the 2010 SFER – Volume I, Chapter 4.

NNRC Basin Source Control Activities

Because this basin is also located in Broward County, some of the training and educational activities being implemented in the C-11 West Basin also apply to the NNRC basin, and additional updates can be found in the *C-11 West Basin Update* section of this chapter.

Summary of Water Year 2010 Activities

During WY2010, the SFWMD and stakeholders continued the implementation of the WQIPs for the NNRC basin as detailed in the 2010 SFER – Volume I, Chapter 4.

Broward County Non-ECP Basin Public Information and Education Contract. The SFWMD and Broward County continued implementation of cost-share agreement initiatives, focusing on public information and educational outreach. Details are presented in *C-11 West Basin Update* section of this chapter.

Anticipated Activities for Water Year 2011

In tandem with the C-11 West Basin efforts, the SFWMD and Broward County are developing a Scope of Work for a new three-year contract to continue the public information and educational outreach efforts provided in the FY2008–FY2010 contract.

NORTH SPRINGS IMPROVEMENT DISTRICT BASIN UPDATES

Water Year 2010 Phosphorus Results for North Springs Improvement District Basin

The NSID Basin in Broward County is able to discharge to the EPA, specifically WCA-2A, through NSID Pump Station 1 (NSID1); however, such discharge is only permitted when the stormwater conveyance system that normally discharges to tide exceeds its capacity. The basin did not discharge to the EPA during WY2010. Pump management BMPs that were implemented in WY2001 drastically reduced the frequency and volume of pumping from the NSID basin to the EPA. The last two confirmed discharges from NSID1 into WCA-2A occurred in July 2002 and September 2004.

Figure 6a of Appendix 4-3 summarizes the daily rainfall and the monthly TP load, TP FWM concentration, rainfall (average of S-38 and S-39 stations), and flow volume in WY2010 for the NSID1 structure. Figure 6b of Appendix 4-3 summarizes the annual TP load, TP FWM concentration, rainfall, and flow volume for the NSID1 structure from WY1998–WY2010. A summary of the upstream water quality data used to identify high phosphorus areas and a map of the NSID Basin are presented in Appendix 4-3.

NSID BASIN SOURCE CONTROL STRATEGY

During WY2010, source control strategy for the NSID Basin continued as summarized in the 2010 SFER – Volume I, Chapter 4.

NSID Basin Source Control Activities

Because this basin is also located in Broward County, some of the training and educational activities being implemented in the C-11 West Basin also apply to the NSID basin, and additional updates can be found in the *C-11 West Basin Updates* section of this chapter.

Summary of Water Year 2010 Activities

During WY2010, the SFWMD and stakeholders continued the implementation of the WQIPs for the NSID basin, as detailed in the 2010 SFER – Volume I, Chapter 4.

1. **BMP Implementation through Existing Regulatory Process.** The SFWMD has utilized the existing ERP program, as opposed to creating a specific program, to require NSID to submit an ERP permit modification to incorporate a plan including an appropriate long-term BMP program, as well as revisions and capital improvements to its existing system to meet EFA-required water quality standards. NSID submitted an ERP modification application on June 21, 2007, and the SFWMD and NSID worked together toward the finalization of the permit modification (which was issued in December 2009).

   The permit modification requires that NSID implement a SFWMD-approved BMP plan to improve upstream water quality within the basin through public outreach and NSID SWM permit requirements.

   The permit modification includes a revised pump schedule that is expected to provide improved flood control within the basin and reduce the need for the basin to discharge west to the EPA. Critical to the permit modification is a Memorandum of Understanding among NSID, Coral Springs Improvement District (CSID), and the SFWMD. The memorandum provides for NSID stormwater discharge to the south at a prescribed rate, under certain canal stage conditions and CSID discharge scenarios.

The permit also provides that NSID discharges to the EPA, should they occur, shall be evaluated each water year and shall be deemed in compliance with TP limits if the annual TP load, based on monitoring data (flow and water quality) obtained at NSID1, does not exceed certain annual or five-year moving average values.

2. **Hillsboro Site 1 Impoundment (Fran Reich Preserve) CERP Project.** The USACE continued design work and final review was completed. The award of the initial contract is expected in WY2011. More information on this project is available at the CERP website www.evergladesplan.org.
3. **Broward County Non-ECP Basin Public Information and Education Contract.** The SFWMD and Broward County continued implementation of cost-share agreement initiatives, focusing on public information and educational outreach activities on water conservation and water pollution prevention within Broward County non-ECP basins.

Anticipated Activities for Water Year 2011

NSID BMP Implementation Plan. The SFWMD and NSID plan to work together on the implementation of NSID's ERP-required, SFWMD-approved BMP Plan.

Broward County Non-ECP Basin Public Information and Education Contract. In tandem with the C-11 West Basin efforts, the SFWMD and Broward County are developing a Scope of Work for a new three-year contract to continue the public information and educational outreach efforts provided in the FY2008–FY2010 contract.

BOYNTON FARMS BASIN UPDATE

Water Year 2010 Phosphorus Results for the Boynton Farms Basin

The Boynton Farms Basin has, in previous water years, discharged to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge). The Refuge headquarters property is considered part of the EPA and extends just outside the eastern boundary of WCA-1. Water quality grab samples for the discharges from this basin were collected by the SFWMD from WY2000–WY2008 on a limited number of flow events. Pumps located on the Dubois property no longer discharge to the Refuge and pumps located on the Palm Beach County property to the north have been inactive since WY2007, as this property has not been farmed since then. Based on the inactivity of the Palm Beach County property pumps, there was no discharge from the Boynton Farms Basin to the Refuge during WY2010.

Information regarding historical flow data from these properties is not available to the SFWMD; therefore, FWM TP concentration and load data from this basin to the EPA are not available. A summary of the upstream water quality data and a map of the Boynton Farms Basin depicting these sites are available in Appendix 4-3.

BOYNTON FARMS BASIN SOURCE CONTROL STRATEGY

During WY2010, source control strategy for the Boynton Farms Basin continued as summarized in the 2010 SFER – Volume I, Chapter 4.

Boynton Farms Basin Source Control Activities

Summary of Water Year 2010 Activities

During WY2010, the SFWMD and stakeholders continued the implementation of the WQIPs for the Boynton Farms Basin, as detailed in the 2010 SFER – Volume I, Chapter 4. The SFWMD has utilized the existing ERP program, as opposed to creating a separate regulatory program, to

require the two landowners within this basin to submit ERP permit modifications to incorporate a plan including an appropriate long-term or interim BMP program, and revisions to its existing system to meet EFA-required water quality standards.

An ERP modification for the Palm Beach County property is pending the leasing of the property to an agricultural entity. Based on discussions with Palm Beach County, if the county leases the property to an agricultural entity, the permit modification will provide for the farming of the eastern portion only, discharging to the Lake Worth Drainage District's E-1 canal. The ERP modification for the property will include provisions that either discharges to the Refuge will be treated to meet water quality standards or will not occur.

Anticipated Activities for Water Year 2011

The SFWMD will continue to monitor the progress of Palm Beach County in obtaining a lessee for the only remaining farm within the Boynton Farms Basin. Should Palm Beach County lease the property to an agricultural entity, the SFWMD will work toward developing the ERP modification for the property that will include the previously mentioned provisions.

FUTURE EFFORTS FOR THE NON-ECP BASINS

Continued implementation of the WQIPs for the non-ECP basins, which are consistent with the EFA, is necessary to ensure significant progress toward improving water quality. The SFWMD will continue to track the implementation of the WQIPs and work cooperatively with local governments, the Seminole Indian Tribe of Florida, the Miccosukee Tribe of Indians of Florida, and other state and federal agencies to ensure essential components of the WQIPs are completed as scheduled.

The Feeder Canal Basin project plan is expected to be revised to recommend additional funding to support the initiation of rulemaking for a basin-specific BMP regulatory program. In the interim, the SFWMD's strategy within the Feeder Canal Basin continues to utilize existing regulatory programs that include the integration of compliance efforts to ensure landowners comply with existing ERP requirements and to incorporate BMPs as conditions of SWM permits or ERPs, or through landowner agreements.

The C-139 Annex Sub-basin (an area within the L-28 Basin) is expected to be diverted to STA-6. Once this diversion is effective, this sub-basin will be designated as an ECP basin.

The SFWMD will continue coordinating with the FDEP for the non-ECP permit renewal process within the remaining non-ECP basins, which will establish long-term compliance permit requirements as well as TP limits. WQIPs (as described in the 2010 SFER – Volume I, Chapter 4, and as discussed in this chapter) are expected to progress toward meeting established water quality standards.

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