Chapter 4: Phosphorus Source Controls for the South Florida Environment

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SUMMARY

This chapter provides a Water Year 2008 (WY2008) (May 1, 2007–April 30, 2008) update on the South Florida Water Management District's (SFWMD or District) efforts associated with source control programs implemented in the watersheds within the Everglades ecosystem. The update this water year is different from previous years in that it combines all source control programs for all watersheds to give a comprehensive presentation of existing, evolving, and future nutrient source control programs. The chapter update for WY2008 will help provide a simplified and organized approach to focus on source control efforts as an integral component of Everglades restoration in the context of the Northern and Southern Everglades as a whole system. Additional information for the regions added to this chapter, as well as evaluations of existing source control efforts can be found in appendices 4-1 through 4-4 of this volume.

One of the strategies for improving and maintaining water quality in the South Florida environment has been through implementation of source controls, also known as Best Management Practices (BMPs), in the watersheds of the Everglades system, which is comprised of both agricultural and non-agricultural land uses. Efforts have primarily been focused on controlling the level of phosphorus (a water quality constituent of primary concern for the South Florida environment) in runoff at the source. The SFWMD has required implementation of source controls at various levels of effort through both regulatory requirements and voluntary incentive-based initiatives. The level of effort has been dependent on a variety of factors, including the water quality goals associated with a watershed, the attainment status of meeting the goal, and the statutory requirements of Florida legislation regarding the implementation framework of the source control program.

During previous annual updates to this chapter, the primary reporting focus has been on the Southern Everglades phosphorus source control program implemented in watersheds south of Lake Okeechobee and directly tributary to the Everglades Protection Area (EPA). For the Southern Everglades watershed, annual reporting has been further divided along the lines of

Everglades Construction Project (ECP) and non-Everglades Construction Project (non-ECP) basins. For WY2008, this chapter has been expanded to lay the foundation for a more comprehensive reporting structure that is planned to also include source control program efforts in the Northern Everglades, which consists of the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds. The update on Northern Everglades source controls in this chapter for WY2008 is mainly focused on the regulatory component of source control efforts in the Lake Okeechobee region and is meant to be complimentary to Chapter 10 of this volume which reports a broader perspective of phosphorus control projects and other efforts in that watershed.

NORTHERN EVERGLADES

Original legislative authorization for a regulatory phosphorus source control program to implement BMPs at the parcel level within the original boundary of the Lake Okeechobee Watershed was derived from the Lake Okeechobee Surface Water Improvement and Management (SWIM) Act of 1987, and District implementation guidelines were subsequently outlined in a new District rule effective in 1989 [Chapter 40E-61, Florida Administrative Code (F.A.C.)] also known as the Lake Okeechobee Works of the District (LOWOD) regulatory program (available at http://www.sfwmd.gov through the *SFWMD Permitting* link, and *Rules, Statutes, & Criteria* section).

Substantial changes to the Lake Okeechobee SWIM legislation occurred with passage of the Lake Okeechobee Protection Act of 2000 or LOPA [Section 373.4595, Florida Statutes (F.S.)] and the 2007 amendments to the statue. The 2000 legislation established the Total Maximum Daily Load (TMDL) target for total phosphorus (TP) for Lake Okeechobee to be met by 2015 and expanded the jurisdiction of the regulatory phosphorous source control program to the Upper Kissimmee sub-watershed and several other smaller sub-watersheds not originally covered under Rule 40E-61. The latter amendment, referred to as the Northern Everglades and Estuary Protection Program (NEEPP), expanded the Lake Okeechobee Protection Act (see Chapter 10 of this volume) to include the Caloosahatchee and St. Lucie River watersheds. NEEPP also authorized the expansion of Rule 40E-61 to incorporate the river watershed areas, and expanded the source control program to add nitrogen as a nutrient of concern due to impairment of these rivers' estuaries. The Northern Everglades is shown in **Figure 4-1**.

The NEEPP further defined the role of the coordinating agencies with regard to the Florida Department of Agriculture and Consumer Service (FDACS) for implementation of non-point source BMPs on agricultural lands and the Florida Department of Environmental Protection (FDEP) for non-point source control implementation on non-agricultural lands throughout the entire NEEPP watershed area. This is complementary to the District's existing regulatory source control programs that include overseeing the Environmental Resource Permitting Program, developing special basin rules to address new construction and land development, and utilizing Rule 40E-61 for all land uses.

During WY2008, District regulatory efforts were substantially focused on revising Rule 40E-61 to incorporate the expanded Lake Okeechobee Watershed, and working out the details on source control program implementation through interagency efforts between the SFWMD, FDACS, and FDEP, as required by the NEEPP legislation. The District rulemaking process to incorporate the expanded Lake Okeechobee Watershed and program requirements is expected to be completed during WY2009. Further rulemaking is anticipated to begin in WY2009, as well, to incorporate the St. Lucie and Caloosahatchee river watersheds. Chapter 10 of this volume contains an update on the overall source control efforts for the Lake Okeechobee Watershed being carried out by the District, FDACS, and FDEP, while this chapter provides more detail on

the District's regulatory source controls under Rule 40E-61. Future annual updates to this chapter are planned to be more comprehensive in nature to describe the source control efforts by the coordinating agencies for the entire NEEPP watershed area.

SOUTHERN EVERGLADES

The Southern Everglades phosphorus source control program is one of the strategies to achieve water quality standards for the EPA and continues to be a strategic priority under the District's Everglades program. The Everglades Forever Act (EFA) of 1994 Section 373.4592, F.S., and the Plan for Achieving Long-Term Water Quality Goals (Long-Term Plan), outline District responsibilities and schedules to implement basin-specific solutions to control phosphorus at the source. These solutions are implemented in basins within the ECP area and in non-ECP basins. The strategy includes implementation of BMPs for phosphorus reduction, regulatory programs, voluntary programs, educational programs, and integration with local and regional projects. The District 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 statute and the Long-Term Plan. In accordance with the EFA, BMP implementation guidelines are outlined in a District regulatory rule Chapter 40E-63, F.A.C., for the ECP basins (available at http://www.sfwmd.gov through the *SFWMD Permitting* link, and *Rules, Statutes, & Criteria* section) which includes the Everglades Agricultural Area and the C-139 basin, and through the non-ECP permit (FDEP Permit No. 06, 502590709) issued to the District for the non-ECP basins. District Rule 40E-63 is also known as the Everglades Works of the District (EWOD) regulatory program.

The Southern Everglades-related update for this year continues to cover District phosphorus source control efforts in the ECP and non-ECP basins during WY2008 and includes basin-specific reporting of compliance status, phosphorus levels and monitoring data, and source control strategies as indicators of success. The following 10 basins in the Southern Everglades Watershed area, identified in **Figure 4-1**, discharge to the EPA: Everglades Agricultural Area (EAA), C-139, C-11 West, North New River Canal (NNRC), North Springs Improvement District (NSID), Feeder Canal, L-28, C-111, Village of Wellington's Acme Improvement District (Acme), and Boynton Farms.

During WY2008, significant progress was made to reduce discharges from the Boynton Farms Basin through diversion away from the EPA altogether. The Boynton Farms Basins' diversion efforts build upon previous diversion efforts which began in WY2007 for the Acme and NSID basins, which continue to be successful strategies for reducing phosphorus loading to the EPA. Source control strategies for each basin were reviewed and strengthened where necessary through optimization efforts consistent with the requirements of the EFA and the Long-Term Plan. The continuing drought in WY2008 contributed to rainfall deficits in most basins and approximately 50 percent less TP runoff load from ECP and non-ECP basins was observed compared to WY2007. For WY2008, the EAA basin was in compliance with its phosphorus reduction requirements for the thirteenth straight year having achieved a 44 percent reduction, and the C-139 achieved its first year of compliance with its mandated phosphorus loading level requirements under the current rule in effect.

While the C-139 basin achieved compliance for the first time in WY2008, failure to achieve compliance for four successive water years since the phosphorus loading compliance requirements took effect in 2003 resulted in initiating a rulemaking effort to revise the regulatory source control rule (Rule 40E-63) to include improved compliance methods. Revision efforts were ongoing throughout WY2008, and included conducting technical working groups and

landowner workshops, evaluation of factors impacting compliance, re-evaluation of BMP plans and scope, and evaluating optimization opportunities. It is anticipated that a revised rule will take effect in WY2009. Significant progress was made with an integrated regulatory compliance effort to ensure that water quality and conservation requirements of Environmental Resource and Water Use permits in the C-139 and Feeder Canal basins were being adhered to and to bring landowners into compliance where deficiencies existed. The BMPs regulatory program has the primary benefit toward improving water quality and only an ancillary benefit toward water quantity issues. It is anticipated this integrated regulatory effort will prove to be a successful approach for these basins where significant increases in runoff volume is evident and volume control needs to be part of the solution to control phosphorus loads from the basin.

For the Southern Everglades, basin-specific updates within this chapter present WY2008 flow and phosphorus concentration and load data, as well as compare the annual data with performance measures established by specific mandates where applicable. Source control updates for each basin are included to describe activities that were performed during WY2008 and to provide the status of long-term efforts relating to Everglades phosphorus source controls. The status of many projects being performed by others (including research, BMPs demonstration projects, and construction projects) are also briefly updated with references to additional information sources. Finally, the future direction for the District's source control program for Southern Everglades watersheds is discussed with emphasis on meeting long-term water quality goals.

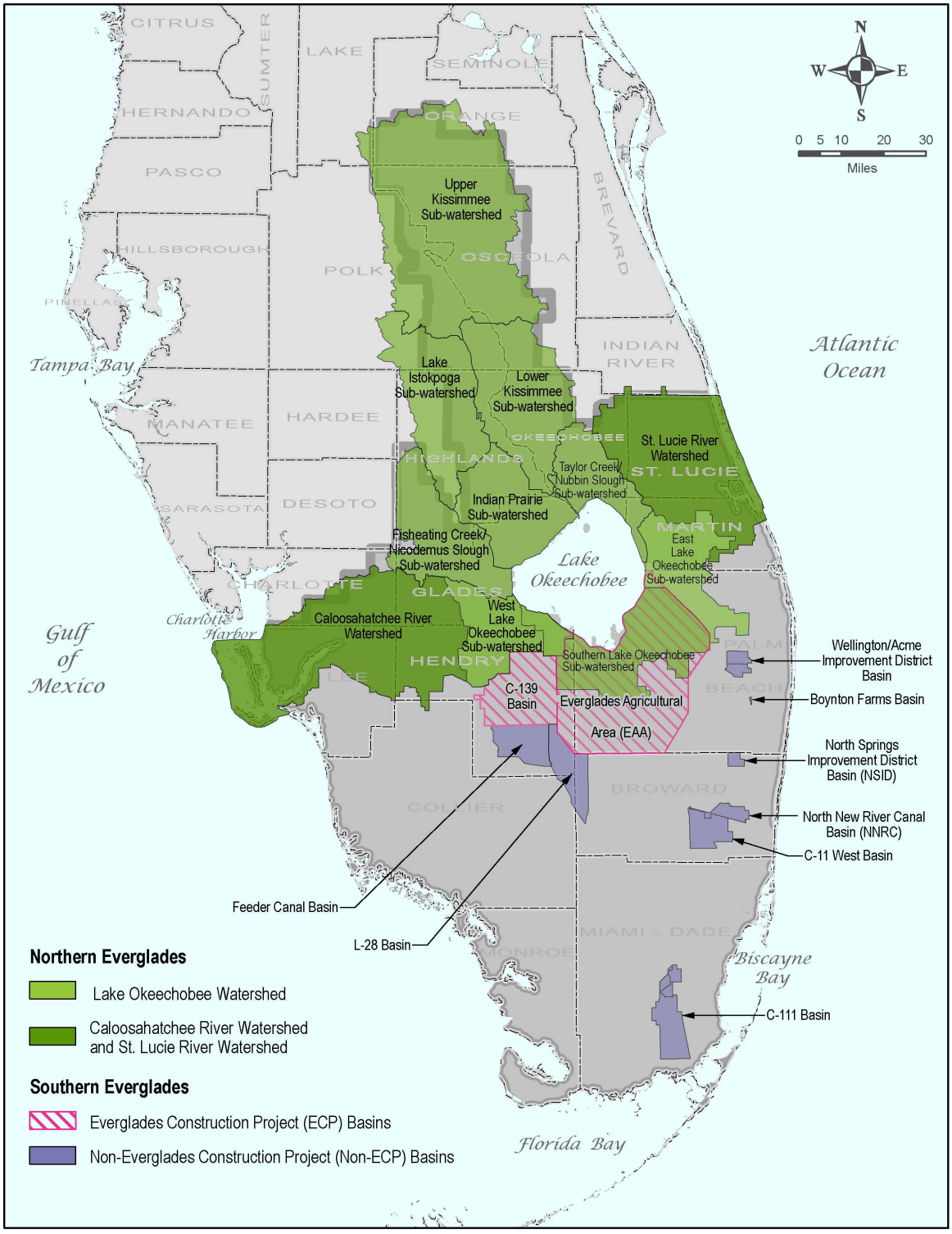


Figure 4-1. Map depicting the Northern Everglades and Southern Everglades source control program implementation areas.

WATER YEAR 2008 HIGHLIGHTS

NORTHERN EVERGLADES

As required by the Northern Everglades and Estuary Protection Plan (NEEPP) legislation, the total maximum daily load (TMDL) for Lake Okeechobee is 140 metric tons (mt) of total phosphorous (TP) during a water year, measured as a five-year rolling average, which must be achieved by 2015. Of this 140 mt of phosphorus, 35 mt are attributed to atmospheric deposition (e.g., rainfall). Therefore, the TMDL TP load entering Lake Okeechobee from direct surface water inflows is limited to 105 mt.

To achieve the NEEPP water quality restoration goals, it is anticipated that landowner implemented Best Management Practices (BMPs) for source control in combination with local and regional projects are necessary. Performance measures to evaluate the coordinating agencies' collective source control program's effectiveness for the Lake Okeechobee Watershed were under development during WY2008. Until specific performance measures are adopted through a revised Rule (40E-61), the update for this chapter will consist of reporting TP loads observed for each of the nine sub-watersheds in the Lake Okeechobee Watershed (see summary in **Table 4-1)**. When Rule 40E-61 is revised and adopted, the goal is to have source controls implemented and initial source control performance measured by 2012 in the Lake Okeechobee Watershed to allow adjustments in source control implementation as necessary prior to 2015.

As required by the NEEPP legislation, protection plans for the Caloosahatchee River and St. Lucie River watersheds were to be submitted to the Florida governor and legislature by January 1, 2009. These plans outline source control program components and goals for the river watersheds, which in turn will be translated into implementation guidelines through a rulemaking revision to District Rule 40E-61. This chapter is expected to provide future updates on the regulatory source control efforts for the Caloosahatchee and St. Lucie River watersheds that are anticipated to occur as a result of these plans beginning with the *2010 South Florida Environmental Report* (SFER) – *Volume I.*

Additional specific highlights for regulatory source control efforts in the Northern Everglades watersheds are provided below.

Lake Okeechobee Watershed

- BMP rule development continued for the Lake Okeechobee Watershed, including meeting with stakeholders such as water control districts, improvement districts, and counties that have water management authority in non-agricultural areas.
- District staff worked with coordinating agencies, including FDACS and FDEP, to revise Chapter 40E-61, F.A.C., to be consistent with NEEPP.
- The District initiated the development of a data sharing process in cooperation with FDACS to allow for tracking progress with FDACS BMP plan implementation in the watershed.

Caloosahatchee and St. Lucie River Watersheds

- The District began the development of the Caloosahatchee River Watershed Protection Plan (CRWPP) and the St. Lucie River Watershed Protection Plan (SLRWPP). See the *Overview of Northern and Southern Everglades Source Controls* section of this chapter for an overview of anticipated programs and efforts expected to be detailed in the CRWPP and SLRWPP for incorporation into the regulatory program for controlling nutrients from the watershed at the parcel level.

Table 4-1. Summary of Lake Okeechobee Watershed discharge total phosphorus (TP) concentrations (flow-weighted mean, or FWM) and loads for Water Year 2008 (WY2008) (May 1, 2007–April 30, 2008) and historical baseline periods (1991–2005).

				Baseline Avg.		Observed WY2008	
Sub-Watershed[1]	Total Area (acres)	% Non-Ag	% Ag.	TP Load (mt)	Unit Load (lbs/ac)	TP Load (mt)	Unit Load (lbs/acre)
Upper Kissimmee	1,021,674	62%	38%	91.3	0.31	32.57	0.11
Lower Kissimmee	429,283	38%	62%	77.4	0.53	11.49	0.08
Taylor Creek/Nubbin Slough	198,299	34%	66%	124.2	1.55	15.71	0.20
Lake Istokpoga[2]	392,147	45%	55%	23.3	0.18	1.98	0.02
Indian Prairie	294,147	20%	80%	88.7	0.77	19.96	0.17
Fisheating Creek & Nicodemus Slough	315,007	33%	67%	54.9	0.50	10.80	0.10
West Lake Okeechobee	200,993	20%	80%	1.0	0.01	17.24	0.23
South Lake Okeechobee[3] (EAA Basins)	361,707	6%	94%	32.6	0.20	5.40	0.03
East Lake Okeechobee[4]	237,831	72%	28%	20.3	0.52	92.21	2.37

[1] The expanded Lake Okeechobee Watershed consists of nine sub-watersheds as delineated in the Technical Plan for the Lake Okeechobee Construction Project. The sub-watersheds are being incorporated into District rule 40E-61 in accordance with the plan.

[2] The TP Load for the Lake Istokpoga sub-watershed is currently measured at the outlet of Lake Istokpoga at structure S-68. Direct measurement of the runoff from the sub-watershed to align with source control program tracking is under development.

[3] Eleven sub-basins comprise the Southern Lake Okeechobee sub-watershed (also referred to as a portion of the EAA basins, including the 298 districts, in the Lake Okeechobee Watershed Construction Project Phase II Technical Plan). Of these, six are under District control (S-4, Industrial Canal, S-2, S-3, S-351, and C-10A) and the remaining five are under the control of private operating entities (South Florida Conservancy, South Shore Drainage District (DD), East Beach Water Control District (WCD), East Shore WCD, and Closter Farms). The S-2, S-3, and S-351 structures were not operated by the District during WY2008 to move water into Lake Okeechobee from the EAA basin. Discharge primarily occurred through the Industrial Canal basin which is not part of the Everglades Construction Project or the Everglades Agricultural Area basin as defined under the Everglades Forever Act.

[4] East Lake Okeechobee flows west to the lake through S-308, and also flows to the east through structure S-80. The reported Unit Area Load (UAL) represents only the portion of TP load directed to Lake Okeechobee.

SOUTHERN EVERGLADES

The Everglades Forever Act (EFA) mandates specific performance levels for controlling phosphorus in discharges from the Everglades Construction Project (ECP) basins [Everglades Agricultural Area (EAA) and C-139 basins] in the Southern Everglades. The EAA and C-139 basins' success indicators for meeting those performance levels are outlined in Appendix 4-3. For the non-Everglades Construction Project (non-ECP) basins, the EFA requires the Florida Department of Environmental Protection (FDEP) to issue long-term compliance permits to the District to regulate phosphorus levels in discharges. During the initial phase of implementation under the Long-Term Plan, the FDEP permits will be based upon Best Available Pollution Reduction Technologies (BAPRT) and include Technology-Based Effluent Limitations (TBELs). More detailed supplemental information for the non-ECP basins is provided in Appendix 4-4.

For the ECP basins, runoff is generally directed to regional Stormwater Treatment Areas (STAs) before entering the Everglades Protection Area (EPA). Therefore, the TP load summary for the ECP basins should not be confused with the TP load that actually enters the EPA after treatment. The treatment effects of STAs in further reducing the ECP basin nutrient runoff loads is presented in Chapter 5 of this volume. For most of the non-ECP basins, runoff entering the EPA does not currently undergo treatment in an STA. The current exception to this is the Acme basins. Since WY2007, Acme basins runoff receives treatment through an STA prior to discharge into the EPA. During WY2008, a new discharge pump station for the C-139 Annex (within the L-28 basin) was completed for the purpose of diverting all runoff to an STA prior to discharge to the EPA. It is anticipated that pump operations will begin for the C-139 Annex in WY2009.

The EAA continues to meet the required performance levels of the EFA with a 44 percent TP load reduction in WY2008. For the C-139 basin, WY2008 marks the sixth year of mandatory BMP implementation, and the first year the basin was able to meet compliance with TP loading requirements. It should be noted the District 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, North New River Canal (NNRC), Feeder Canal, and L-28 basins. It was previously expected that the EFA long-term compliance permit, also referred to as the post-2006 Phase II permit, containing the TP concentration limits for the C-111 basin and the first non-ECP TBEL requirements, would be issued during WY2008; however, the application is still under consideration.

Results from TP data collected during WY2008 for each ECP and non-ECP basin are summarized in **Table 4-2**. Of the 111 mt of runoff TP load generated by the combined ECP and non-ECP basins, the ECP basins accounted for 90 percent of the total runoff load. Due to continuing drought conditions, relatively low rainfall amounts were characteristic for all basins during WY2008. Details on WY2008 hydrologic events are reported in Chapter 2 of this volume.

Additional specific highlights for regulatory source control efforts in the Southern Everglades watersheds are provided below.

ECP Basin (Everglades Agricultural Area)

- Five-year BMP permit renewals were completed for EAA basin permit holders. The District worked with landowners to optimize the BMP plans contained in their permits when applicable.

- The University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) statistical analysis of farm-level data was completed under the rule-required EAA BMP Master Research Permit. The EAA Environmental Protection District submitted a proposal for continuing farm BMP research under the permit.
- Water quality analyses of priority phosphorus discharges into the basin, Lake Okeechobee and the East Beach Water Control District (EBWCD), were developed.
- The District and FDEP coordinated the development of performance measures for areas that discharge to Lake Okeechobee and the Everglades.

ECP Basin (C-139)

- Rule development continued with five public workshops and coordination meetings with the FDACs, FDEP, and individual stakeholders. Technical investigations and workshops were conducted to refine the method to determine compliance with EFA requirements.
- The UF/IFAS conducted demonstration projects to optimize application of phosphorus nutrients in vegetable farms with District funding. The District contracted with UF/IFAS to refine and extend this research for an additional three years.
- Monitoring and data analyses continued to identify upstream TP sources and potential water quality improvement projects, including BMPs, that can be developed to control those sources.
- The Watershed Assessment Model, developed and calibrated through the C-139 Basin Hydrology and Water Quality Analysis, was used to evaluate water quality improvement projects involving changes to the water management system, BMPs, or other conditions affecting phosphorus loading from the basin.
- An integrated regulatory compliance strategy was implemented to ensure that water quality requirements of District-issued Environmental Resource and Water Use permits for the basin are being met. Workshops and one-on-one consultations with landowners were conducted.

Non-ECP Basins

- Analysis of TP concentrations in WY2008 indicates less variation among non-ECP basins than in WY2007. Observed TP flow-weighted mean (FWM) concentrations in WY2008 ranged between 7 and 101 parts per billion (ppb).
- Phosphorus source controls and Water Quality Improvement Plans in the C-11 West, C-111, NNRC, and North Springs Improvement District (NSID) basins continue to be successful strategies. The C-11 West basin and the C-111 basin TP FWM concentrations were between 7 and 16 ppb. There was no flow from the NNRC, NSID, or Acme basins to the EPA in WY2008.
- Since December 2006, the Acme flows have been discharged into the C-51 canal with discharges generally directed to STA-1E. Therefore, beginning with WY2009, the Acme basin will be designated as an ECP basin. A phosphorus source control strategy will continue to be implemented in this basin.

- Once the C-139 Annex landowner meets all regulatory compliance requirements (including implementation of a phosphorus source control strategy), flow from this sub-basin (approximately 25 percent of the area within the L-28 basin) will be diverted to STA-6. Also, the sub-basin will be designated as an ECP basin in future updates.
- For WY2008, approximately 11.4 mt of TP load was discharged by non-ECP basins to the EPA. The Feeder Canal and L-28 basins (comprised of primarily agricultural land use) contributed 7.2 mt of TP load, or 63 percent, of the total non-ECP basin load.
- Integrated Permit Compliance efforts within the Feeder Canal basin aim to ensure that landowners are in compliance with Environmental Resource Permit, Surface Water Management Permit, and Water Use Permit requirements as well as requiring implementation of BMPs. The efforts were initiated with a landowner workshop held in February 2007. During WY2008, the District conducted one-on-one consultations with landowners to ensure that they comply with these permits as well as to facilitate implementation of phosphorus source control BMPs. A total of seven one-on-one consultations were conducted with the landowner permittees that perform intensive row crop farming and citrus production within the basin.
- The District continued working with landowners within the McDaniel Ranch area to ensure appropriate water quality treatment and implementation of BMPs.
- The District continued to monitor the discharges from each non-ECP basin to evaluate their progress toward achieving established water quality standards. It was previously expected that the EFA long-term compliance permit, also referred to as the post-2006 Phase II permit, containing the TP concentration limits for the C-111 basin and the first non-ECP TBEL requirements would be issued during WY2008; however the application was still under consideration by FDEP at the time of this report.

Table 4-2. Southern Everglades summary of Everglades Construction Project (ECP) and non-ECP basin discharge total phosphorus (TP) concentrations (flow-weighted mean, or FWM) and loads for WY2008.

Basin[1]	Primary Land Use	FWM TP Concentration (ppb)	TP Load (mt)	Unit Area Load (lbs/acre)
ECP Basins				
Everglades Agricultural Area (EAA)	Agricultural	123	94.1	0.44
C-139	Agricultural	113	5.4	0.07
non-ECP Basins				
C-11 West	non-Agricultural	17	2.8	0.05[2]
North New River Canal (NNRC)	non-Agricultural	(no flow)[3]	(no flow)[3]	(no flow)[3]
North Springs Improvement District (NSID)	non-Agricultural	(no flow)[4]	(no flow)[4]	(no flow)[4]
Feeder Canal	Agricultural	101	3.2	0.05
L-28	Agricultural	36	4.0	0.06
C-111	non-Agricultural	7	1.4	0.02
Acme Improvement District (Acme)	non-Agricultural /Equine	(no flow)[5]	(no flow)[5]	(no flow)[5]
Boynton Farms	Agricultural	(N/A)[4]	(N/A)[4]	(N/A)[4]

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

[2] C-11 West basin flows west to WCA-3A through pumps S-9 and S-9A to the EPA, and also flows to the 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 from NSID and NNRC basins to the EPA during WY2008.

[4] Since December 2006, the Acme flows discharge into the C-51 canal, and are then generally directed to STA-1E. Beginning with WY2009, Acme will be designated an ECP basin.

[5] No instrumentation in place for flow monitoring from this area.

OVERVIEW OF NORTHERN AND SOUTHERN EVERGLADES SOURCE CONTROLS

Underscoring the state's commitment to Everglades ecosystem restoration, the Florida legislature introduced the Northern Everglades Initiative and provided a simplified and organized approach to focus on the full scope of Everglades restoration in the context of the Northern and Southern regions of the Everglades system. A watershed source control program to control pollutants at the source in water bodies related to the Northern and Southern Everglades is integral to the restoration efforts for the Greater Everglades ecosystem.

The Northern Everglades Initiative expanded the Lake Okeechobee Protection Act (LOPA) [Section 373.4595, Florida Statutes (F.S.)] to safeguard and restore the entire Northern Everglades system, including the interconnected Kissimmee River and Lake Okeechobee, as well as the Caloosahatchee River and St. Lucie River watersheds and estuaries. These goals are anticipated to be accomplished through watershed-specific protection plans. These plans will augment and enhance restoration currently under way in the remnant Everglades south of the lake. The legislature directed that each watershed protection plan shall include a pollutant source control program. For the 2009 SFER, this chapter has been expanded and renamed *Phosphorus Source Controls for the South Florida Environment* to focus on the full scope of Everglades restoration; the chapter is now organized to report on both Northern Everglades and Southern Everglades source control programs. While Chapter 10 of this volume provides an overview of the source control efforts necessary to support the Northern Everglades Initiative, this chapter focuses on the planning and details behind the technical efforts under way to develop and build a consistent and holistic approach to source control programs in the various watersheds — while at the same time recognizing the unique source control issues for each watershed. The goals and objective of the Northern and Southern Everglades source control program efforts complement and support one another. Further information on the Northern Everglades, particularly Lake Okeechobee, the Kissimmee Basin, and the northern estuaries, is also presented in Chapters 10, 11, and 12 of this volume, respectively.

NORTHERN EVERGLADES

In April 2007, the Florida legislature substantially expanded LOPA to include protection and restoration of the Lake Okeechobee Watershed and the Caloosahatchee and St. Lucie River watersheds and their estuaries. The newly expanded program(NEEPP), required the District, in collaboration with the FDEP and the Florida Department of Agricultural and Consumer Services (FDACS) (as coordinating agencies) and in cooperation with local governments, to develop: (1) the Lake Okeechobee Watershed Construction Project Phase II Technical Plan (P2TP), (2) the St. Lucie River Watershed Protection Plan (SLRWPP), and (3) the Caloosahatchee River Watershed Protection Plan (CRWPP). These plans are expected to augment restoration currently under way in the Everglades south of the lake — and build on ongoing restoration efforts north of Lake Okeechobee and in the river watersheds.

The NEEPP also requires that each of the two river watershed protection programs include watershed protection plans, a watershed construction project, a watershed pollutant control program, and a watershed research and water quality monitoring program. The watershed pollutant control program must include a component utilizing BMPs for water quality improvement. In the future, this chapter is expected to report on the source control component of each watershed's restoration program as it evolves.

The Lake Okeechobee Watershed Construction Project Phase II Technical Plan (P2TP), submitted to the legislature in February 2008, is currently being implemented. This technical plan identifies construction projects, along with on-site measures that prevent or reduce pollution at its source, such as agricultural and urban BMPs, needed to achieve Lake Okeechobee TMDL. In addition, the plan includes other projects for increasing water storage north of the lake to achieve healthier lake levels and reduce harmful discharges to the Caloosahatchee and St. Lucie river estuaries. The technical plan and its appendices are available on the District's web site at www.sfwmd.gov, under the *Lake Okeechobe*e tab. The SLRWPP and CRWPP plans are due by January 1, 2009.

Lake Okeechobee Watershed

Prior to the NEEPP legislation, legislative authorization existed for a regulatory phosphorus source control program to implement BMPs at the parcel level within the original boundary of the Lake Okeechobee Watershed. This original authorization was derived from the Lake Okeechobee Surface Water Improvement and Management (SWIM) Act of 1987; South Florida Water Management District (SFWMD or District) implementation guidelines were subsequently outlined in a new rule effective in 1989 [Chapter 40E-61, Florida Administrative Code (F.A.C.)] also known as the Lake Okeechobee Works of the District (LOWOD) regulatory program. LOPA and NEEPP have substantially changed the original SWIM Act. LOPA established the Total Maximum Daily Load (TMDL) target for TP for Lake Okeechobee to be met by 2015 and expanded the jurisdiction of the regulatory phosphorous source control program to the Upper Kissimmee sub-watershed and several other smaller sub-watersheds not originally covered under Rule 40E-61. The NEEPP also added the Caloosahatchee and St. Lucie River Watersheds Protection Program, authorized the expansion of Lake Okeechobee Works of the District (LOWOD) to incorporate the river watershed areas, and expanded the source control program to add nitrogen as a nutrient of concern due to impairment of these rivers' estuaries.

The NEEPP legislation required the development of the Lake Okeechobee Watershed Construction Project Phase II Technical Plan (P2TP). This plan included an evaluation of current programs and projects aimed at reducing harmful flows and phosphorus loads and developing alternatives to achieve water quality and quantity objectives (SFWMD et al., 2008) for the Lake Okeechobee Watershed. The technical plan provided direction for future development of regulatory programs in the Lake Okeechobee Watershed.

- Land use and management practices are significantly influencing water quality and quantity in the watershed.
- Implementation of BMPs, along with other TP reduction measures, is expected to reduce loading from the watershed. However, legacy phosphorus will be an issue for some time.
- In the Upper Kissimmee Region, BMPs are expected to reduce phosphorus loadings into the major lakes in the region upstream of Lake Okeechobee. While the benefit to Lake Okeechobee may not be immediate, the protection of the upstream lakes will aid in the long-term protection of the lake.

The technical plan calls for a phased execution of projects throughout the watershed. Through 2015 it is expected that phased implementation of BMPs will occur. It is also expected in this time frame that a special basin Environmental Resource Permit (ERP) rule will be adopted with specific supplemental criteria to result in no increase in runoff from new development in the watershed, along with a new FDEP statewide stormwater treatment rule based on a performance

standard whereby post-development nutrient (nitrogen and phosphorus) levels are not exceeding pre-development (natural state) conditions for new development. Overall, the efforts to control phosphorus through source controls will be accomplished through a joint effort between the coordinating state agencies (the SFWMD, FDACS, and FDEP) and will include the following activities:

- Implementation of non-point source BMPs on agricultural and non-agricultural lands to ensure that the amount of nutrients discharged off-site are minimized to the greatest possible extent.
- Coordination with local governments to implement the nonagricultural, non-point-source BMPs within their respective geographic boundaries.
- Assessment of current water management practices within the watershed and development of recommendations for structural, nonstructural, and operational improvements that consider and balance water quality and supply.
- Ensuring that wastewater residuals (within the watershed) do not contribute to nutrient loadings in the watershed.
- Coordination with the Florida Department of Health (FDOH) to ensure that septage disposal within the watershed is under an approved agricultural use plan that limits applications based on nutrient loading limits established in the LOWOD.
- 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.
- Implementation of a source control monitoring program to measure the collective performance and progress of the coordinating agencies' programs, to 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.

There are nine sub-watersheds in the Lake Okeechobee Watershed as identified by the P2TP. Source control programs are anticipated to be implemented through a phased approach based on priority areas of water quality concern.

Caloosahatchee River and St. Lucie River Watersheds

As previously described, the NEEPP amended LOPA to expand watershed protection and restoration activities to the Caloosahatchee and St. Lucie river watersheds. Development of the protection plans was initiated in Water Year 2008 (WY2008) (May 1, 2007–April 30, 2008) and both plans are required to be presented to the governor and legislature by January 1, 2009. Future updates to this chapter are planned to provide progress with rule development and the status of implementation of the source controls in these river watersheds.

SOUTHERN EVERGLADES

The Southern Everglades phosphorus source control program is one of the strategies to achieve water quality standards for the EPA and continues to be a strategic priority under the District's Everglades Program. The EFA and the Long-Term Plan outline District responsibilities and schedules to implement basin-specific solutions to control phosphorus at the source.

The strategy includes implementation of BMPs for phosphorus reduction, regulatory programs, voluntary programs, educational programs, and integration with local and regional projects. The District 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 statute and the Long-Term Plan. In accordance with the EFA, BMP implementation guidelines are outlined in a District regulatory rule (Chapter 40E-63, F.A.C.) for the ECP basins (available at http://www.sfwmd.gov through the *SFWMD Permitting* link, and *Rules, Statutes, & Criteria* section) which includes the EAA and the C-139 basin, and through the FDEP Permit No. 06, 502590709 for the non-ECP basins. District Rule 40E-63 is also known as the Everglades Works of the District (EWOD) regulatory program.

The long-term Everglades water quality goal is to meet water quality standards established by the EFA, including compliance with the phosphorus criterion in the EPA by using the Long-Term Plan (Burns and McDonnell, 2003), which consists of an optimal combination of source control strategies, Stormwater Treatment Areas (STAs), Advanced Treatment Technologies, and integration with Comprehensive Everglades Restoration Plan (CERP) projects. Chapter 8 of this volume provides further information on the Long-Term Plan. The restoration program incorporates both a strong science base and an adaptive management philosophy to achieve and maintain long-term water quality goals. Controlling phosphorus at the source is the foundation of the water quality improvement component of the Everglades Restoration Program.

The District has identified 10 basins with discharges tributary to the EPA in which phosphorus source control programs are to be implemented (**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 education and outreach activities have been extensively reported in previous SFERs.

To ensure compliance with the EFA, the District 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 District is required by permit to report on the results of these programs annually. This chapter and related appendices serve as the reporting mechanisms to fulfill this requirement.

The source control strategy for the basins tributary to the ECP, which includes the EAA and C-139 basins, 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 District to achieve the phosphorus criterion in the EPA and fulfill its obligations under the EFA and the federal Everglades Settlement Agreement. During WY2008, the District continued to implement the primary source control activities listed

in **Table 4-3** on a basin-specific basis. See the *Source Controls for the ECP Basins* and *Source Controls for non-ECP Basins* sections of this chapter for a detailed update on these activities.

ECP Basins

The ECP permits require the District to construct, maintain, and operate the ECP in the EAA and C-139 basins, the largest tributary sources to the EPA. The ECP permits regulate the construction and operation of the STAs and require the District 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 source control program is defined in District Rule 40E-63. BMP plans are approved through the regulatory program and are implemented by individual permittees. BMPs are approved with the intent of providing a comprehensive BMP plan. 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 research is a component of optimization efforts, 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 can be found in Appendix 4-1, and an analysis of EAA farm-level phosphorus results for WY2008 is presented in Appendix 4-3.

Further, the Long-Term Plan stipulates that the District perform supplementary activities designed to maintain and improve upon the contribution of source controls to the overall water quality improvement goals in the basins. This chapter provides WY2008 TP results for the ECP basins and an update on the progress of their regulatory and Long-Term Plan 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

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 education 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 District that discharge into, within, or from the EPA and are not included in the ECP project. 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. As required by the EFA, the non-ECP permit is expected to be modified to require compliance with the TP concentration limits for the C-111 basin and with Technology-Based Effluent Limitations (TBELs) for the C-11 West, NNRC, Feeder Canal, and L-28 basins. The proposed TBELs will define TP concentration limits in discharges from into structures associated with these four non-ECP basins. This chapter provides an update of the WQIPs for each non-ECP basin. TP data is presented in this chapter to evaluate the success of the WQIPs and to evaluate each non-ECP basin's progress toward achieving established water quality standards compliance of non-ECP basins with the TP concentration limits or their proposed TBELs. 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 updated comprehensive evaluation of water quality as required by non-ECP permit conditions.

Eight basins that discharge directly to the EPA are not part of the ECP. Five of these basins have into structures that are operated and maintained by the District and are permitted under the non-ECP permit: C-11 West, NNRC, Feeder Canal, L-28, and C-111. The non-ECP permit is expected to be modified to require TBELs in TP concentration for discharges from the into structures associated with these five basins. These into 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 three remaining non-ECP basins that were capable of discharging directly to the EPA through structures that are not owned or operated by the District: Acme, NSID, and Boynton Farms. Pursuant to the EFA and Long-Term Plan, the District has implemented source control programs in each of these basins through development of WQIPs equivalent to those required under the non-ECP permit. As part of the WQIPs, the Acme basin ceased pumping of untreated runoff into the Arthur R. Marshall Loxahatchee National Wildlife Refuge in December 2006 after completion of the necessary conveyance improvements for diversion of these flows to the C-51 canal, which is then generally directed to STA-1E. Beginning in WY2009, the Acme basin will be redesignated as an ECP basin, since runoff from the basin will be directed to the STA.

Table 4-3. Summary of ECP and non-ECP source control activities for WY2008.

Watershed or Basin	Water Quality Improvement and Related Projects	BMP Development and Implementation	Education and Training
Everglades Construction Project (ECP)			
EAA	Supplemental Long-Term Plan Projects	Permit-required BMPs; EAA – Everglades Protection District (EPD) BMP Research	On-site BMP Verifications; UF/IFAS BMP Training Workshops; Development of UF/IFAS Extension Materials; UF/IFAS One-on-One BMP Consultation Program
C-139	Supplemental Long-Term Plan Projects	Permit-required BMPs; C-139 BMP Demonstration and Effectiveness Grant Program; C-139 Basin Vegetable Production Demonstration Project	On-site BMP Verifications; Compliance Workshops with Landowners
non-ECP			
C-11 West	Broward County Water Preserve Area (CERP); South Broward Drainage District and Central Broward Water Control District Improvements	Broward Everglades Working Group (BEWG) Comprehensive Pollution Reduction Action Plan; C-11W Nursery BMP Grant Program; Urban, Equine, and Golf Course BMPs; Environmental Resource Permit (ERP)-required BMPs	Educational Public Service Announcements (PSAs); Know-The-Flow Workshops; Web site development
NNRC	WCA-2 and WCA-3 Diversion (CERP)	BEWG Comprehensive Pollution Reduction Action Plan; Urban, Equine, and Golf Course BMPs	Educational PSAs; Know-The-Flow Workshops; Web site development
NSID	Hillsboro Site 1 Impoundment (CERP)	BEWG Comprehensive Pollution Reduction Action Plan; BMP Cooperative Agreement; Golf Course BMPs; ERP-required BMPs	Educational PSAs; Know-The-Flow Workshops; Web site development
Feeder Canal	Big Cypress/L-28 Interceptor Modifications (CERP); Seminole Tribe Water Conservation Plan (WCP) Project; McDaniel Ranch Surface Water Management System	C-139 and Western Basins BMP Grant Program; BMPs required under existing regulatory programs	On-site BMP verifications; BMP education and training workshops; one-on-one compliance efforts

Table 4-3. Continued.

Watershed or Basin	Water Quality Improvement and Related Projects	BMP Development and Implementation	Education and Training
L-28	STA-6 Expansion (ECP); C-139 Annex Diversion; Seminole Tribe WCP Project; Miccosukee Tribe Water Management Plan Project	C-139 Annex BMP implementation; ERP-required BMPs	On-site BMP verifications
C-111	C-111 Project; C-111 Spreader Canal (CERP); Combined Structural and Operational Plan (CSOP)	C-111 Basin Nursery Grant Program; Mobile Irrigation Lab	Educational PSAs; web site development
Acme	Acme Basin B Discharge Project (CERP); Race Track Lake Expanded Water Quality Treatment Marsh; Acme Conveyance Improvements for Acme Basin B Discharge Project	BMP Cooperative Agreement; Enforcement of fertilizer and manure ordinances; ERP-required BMPs	Educational PSAs; web site 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

SOURCE CONTROLS IN THE LAKE OKEECHOBEE WATERSHED

REGULATORY BACKGROUND

The Lake Okeechobee SWIM plan set forth a loading target for Lake Okeechobee of 360 metric tons (mt). District Technical Publication 81-2 provided the basis for establishing target phosphorus concentrations that each basin flowing into Lake Okeechobee had to achieve in order to attain a TP inflow loading of 360 mt, measured as five-year rolling average. The LOWOD (Rule 40E-61) limited the amount of phosphorus that could be discharged from a parcel based on land use and the target phosphorus concentrations established by Technical Publication 81-2. The LOWOD regulatory source control program is an ongoing program of BMPs implemented through the issuance of permits for new and existing agricultural, non-agricultural, and urban land uses. It is a comprehensive program of BMP plan approval, verification of implementation through field visits, and data evaluation.

In 2000, the Florida Legislature revised the SWIM statute and it became LOPA (see the *Overview of Northern and Southern Everglades Source Controls* section of this chapter), establishing a restoration and protection program for the lake and expanding the program's geographic area to the Upper Kissimmee sub-watershed and the Lake Istokpoga sub-watershed (see **Figure 4-1**). It directed that phosphorus load reductions will be achieved through a phased program of implementing long-term solutions based upon the Lake Okeechobee TMDL for TP developed by the FDEP (2001) to be attained by 2015. The District, FDEP, and FDACS were identified as the coordinating agencies mandated to develop a Lake Okeechobee Protection Plan (LOPP), including development of a program of non-point source BMPs that complements the District's existing regulatory programs and is designed to achieve the objectives of LOPP. In 2001, SFWMD, FDEP, and FDACS executed a Memorandum of Understanding to establish agreement on the comprehensive implementation of LOPA. As a result, FDACS adopted rules to implement a BMP program for agricultural landowners complementary to the District's LOWOD source control rule for phosphorus reductions and ERP rule for design of stormwater management systems.

NEEPP, passed in 2007, further refines the responsibilities of the coordinating agencies to achieve the objectives of the LOWPP on an expedited basis. The LOWPP includes, but is not limited to (1) continued implementation of existing regulations and voluntary agricultural and non-agricultural 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. The FDEP, FDACS, and other SFWMD source control programs under the LOWPP for agricultural, non-agricultural, and urban land uses are described in Chapter 10 of this volume. Chapter 10 also describes data collection efforts aimed at estimating the effectiveness of BMPs based on land uses for future project planning and program optimization purposes. This should not to be confused with performance measures that will be developed for the LOWOD rule to determine the effectiveness of the combined pollutant source control programs implemented by the coordinating agencies and measured through data collection at representative sub-watershed locations as described below.

In response to the NEEPP mandates, the LOWOD regulatory source control program rule is being revised to be compatible with current initiatives. The specific objectives are to amend the rule to:

- Implement a phosphorus source control program utilizing BMPs addressing all lands within the Lake Okeechobee Watershed.
- Recognize agricultural lands that are greater than 100 acres (ac) and are implementing BMPs under the FDACS BMP rule (Chapter 5M-3, F.A.C.) as meeting the intent of the rule.
- Establish load-based performance measures for the combined BMP source control programs implemented in the watershed and a timeline for BMP implementation coincidental with performance measure timelines.
- Define the monitoring network necessary to monitor compliance with the established performance measures, to identify priority areas of concern and BMP optimization, and to provide data to evaluate and enhance performance of downstream facilities.
- Establish a plan for optimizing the combined BMP source control programs should the expected water quality performance goals not be met.
- Ensure consistency with data presented in LOPP.
- Include incentives for permittees to participate in TP reduction demonstration projects that will provide valuable data for expanding, accelerating, and optimizing the implemented BMPs to meet water quality objectives and for further refinement of the LOWOD source control program as necessary.

This section of the SFER provides an update for the LOWOD and watershed source control program in WY2008, focusing on status of the water quality within the Lake Okeechobee Watershed and an update on the status of the source control rule revision.

PROGRAM UPDATES

At the time of this report, rule development was progressing for the Lake Okeechobee source control program under Chapter 40E-61, F.A.C., to reflect the requirement that LOPP aligns with the expanded boundaries and requirements of NEEPP. As part of that effort, performance measures are being developed to evaluate the TP reductions associated with the combined source control programs by the coordinating agencies. Program performance will be evaluated annually after the rule is effective. However, the annual performance evaluations will represent partial implementation of source controls until the phased implementation of BMPs throughout the watershed under the combined BMP programs is complete. For the 2009 SFER, an analysis has been prepared to compare the observed unit area load for TP within the Lake Okeechobee Watershed for WY2008 against the average unit area loads based on historic water quality data from WY1991–WY2005, also known as the period of record (POR) for the Lake Okeechobee Watershed Technical Plan, since the performance measures under the proposed rule revision have not been finalized. Additional supplemental details on the regulatory program are presented in Appendix 4-2 of this volume.

Water Year 2008 Total Phosphorus Results for the Lake Okeechobee Watershed

This section provides an update of the Lake Okeechobee Watershed's WY2008 TP unit area loads in comparison to the five-year POR TP unit area loads. WY2008 observed loads versus POR average loads are divided into the nine sub-watersheds and presented in **Table 4-1. Figure 4-2** graphically depicts how the WY2008 TP unit area load compares against the POR load.

The watershed did not exceed the average POR TP load (TP load of 207.37 mt) during WY2008; this load was less than half of the POR average TP watershed load of 513.83 mt. This noticeable decrease may be due to below-average rainfall amounts experienced during WY2008 as part of the 2006–2008 drought. **Table 4-1** and **Figure 4-2** show that the observed TP unit area load for the East Lake Okeechobee sub-watershed in WY2008 was 4.6 times higher than the average unit area load for the POR. This high value was observed due to higher than average inflow rates into Lake Okeechobee from the St. Lucie Estuary during July, September, and October 2007.

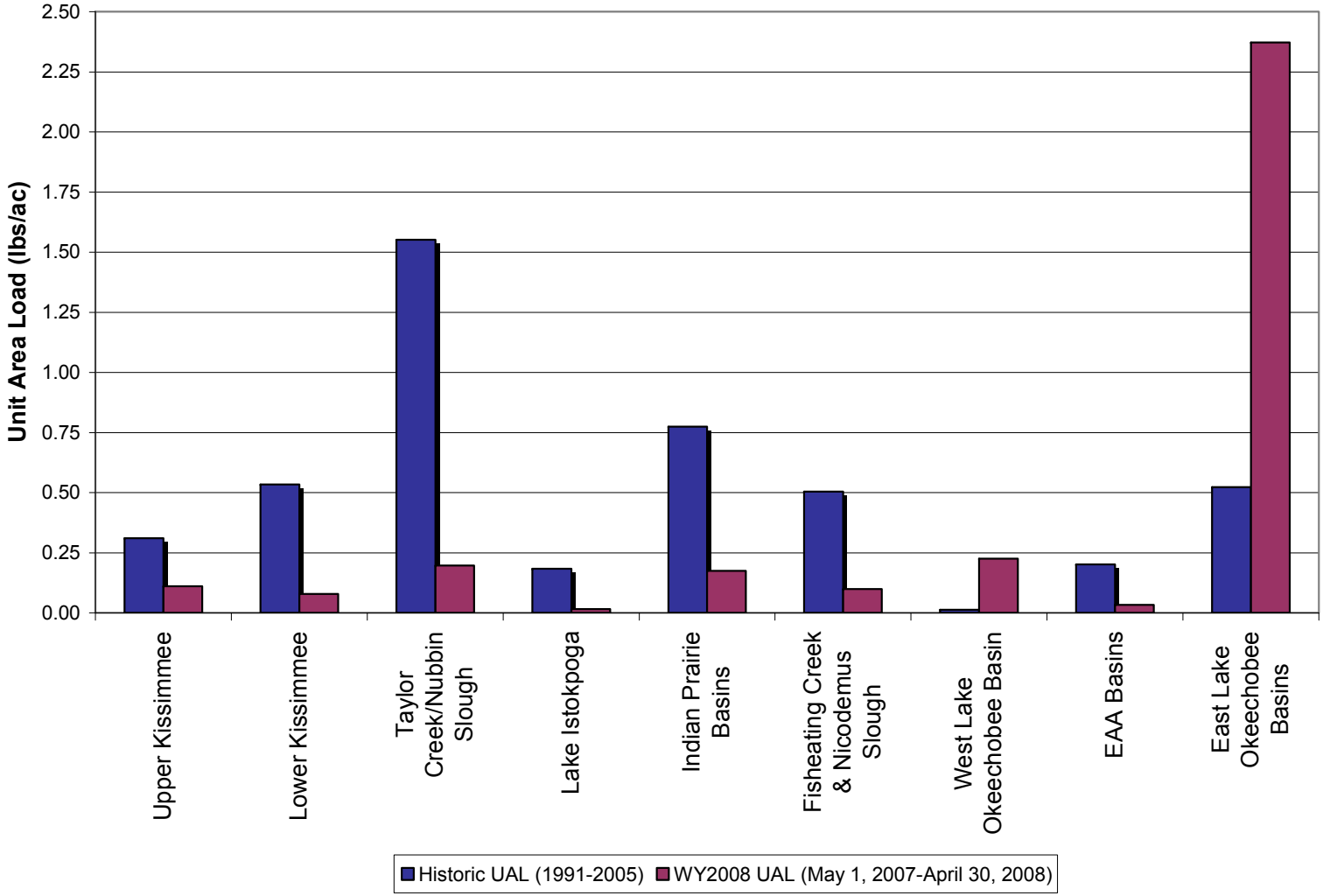


Figure 4-2. Unit area load (UAL) comparison for Lake Okeechobee sub-watersheds for WY2088 versus the historical period of record (WY1991–WY2005).

Lake Okeechobee Watershed Source Control Strategy

Based on existing rule criteria, permittees are presumed to be in compliance unless parcel-level monitoring data indicate otherwise. Because of budgetary constraints, limited parcel-level monitoring is conducted by the SFWMD through a network of moving sampling sites, originally used to determine parcel-level compliance. Based on the legislative changes to LOPA in 2000, FDACS became the primary agency for working with agricultural lands to encourage incentive-based BMP implementation, while the SFWMD focused on non-agricultural land uses. The parcel-level SFWMD monitoring then evolved to be used, in part, to direct FDACS to agricultural land uses exhibiting poor water quality. The parcel-level monitoring program has been very limited in scope and does not measure the effectiveness of the source control program. It is concentration-based and only targets those land areas that are shown to be significant contributors of phosphorus.

Lake Okeechobee Watershed Source Control Activities

Summary of Water Year 2008 Activities

The main focus of the source control program in WY2008 was to conduct rulemaking to incorporate the most recent legislative changes into the District's source control rule. During WY2008, the District continued to issue permits under the existing rule, make progress toward amending the rule, and work with the coordinating agencies to identify areas of existing water quality concern for FDACS BMP program implementation for the Lake Okeechobee Watershed. The following is an update of District activities that have taken place during WY2008:

1. **LOWOD Permitting:** During WY2008, the District continued to issue permits for phosphorus source control plans and proceed with amending Chapter 40E-61, F.A.C., to reflect the changes in statute. One of those changes is the expanded program boundary. Public workshops were held with stakeholders in the original Lake Okeechobee Watershed boundary as well as the Upper Kissimmee sub-watershed under the expanded boundary.
2. The District also conducted technical reviews toward the development of performance measures for the combined source control program.

Anticipated Activities for Water Year 2009

1. **Regulatory Program Rule Revision:** The rule revision process will be continued by the District in WY2009. As part of this rule revision, five public workshops were held in July and August of 2008; two workshops were held in Okeechobee, two workshops were held in Kissimmee, and one workshop was held in Belle Glade. It is expected that the rule revision will be completed during WY2009. Once rule revision has been completed and adopted, permitting to approve BMP plans, verification of implementation, and data evaluation to track performance under the new rule are anticipated to begin in the watershed.
2. **Technical Evaluation of the Lake Okeechobee Watershed Assessment (LOWA) Monitoring Network:** In WY2009, the District will initiate efforts to track and report on the combined source control programs' performance using phosphorus load data at the sub-watershed level and utilize data collected at the summary basin level to understand upstream contributions and source for optimization efforts. Performance data must be placed within the context of the phased approach to BMP implementation as verified throughout the watershed to be representative of water quality improvements resulting from BMP

implementation. Therefore, the calibration and optimization of the LOWA monitoring network to better analyze the watershed's performance is necessary.

FUTURE EFFORTS FOR THE LAKE OKEECHOBEE WATERSHED

Because the source control program boundaries were expanded by the NEEPP to include areas never before regulated by the District for phosphorus source control, source control efforts will incorporate an adaptive management process for optimizing the source control programs' effectiveness when rule revisions are completed. An optimized monitoring network for performance measures will also allow prioritization of resources to those areas of greatest water quality concern and to enhance performance of downstream treatment facilities where applicable.

In some cases, sub-watersheds are further divided into smaller basins, also called summary basins. It is anticipated that future BMP optimization efforts will be guided by the overall performance of BMPs at a sub-watershed level, as evidenced by the phosphorus loads from the sub-watersheds. Further refinement of BMP optimization may be possible within particular sub-watersheds, down to the summary basin level, if phosphorus loading information is available for this level of refinement. It is anticipated that updates to this chapter after the revised rule is effective will include details about the progress of load reductions from BMP efforts at the sub-watershed and summary basin scales.

Reductions in phosphorus loads were observed in WY2008 for the Lake Okeechobee Watershed (with the exception of the east and west Lake Okeechobee sub-watersheds). The loads were well below historical averages but still above the TMDL target for Lake Okeechobee. These results most likely can be attributed to lower than average rainfall amounts for the watershed. BMP programs, coupled with a process to verify their implementation, are necessary in the watershed to ensure source control program effectiveness and that downstream water quality ultimately complies with the Lake Okeechobee TMDL in the long term.

SOURCE CONTROLS IN THE ECP BASINS

REGULATORY 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 District 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 statute. For the EAA, the legislature provided for a tax incentive credit against the Everglades Agricultural Privilege tax for any phosphorous load reductions achieved in excess of 25 percent in order to encourage BMP performance and maximize load reductions. Limits on TP load from these tributary basins are 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 reduction of the TP loads discharged from the basin of 25 percent when compared to the pre-BMP baseline period as defined in Rule 40E-63. 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 is used as a secondary compliance method. This secondary method assesses individual farm TP load contributions and individual farm compliance. There is not a provision in the rule for use of the permittee's TP loads from individual farms for determining compliance as long as the basin-level TP load reduction requirement is met. The District 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 District-approved discharge monitoring plans).

The EFA mandate for the C-139 basin has similar compliance and monitoring requirements as the EAA basin (for the TP loads leaving the basin) with a few modifications. 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 historical loads observed during the baseline period with no additional requirement of achieving load reductions in future years with BMP implementation. Therefore, as long as the C-139 maintains phosphorus loading levels at historic levels with allowable adjustments for hydrologic variability, then the C-139 basin will maintain compliance with EFA requirements.

The EFA states that, if the basin is out of compliance, actions required from individual landowners are conditioned upon the proportional share of the TP load discharged from the basin. A secondary compliance determination for individual landowners in the C-139 basin, as specified in Rule 40E-63, 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 rule 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 WY2008 update on compliance with TP loading limits and source control strategies for the EAA and C-139 basins. The compliance update includes WY2008 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.

EAA BASIN UPDATES

During WY2008, the TP loads discharged from the basin were decreased by 44 percent compared to the predicted load. This represents the thirteenth consecutive year for the EAA being 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 utilized. An EAA basin map and the representative monitoring locations for determining WY2008 compliance with the TP load reduction requirement is shown in **Figure 4-3**.

Water Year 2008 Phosphorus Results for the EAA Basin

This section provides an update on the observed WY2008 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 FWM concentrations are presented in Appendix 4-3.

Table 4-4 provides a summary of the WY2008 results for the total 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 (adjusted 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 while the target loads are evaluated based on exceedance for three consecutive years. The comparison for WY2008 shows that the EAA basin achieved a 44 percent TP load reduction.

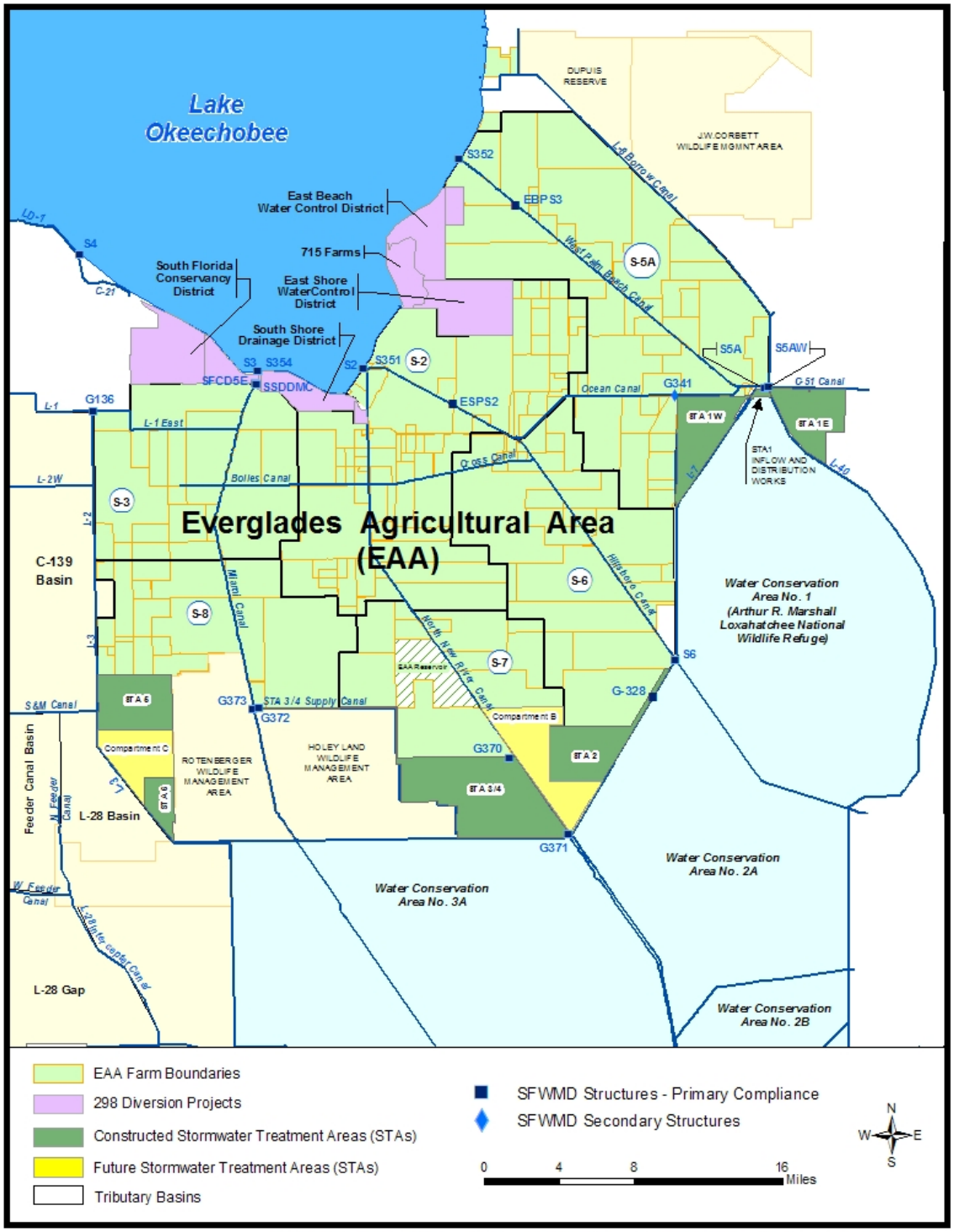


Figure 4-3. The Everglades Agricultural Area (EAA) basin and primary compliance water control structures within the ECP boundary.

Table 4-4. Results of WY2008 EAA basin TP compliance calculations.

WY2008 EAA TP Load in Metric Tons (mt)	
Predicted TP load (adjusted for WY2008 rainfall amounts and monthly distribution relative to baseline period)[1]	167 mt
Target TP load (Predicted TP load reduced by 25%)	126 mt
Limit TP load (upper 90% confidence limit for target load)	172 mt
Observed WY2008 TP load from the EAA with BMPs implemented	94 mt
WY2008 TP load reduction (relative difference between observed and predicted TP loads)	**44%**
Three-year average TP load reduction	**36%**

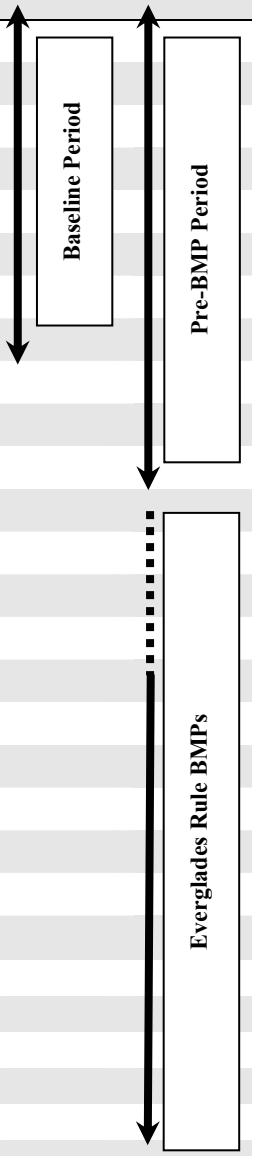
WY2008 EAA TP Concentration (parts per billion)	
Observed annual average EAA TP concentration prior to BMP implementation (WY1980–WY1988)[1]	173 ppb
Observed WY2008 TP concentration from the EAA with BMPs implemented	123 ppb
Three-year (WY2006-WY2008) flow-weighted mean TP concentration	135 ppb

[1]The baseline period of record is October 1978–September 1988 in accordance with EFA requirements. Compliance under Rule 40E-63 bases compliance on the water year periods from May 1 through April 30 that fall within the October 1978–September 1988 range, that is, WY1980–WY1988.

The data for all calculated water years are summarized in **Table 4-5**. This table presents observed and predicted (baseline period rainfall adjusted) 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 90 percent confidence level for the target load and accounts for statistical variability in the rule-mandated prediction model.

Table 4-5. WY1980–WY2008 EAA basin TP measurements and calculations.

Water Year	Observed TP Load (mt)	Predicted TP Load[1] (mt)	% TP Load Reduction[2]	Annual Rain (in)	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	



Note: Dashed vertical line indicates the period for which BMPs were not fully implemented (WY1992–WY1995).

[1] "Predicted TP Load" represents the base period load, adjusted for rainfall variability.

[2] "%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 4-4** and **4-5**, if the EAA basin had only met the minimum requirement of a 25 percent reduction in TP load for the 13 years that the program has been fully implemented, 875 mt of phosphorus would have been prevented from leaving the basin. With the exception of WY2007, the EAA basin has exceeded the minimum requirements by preventing 1,841 mt 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 4-6**. 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 4-6** 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 4-7** 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 4-3 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.

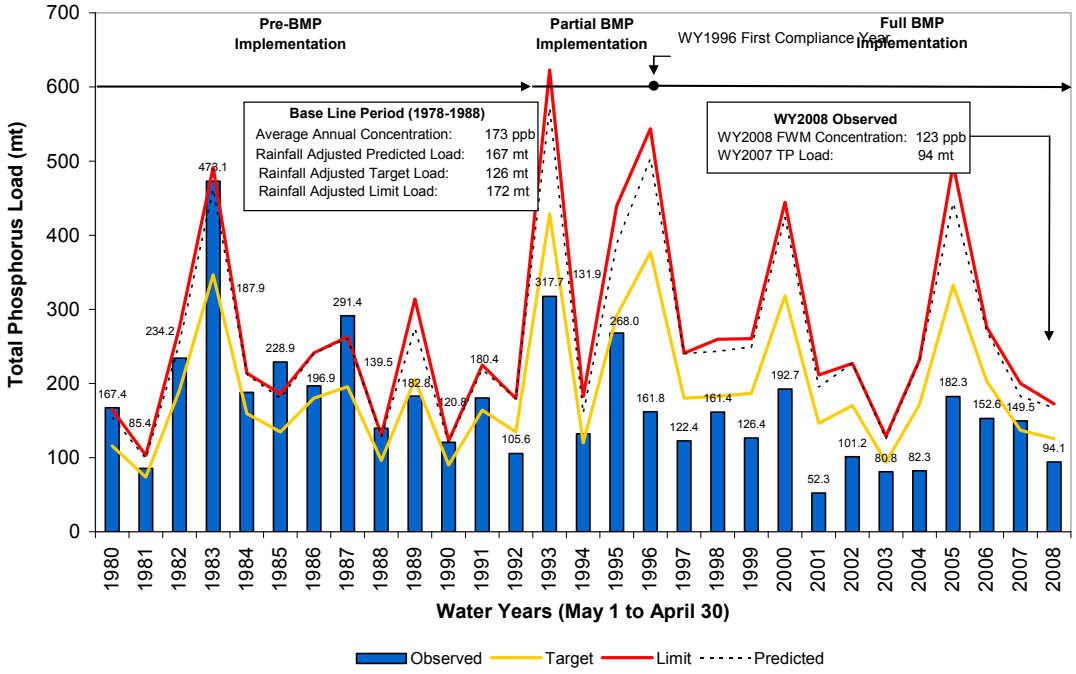


Figure 4-4. Everglades Agricultural Area (EAA) basin total phosphorus (TP) loads observed (measured) and predicted (calculated).

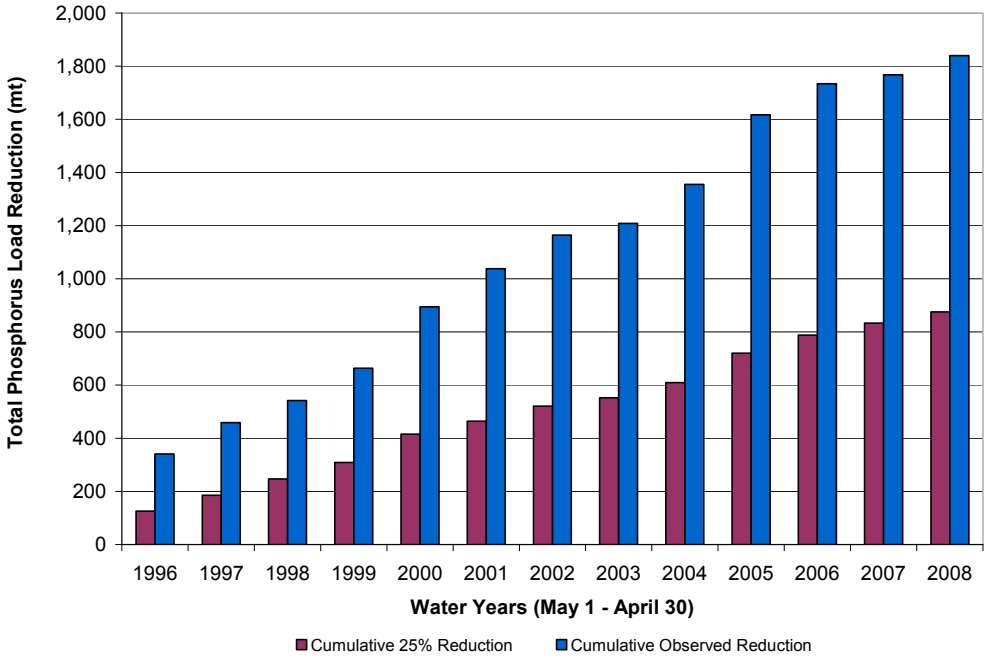


Figure 4-5. EAA basin cumulative percent TP load reduction trend shown alongside the reduction target for each water year.

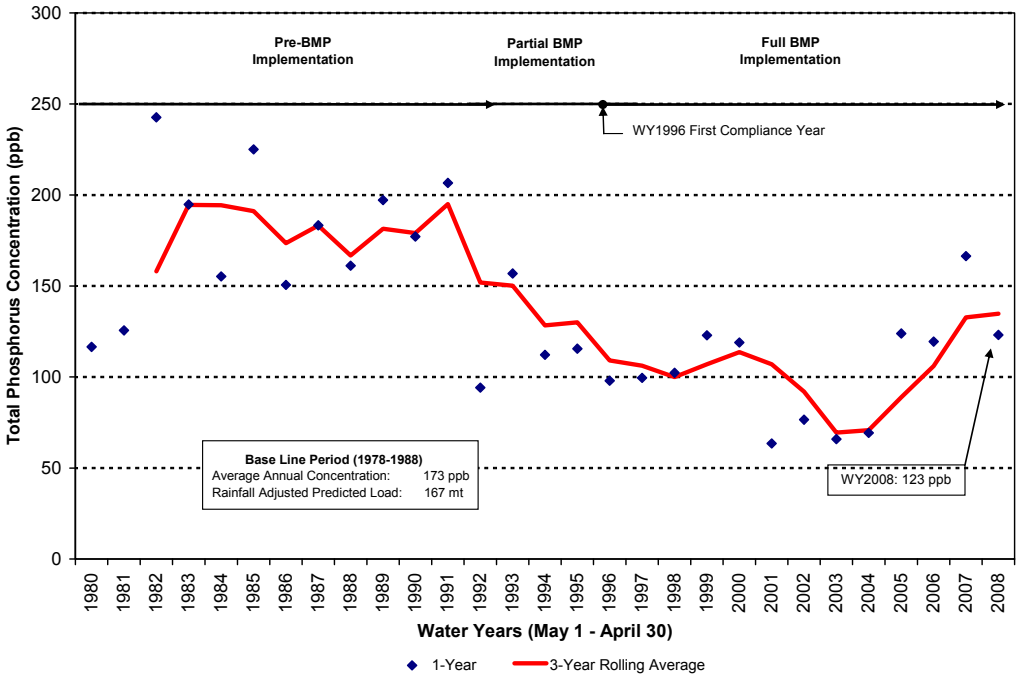


Figure 4-6. EAA basin percent TP load reduction trend with period of record (POR) comparisons.

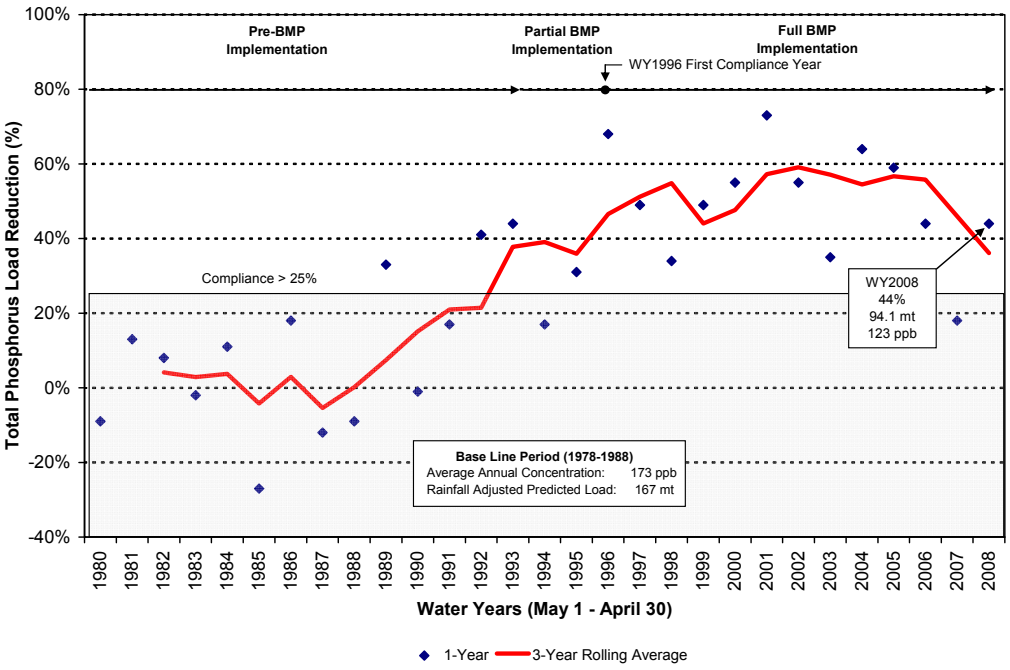


Figure 4-7. EAA basin TP FWM concentration trend with POR comparisons.

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 states that the use of Everglades Works of the District (EWOD) within the EAA basin requires a permit for a BMP plan for each crop or land use within each sub-basin or farm. Also, 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 District'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 Appendix 4-1 for more information on comprehensive BMP plans and BMP plan examples, and Appendix 4-3, Table 1, 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 found out of 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 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 this document for individual BMPs are available at http://edis.ifas.ufl.edu (as of December 2008). These documents include design criteria for construction, as applicable, and operation of BMPs, and farm management. The District 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 District'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 continue to be enhanced.

In addition to the research pursuant to the EAA-EPD Master Permit, 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. However, 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 the required phosphorus loading levels, implementation of more effective BMP practices is not mandatory.

In addition, the source control strategy in the EAA basin includes supplemental Long-Term Plan projects for the purpose of maintaining or improving the current level of performance. The

District conducts upstream data collection at tributaries and supplementary analyses of non-agricultural and agricultural sources with potential to affect basin-wide performance to determine the most effective source control strategies. As indicated in the current Program Management Plan of the Long-Term Plan, however, 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 2008 Activities

During WY2008, the District implemented the ongoing EFA-mandated regulatory BMP program and made progress on the Long-Term Plan supplemental projects as detailed in the 2008 SFER – Volume I, Chapter 4. The following is an update on these activities:

1. **BMP Regulatory Program:** All EAA EWOD permits have expiration dates and follow a five-year renewal cycle. The latest five-year expiration date for these permits was June 30, 2007. During WY2008, all EAA EWOD permits were renewed. Through the renewal process, records on BMP implementation were reviewed and BMPs plans were revised as needed to assure that each farm had an adequate BMPs plan. At the end of WY2008, there were 474,519 ac under 31 EWOD permits in the EAA. The reduction in acres from WY2007 represents acres removed from EWOD permits for construction of CERP projects during the year and adjustments made during the renewal process based on information submitted by permittees that more accurately represent the permitted acreage. 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. For examples of the type of BMP records reviewed and revised during the renewal process, and BMP plans in the EAA, refer to Appendix 4-1.
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. Between 2001 and 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 program — 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 have been proposed 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 were evaluated to establish initial concepts for defining a performance measure for discharges from these areas. The methods developed to assess compliance incorporate a water year period to provide consistency with the source control program in the EAA, and include an annual target and limit, an annual assessment, and a historic baseline period of WY1991–WY2000, consistent with the SWIM Plan for Lake Okeechobee. The BMP performance measure methods were coordinated with the FDEP during issuance of the separate LOPA permits for operation of

Lake Okeechobee pumps serving these areas, and that discharge directly to Lake Okeechobee. Both EWOD permit requirements for BMP implementation for phosphorus reduction and the FDEP LOPA permits for pump operation directly effect water management and phosphorus source controls within the 298 Diversion Project areas.

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 CERP/Everglades expedited projects would effect the TP load compliance and BMP replacement water models was initiated in September 2007. The objectives of the project are to review the algorithms contained in Rule 40E-63, and review the models implemented to assess compliance. A workshop was held to identify all of the changes in the EAA that would affect the compliance models, and a sensitivity analysis is under way to compare various changes to the algorithm for calculating TP loads and runoff volumes and determine if there are significant differences between model results using the existing Lake Okeechobee flow-through calculation method. These analyses will further guide development of the EAA compliance model. Necessary changes will be incorporated to Rule 40E-63 through the rulemaking process.

4. **BMP Research:** In addition to the Everglades Regulatory Program, the EFA and Rule 40E-63 requires EAA landowners, through the Everglades Agricultural Area – Everglades Protection District (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. That is, landowners sponsor research to identify water quality parameters (in addition to phosphorus) that are not significantly improved either by STAs or BMPs, and to identify further BMP strategies needed to address these parameters. The master permit for BMP research, testing, and implementation is the mechanism through which the District 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 Everglades 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 WY2008 were as follows:

    - UF/IFAS submitted a statistical analysis entitled "Management and Environmental Factors that Impact Phosphorus Loading from Everglades Agricultural Area Farms – Final Report" on November 18, 2007. The project goal was to enhance BMP performance on EAA farm basins through improved selection and implementation of current BMPs by the EAA grower community. A number of hypothesis and questions were developed with an overall goal of understanding the factors affecting farm-level phosphorus loading in the EAA. The factors that may impact farm phosphorus loading (unit area loads) in the EAA can be grouped into four categories, (1) water level management [canal elevations (inside, outside, and head difference) and pump-to-rainfall ratio], (2) cropping practices (percent sugarcane, percent flood, percent fallow+flood), (3) rainfall and irrigation (rainfall, irrigation demand, irrigation phosphorus concentration, and irrigation phosphorus load); and (4) farm-specific constants (farm size, soil series, soil depth, and location). The analysis established the relative effect of these factors on phosphorus levels for the 10-farm sample, however, limited information for improving BMP effectiveness through improved selection and implementation was reported.
    - Six BMP training workshops were conducted between July 2007 and January 2008 for growers in the EAA.

- A total of six BMP extension publications in English and three in Spanish are now published online. All extension publications can be found at http://edis.ifas.ufl.edu/ as of December 2008.

5. **East Beach Water Control District (EBWCD) Data Collection and Analysis:** Upstream water quality data were collected within the EBWCD diversion area because of increasing trends in TP load at the basin outlet. As part of a joint investigation between the District and the FDEP, the upstream data were collected from January through October 2007, and were assessed to provide information for determining the major sources of nutrient inputs to water bodies within the basin. This was necessary to determine whether a comprehensive source control strategy for phosphorus between the FDEP and the District was necessary to address the cumulative impact of agricultural and non-agricultural uses (industrial sites and abandoned solid waste disposal sites). The type of sources and timeline for implementing the control strategies may need to be considered when measuring the effectiveness of BMPs for the different areas within EBWCD. During the 2007 monitoring period, conditions were relatively dry, and very little discharge from the basin occurred until the months July–September. High concentrations were found for total dissolved phosphorus and total particulate phosphorus, and high ratios of dissolved to particulate phosphorus and high concentrations of soluble reactive phosphorus (SRP) were found at many of the sites. Analysis of the timing and location of measurement of high constituent levels within the canals suggest differentiated and substantial contribution patterns from both agricultural and non-agricultural sources which are likely responsible for increased phosphorus levels observed from the region (Teegavarapu and Meeroff, 2008). In WY2009, the District, in coordination with FDEP, plans to consider the report recommendations for additional monitoring and analysis and assist 298 Diversion Projects compliance methodology development.

6. **Lake Okeechobee and EAA Data Interaction Analysis:** The District developed Phase II of the EAA and Lake Okeechobee interaction analysis to evaluate lake inflow impacts to EAA BMP performance based on available data. The data evaluation was conducted at the hydrologic sub-basin level, represented by the S5A sub-basin, the S6/S7 sub-basin, and the S8 sub-basin. Datasets were grouped into three distinct time periods based on BMP implementation: baseline period (WY1980–WY1988), the pre-BMP period (WY1989–WY1994), and the BMP period (WY1996–WY2007). Effect on BMP performance was evaluated based on the effect of supplemental inflows (inflows into the EAA without a counterpart outflow on the same day). The assumption being that for Lake Okeechobee inflows to affect BMP performance, the higher-concentration phosphorus water would need to primarily enter the farms via irrigation. The analysis found that the portion of supplemental inflow that reaches the farms has not substantially effected outflow. However, there is a perceived effect because the portion of Lake Okeechobee flows that merely passes through the basin within a short period (flow-through) has substantially increased (BPC Group, 2008).

Water Year 2009 Anticipated Activities

1. **BMP Regulatory Program:** Post-permit compliance activities will continue. BMP verifications will be emphasized based on the analysis of farm-level results for WY2008 using a prioritized list based on farm location, water quality history, size, and date of previous verification.
2. **298 Diversion Projects:** The District will continue to negotiate with stakeholders to implement a compliance methodology for the diversion areas, and for evaluating effectiveness of BMPs from the diversion areas to the EPA to meet requirements of the EFA and to ensure consistency with Lake Okeechobee water quality goals associated with NEEPP.
3. **BMP Research:** A preliminary scope of work was submitted on May 9, 2008. The proposal has two components, a research and an extension component.
    - The research component focuses on the management of floating aquatic plants in farm canals. The main goal is to identify whether farm canals that are maintained free of floating aquatic plants will produce less transportable, less labile sediment than farm canals covered by floating aquatic plants.
    - The extension component includes the extension services provided by UF/IFAS to EAA growers. Researchers will continue to provide BMP training to growers in the EAA through workshops and individual BMP consultations.
4. **EAA TP Load Reduction Compliance Model:** The current phase of the EAA TP Load Reduction Compliance Model evaluation will be completed. The work will address many existing questions associated with the model's calculation methodologies as well as assist in preparation for future changes to the EAA system operation. Due to current uncertainties in projects affecting the EAA, development of the specific changes necessary to account for changes to the EAA system and incorporation in Rule 40E-63 through the rulemaking process may not be initiated.
5. **Data Collection and Analysis in the S5A, S2, and S6 Sub-basins:** Although the EAA basin as whole is complying with the TP load reduction requirement, stakeholders have inquired on the District's specific strategy to counteract phosphorus contributions from specific EAA sub-basins as these have the ability to impact overall basin performance. Gaining an improved understanding of the phosphorus sources contributing to inflow loads to STA-1W and STA-2, and the factors affecting phosphorus contributions from these sub-basins, are crucial to implementing adaptive management methods to help achieve consistent treatment performance across the STAs. A data collection effort is proposed for the West Palm Beach and Hillsboro canals and is expected to be evaluated to determine if there is sufficient information to evaluate current phosphorus sources, transport, speciation, and cycling mechanisms. If data collection is further warranted, the project will be prioritized and assigned to a future fiscal year to execute.

C-139 BASIN UPDATES

The goal of the source control program in the C-139 basin is to maintain TP loads at or below historical levels. The EFA mandates that landowners within the C-139 basin not collectively exceed the annual average TP load observed during the baseline period. 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 is reported in this chapter. The C-139 basin and the representative monitoring locations during WY2008 for determining compliance with TP load reduction are shown in **Figure 4-8**.

Water Year 2008 Phosphorus Results for the C-139 Basin

This section provides an update on the observed WY2008 TP loads in comparison to the basin's EFA-mandated load limits as defined by Rule 40E-63. In an effort to focus 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 4-3 of this volume. The supplemental evaluation includes compliance calculation details, monitoring data and water quality summary, as well as discussion of short-term and long-term variations in basin loads.

Table 4-6 provides a summary of the results of the WY2008 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 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 the target loads are accounted toward 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 4-7**. The table presents these data since 1980, which includes the intermediate years after the baseline was selected and before BMP implementation was started. The TP values presented in **Table 4-7** are attributable only to the C-139 basin.

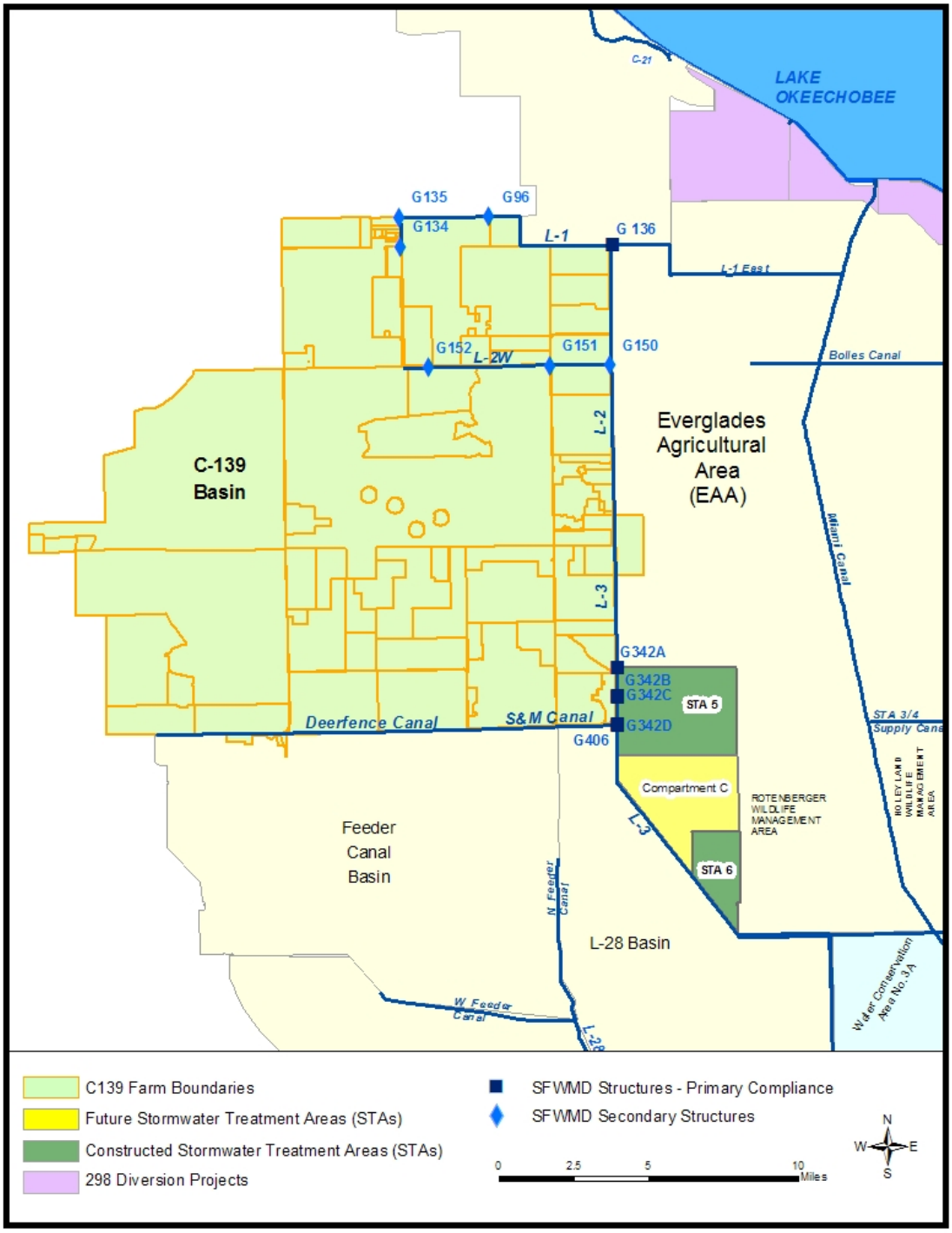


Figure 4-8. The C-139 basin and primary compliance water control structures within the Everglades Constriction Project (ECP) boundary during WY2008.

Table 4-6. Results of WY2008 C-139 basin TP compliance calculations.

WY2008 C-139 Basin TP Load	
Target (Predicted) TP load (adjusted for WY2008 annual rainfall amount)	12.4 mt
Limit TP load (upper 90 percent confidence level for target load)	22.3 mt
Observed WY2008 TP load from the C-139 basin with BMP implementation (Level IV)	5.4 mt

WY2008 C-139 Basin TP Concentration	
Observed annual average C-139 basin TP concentration prior to BMP implementation (WY1980–WY1988)[1]	227 ppb
Observed WY2008 TP concentration from the C-139 basin with BMP implementation at Level IV	113 ppb
Three-year (WY2006–WY2008) flow-weighted mean TP concentration	255 ppb

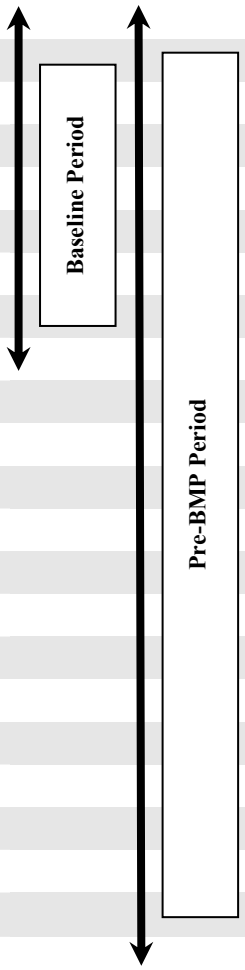
[1] The baseline POR is October 1978–September 1988 in accordance with EFA requirements. Compliance under Rule 40E-63 bases compliance on the water year periods that fall within the October 1978–September 1988 range, that is, WY1980–WY1988.

Figure 4-9 shows the data from **Table 4-7** graphically. In **Figure 4-9**, 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 4-10** shows the annual FWM TP concentration of discharge from the C-139 basin shown by both individual yearly concentration values and the three-year moving average FWM TP concentration. 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 of G-136, representing the northern outflow boundary (L-1 canal), and G342A-D (inflow structures to 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 and construction is underway on the remaining STA-5 and STA-6 flow-ways associated with the Compartment C build out, the G-406 structure will remain as a compliance boundary for the C-139. 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 G-406 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.

Table 4-7. WY1980–WY2008 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 (in)	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



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

[2] First year of compliance measurement was WY2003.

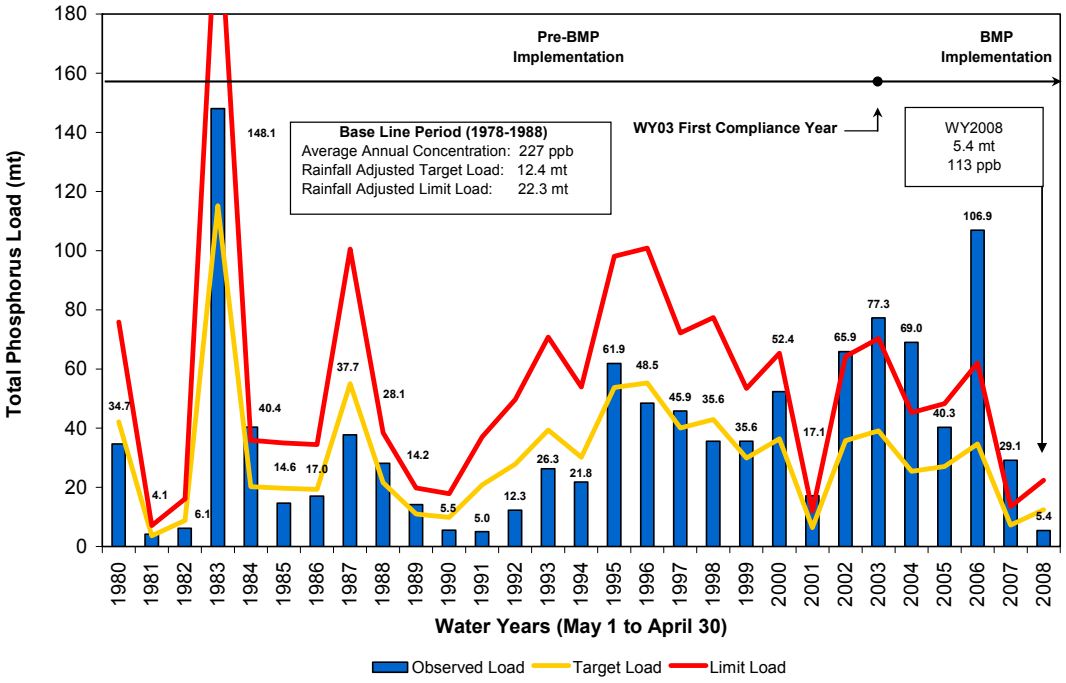


Figure 4-9. C-139 basin TP loads observed (measured) and predicted (calculated).

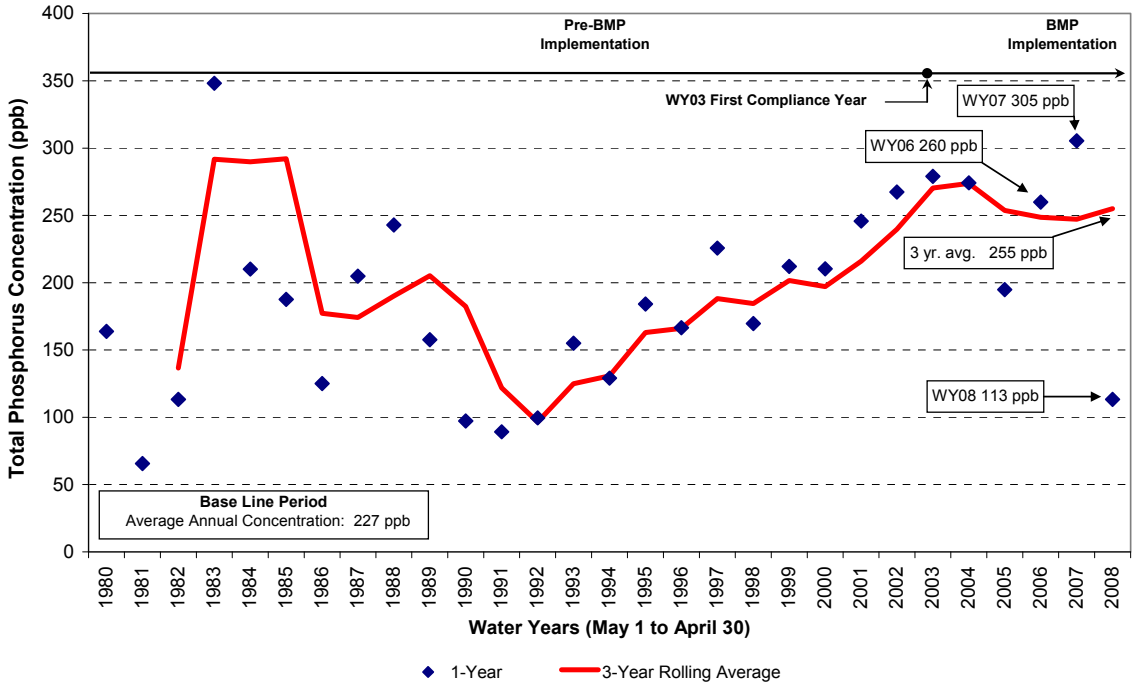


Figure 4-10. C-139 basin FWM TP concentrations and three-year moving averages.

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 the basin load 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 4-8**. Full implementation of BMPs at Level IV, beginning with WY2006, are considered to be the level where measurable success would start to occur toward maintaining basin TP loads at historical levels.

During WY2008, C-139 basin permittees were required to continue implementation of Level IV BMPs, the maximum level provided by the rule. WY2008 was only the second full water year where Level IV BMPs were implemented. A six-month lag existed between the time the C-139 basin was out of compliance with mandated requirements and increased BMP implementation was required. The implementation of comprehensive BMP plans, such as those implemented in the EAA, has been identified as the next BMP optimization step in the C-139 basin to consistently achieve compliance with phosphorus limits and is being proposed through the rule development process. Additional provisions are being proposed to require further BMP optimization if the C-139 basin does not meet required phosphorus limits in future water years. Future optimization will be based on results from upstream water quality and quantity monitoring data obtained from the monitoring network defining upstream sub-regional areas.

Table 4-8. WY2003–WY2008 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

Rule 40E-63 states that the use of EWOD within the C-139 basin requires a permit that approves a permittee-implemented BMP plan. 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-cattle 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 addition of criteria for approval and optimization of BMP plans to meet TP loading requirements.

To verify BMP implementation and opportunities for optimization, the District 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 optimization, 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 above-ground surface water impoundments (AGIs) have been built to provide increased detention as required by Environmental Resource Permits and Surface Water Permits (ERP/SW), little information is available on the effectiveness of these reservoirs to attenuate the total SRP species. Total reactive phosphorus is the predominant component of TP discharge from C-139 basin farms.
- Emphasis on verifying compliance with ERP/SW permits is required to ensure that 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 by staff at the time of 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.

In addition to the mandated regulatory program, the source control strategy in the C-139 basin includes supplemental Long-Term Plan projects to further improve the existing regulatory program of BMPs. Funding of demonstration projects to provide growers with the technical tools for more effective implementation of BMPs and assurance that there shall be no impact to their crops is crucial for implementation. Initiatives to fund BMP demonstration projects will begin in WY2009. Future improvements to performance are also anticipated through changes to the regulatory program, including 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 (land application of phosphorus nutrients, or cattle feed of phosphorus rich), 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 District initiated (in WY2006) a phased approach to install 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, the timing of releases, and phosphorus species is crucial for determining effective source control strategies. During WY2008, the remaining instrumentation sites were completed. However, due to drought conditions during WY2007–WY2008, data collection was limited. The available data generally does show that high SRP concentrations are evident in canal waters and surface water management treatment systems, indicating the need to prevent any unnecessary application of synthetic fertilizers containing phosphorus. The data collected through WY2008 from the sub-regional network is undergoing evaluation and analysis; efforts to report the data will be geared toward the 2010 SFER.

C-139 Basin Source Control Activities

Summary of Water Year 2008 Activities

During WY2008, the District continued to strengthen the mandatory regulatory program with funding provided by the Long-Term Plan and state appropriation funds for the following C-139 basin source control initiatives as detailed in the 2008 SFER – Volume I, Chapter 4. The following is an update of these activities:

1. **BMP Regulatory Program:** Mandatory BMP verification visits were continued during WY2008. Five rule development workshops were held for revising Rule 40E-63 for the C-139 basin. The input and ideas provided at these workshops, along with the information gained from six years of BMP implementation and the supplementary source control projects have been used to propose rule modifications that are expected to be effective in the long term. Proposed revisions to the rule include (1) optimizing BMPs plans by requiring a comprehensive strategy, (2) providing sufficient timeframes for implementation and measurement of optimized BMP practices, (3) requiring BMP optimization through an adaptive management approach, (4) demonstration projects if the basin does not meet compliance, and (5) revising compliance methodology to better reflect conditions in the C-139 basin. For more information on comprehensive BMP plans and BMP optimization, see Appendix 4-1.
2. **Integrated Permit Compliance:** Degree of water quality treatment, attenuation, water storage, and water conservation are factors, besides nutrient application, that effect phosphorus loads. EWOD permit BMP implementation addresses nutrient controls, while Surface Water Management (SWM) addresses water quality treatment, attenuation and storage, and Consumptive Water Use (CWU) authorizations address water use and conservation. This effort was initiated with a landowner workshop on April 19, 2007. The District introduced an integrated regulatory approach to achieve the water quality goals mandated by the EFA by initiating review of SWM and CWU authorizations in the basin. This review was done to ensure that the water quality requirements of these permits are met, as they supplement the phosphorus control efforts of EWOD authorizations. The integrated regulatory approach generally consisted of review of all permits, consultation with permittees, and a request for submission of outstanding items or a timeline for addressing them. A total of 14 one-on-one consultations were conducted with permittees in the C-139 basin, representing 130,835 acres (79 percent) of the basin. For more detailed information on the actions taken to bring permittees into compliance see Appendix 4-1.

3. **C-139 Basin Vegetable Production Demonstration Project (Long-Term Plan Project entitled "C-139 Basin - Source Controls," FY2005–FY2008):** The goal of the C-139 Basin Vegetable Production Demonstration contract project is to optimize phosphorus fertilization rates through soil testing specifically for the C-139 basin. When excess fertilizer is applied to a crop, there may be no positive response by the crop and excess phosphorus may leach or run off. This three-year project is being conducted by the UF/IFAS Southwest Florida Research and Education Center in Immokalee and the UF/IFAS Hendry County Cooperative Extension Service in LaBelle. Results of the second year were provided to the District in September 2007, and included five demonstration sites (Morgan et al., 2007). The results were presented to growers at the December 15, 2007, Vegetable Field Day in the UF/IFAS center (as well as one-on-one in an ongoing basis). General results indicate that adding fertilizer phosphorus to soils high or very high in soil phosphorus contributes little to plant biomass production but increased available soil and total leaf phosphorus concentrations. While not significantly different than a zero phosphorus rate, the half and grower phosphorus rates appear to positively influence tomato and pepper size at harvest. The effect of increased fruit size with increased fertilizer phosphorus application rates was significant for green bean production at two sites and two different growing seasons. The results of the report suggest that the current phosphorus index for soil tests used in the C-139 basin need refinement for the higher pH soil conditions. Recommendations included studies with a greater number of replications to produce better statistics with different soil phosphorus extractants. Studying the effect of lower soil pH on phosphorus availability to plants without the leaching of excess soil phosphorus would better establish a phosphorus index for South Florida.

4. **C-139 Basin Monitoring Network (Long-Term Plan Project "C-139 Basin – Source Controls," FY2006–FY2009):** Automatic sampling stations collecting TP concentration and flow are installed in the C-139 basin to isolate runoff from the sub-basins identified in Phase I of the C-139 Basin Phosphorus Water Quality and Hydrology Analysis. Efforts were made to install and calibrate these sites during WY2006–WY2008. Unfortunately, due to dry weather, many of the sites remain in need of calibration for flow measurement. One additional site was installed during WY2008, bringing the total to eight. The data collected are being analyzed under the C-139 Phosphorus Transport and Cycling Project.

5. **C-139 Basin Upstream Synoptic Monitoring:** As part of monitoring initiatives, the District continued collecting water samples at 18 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 WY2008, weekly samples from May 1, 2007 through October 31, 2007, and April 1, 2008 through April 30, 2008, were collected. The parameters tested were TP, total dissolved phosphorus (represents total soluble phosphorus or TSP), and ortho-phosphorus (represents SRP). In addition, flow measurements coincident with the grab sample collections were collected. WY2008 data are being analyzed and compared with data collected for WY2006 and WY2007 under the C-139 Basin Phosphorus Transport and Cycling Project. This project will be suspended in FY2009 because of resource constraints. The District will rely on the C-139 Basin Monitoring Network for upstream data collection.

6. **C-139 Basin Phosphorus Transport and Cycling:** Water quality and flow data collected in WY2007 through the C-139 Basin Monitoring Network and C-139 Basin Upstream Synoptic Monitoring were analyzed during WY2008 to evaluate phosphorus sources, transport, cycling, and export for the C-139 basin. The WY2007 report provided an update to the previous years' report (WY2006) and further characterized the phosphorus sources, transport, speciation, and cycling in the C-139 basin. Due to continuing dry conditions, calibration of

the C-139 Basin Flow Monitoring Network was not possible during WY2007 and WY2008, therefore reliable flow data was not available to fully assess phosphorus transport. However, the results based on WY2007 data show that dissolved phosphorus continues to be a significant portion of the TP discharged in southern basin. The WY2007 data revealed, in contrast with WY2006 data, that average TP concentration was greatest for the sub-basins in the central part of the C-139 basin, suggesting that relative sub-basin TP concentrations may vary annually. (Community Watershed Fund, 2007).

7. **C-139 Basin Phosphorus Water Quality and Hydrology Analysis:** Phase II of the C-139 Basin Phosphorus Water Quality and Hydrology Analysis was continued. Phase II of the analysis consists of (1) development of a calibrated hydrologic and water quality model and modeling tools, (2) identification and evaluation of five conceptual regional water quality improvement projects to test the model, (3) staff training, and (4) a public workshop. The five conceptual regional water quality improvement projects were tested using the calibrated Watershed Assessment Model (WAM) model. A report was submitted in October 2007 detailing the evaluation of the projects which were evaluated based on relative benefits to water quality and estimated project costs. The results showed that each project provided an improvement over existing conditions, but none of the projects implemented individually allow the C-139 basin to discharge TP loads lower than the rainfall-adjusted target TP loads. The importance of acquiring hydrogeologic conditions in the C-139 basin was emphasized to further calibrate the WAM model (ADA Engineering, 2007). The WAM model was also used to test several BMP optimization scenarios involving water management and nutrient management in the C-139 basin in support of rule development efforts. The final task for this project involves delivering a user-friendly model version that can be used by stakeholders to test what-if scenarios and assist in BMP optimization. This final task has been delayed because the user interface required for the task was not released by the software company.

8. **Technical Evaluations of Factors Affecting Compliance:** Following each water year there is additional data available to evaluate the relationships that drive TP loading and annual compliance for the C-139 basin. Since C-139 annual compliance is computed solely from annual rainfall depth, several water years were selected with similar rainfall values and an analysis initiated to compare and contrast intra-annual periods and the impact to basin TP load. The details of this investigation are included in Appendix 4-3 of this volume. An investigation of the influence of STA-5 operation on C-139 basin load compliance (Goforth, 2008) was contracted by the District in response to stakeholder questions raised through rule development workshops. In addition to identifying conditions that may produce higher loads from the basin, alternatives to the existing compliance methodology continue to be explored to increase the robustness of the rule compliance determination methodology (e.g., to account for the variety of intra-annual rainfall patterns being observed in recent years). Another component to the technical evaluations is consideration of information the data can reveal for BMP optimization within the basin and how it can apply to other ongoing source control projects and activities.

Anticipated Activities for Water Year 2009

1. **BMP Regulatory Program:** Level IV BMP verifications and outreach efforts are planned to continue with a minimum of one inspection annually for farms in the basin to ensure improved BMP implementation and effectiveness. Six years of program implementation indicate that this level of effort is necessary to achieve TP loading performance goals and to ensure program involvement is maintained by stakeholders. Amendment of Rule 40E-63 will be completed for the C-139 basin, resulting in an optimized BMP program by May 2009. Two workshops are planned in WY2009 in order to present the rule amendments.
2. **Integrated Permit Compliance:** The District will continue this coordinated initiative to bring landowners in the C-139 basin in compliance with ERP, consumptive water use permits, and EWOD permits. The landowners not reached during WY2008 (representing approximately 21 percent of the acreage in the basin) will be contacted for one-on-one consultations.
3. **C-139 Basin Vegetable Production Demonstration Project (Long-Term Plan Project "C-139 Basin – Source Controls," FY2005–FY2008):** This project will include presentation of WY2008 results in a third annual report and dissemination through an annual workshop with vegetable growers. The project will be expanded based on current results. The planned expansion areas include additional replications of the soil phosphorus extractant currently used in the C-139 basin, as well as evaluation of five additional soil phosphorus extractant methods to determine the most appropriate soil test method for vegetables in the alkaline soils of the C-139 basin. Treatments to adjust soil pH to maximize the availability of historically accumulated phosphorus for vegetable growth are also planned.
4. **BMP Demonstration Grant Program:** The District will provide grant funds for BMP demonstration projects in the C-139 basin. The projects will involve infrastructure improvements and reporting of technical findings on BMP effectiveness. The priority topics for BMP demonstration that have been identified include nutrient application rates, improved irrigation water management, water conservation practices, and improving the design of surface water impoundments to increase phosphorus removal. See Appendix 4-1 for a more comprehensive list of topics identified for demonstration.
5. **C-139 Basin Monitoring Network (Long-Term Plan Project "C-139 Basin – Source Controls," FY2006–FY2009):** The monitoring locations in the C-139 basin will continue to be used to track discharge characteristics from the eight C-139 sub-basins, and be used to identify BMP optimization strategies.
6. **C-139 Basin Phosphorus Transport and Cycling:** WY2008 water quality and flow data will be analyzed to evaluate phosphorus sources, transport, and cycling, and be compared with WY2006 and WY2007 data. This continued analysis will provide a better understanding of the characteristics of phosphorus discharges in the C-139 basin and provide valuable information for future BMP optimization strategies.
7. **Technical Evaluations of Factors Effecting Compliance:** Ongoing efforts to better understand the significant influences to C-139 basin compliance will continue as more data is collected. In addition to the existing rainfall and basin compliance structure monitoring, upstream sub-regional monitoring stations are planned to provide stage, flow, and concentration data. This monitoring is expected improve the ability of the District and permittees to assess opportunities for BMP optimization and locations for TP load reduction.
8. **C-139 Basin Phosphorus Water Quality and Hydrology Analysis:** The WAM model will continue to be used to test water quality improvement projects and BMP optimization

scenarios. The user-friendly interface for the WAM model is planned for completion, allowing stakeholders to use it as a BMP planning tool.

9. **C-139 Basin Regional Feasibility Study:** A regional feasibility study, encompassing the C-139 basin, the Feeder Canal basin and the L-28 basin is planned. The reason for the feasibility study is to address the significant water resources issues in this region. Since 2000, there have been many water resource infrastructure changes and more are anticipated. The District will determine if a combination of regional project(s) and/or development of an integrating regional operational plan that, together with a coordinated regulatory/BMP program, could help the region meet its water quality goals, accommodate and/or make beneficial use of current and projected redirected regional flows, and help to resolve identified regional water supply issues.

FUTURE DIRECTION FOR THE ECP BASINS

Because of EAA performance, planned activities consist of (1) continuing the current level of BMP implementation as mandated in the Long-Term Plan, (2) completing water quality technical evaluations on priority areas to determine if site-specific strategies are necessary to maintain basin-wide performance, (3) working cooperatively with the EAA-EPD to ensure that a scope of work for BMP research is finalized, and (4) completing the process of establishing BMP performance measures for Closter Farms and the 298 Diversion Projects.

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. WY2008 results reflected a second year of 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 compliance in the long term. Planned activities for the C-139 focus on the following:

- As mandated by Rule 40E-63, rule development was initiated for the C-139 basin during WY2008 and will continue through WY2009, with a proposed date for implementation of May 2009. The regulatory model based on historical levels is being re-examined concurrent with rule development. The model will be refined to account for regional system changes and assumptions that were not considered of concern when the model was developed. The District will seek participation from other cooperating agencies for BMP development and implementation.
- Current direction is toward providing regulatory and funding incentives to spearhead landowner-driven BMP demonstration projects. The District proposed the C-139 Basin Vegetable Demonstration Project.
- Supplementary water quality and quantity data at the regional level (hydrologic sub-basins) will continue to be used to promote a better understanding of upstream contributions, program effectiveness, and assist with focused remedial action under a revised rule. Only an initial level of information is available because of the hydrological and implementation constraints.
- The District expects to continue implementing a source control program with an integrated technical and regulatory approach (ERP/SW and CUP). 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.

SOURCE CONTROLS IN THE NON-ECP BASINS

BACKGROUND

The EFA initially allowed for a more flexible adaptive approach to water quality improvement in discharges for the non-ECP basins as compared to the ECP basins' mandatory BMP program. This was, in large part, based on the non-ECP basins having historically contributed approximately 12 percent of the total load discharging to the EPA compared to the 88 percent contribution by the ECP basins. Because of the relatively small TP contribution by the non-ECP basins, they were allowed to discharge directly to the EPA with source control programs initiated in WY1998 to address the quality of the basins' discharges. However, the 2003 amendment to the EFA 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 2003 EFA established that the Long-Term Plan constitutes the Best Available Phosphorus Reduction Technology (BAPRT).

The Long-Term Plan for the non-ECP basins proposes a combination of source control BMPs and integration with diversion and construction activities planned as part of CERP and other federal and/or local construction projects. The WQIPs for each non-ECP basin (described in detail in 2006 SFER – Volume I, Chapter 3) include a combination of source controls (BMPs), diversion strategies, and capital improvement projects. The WQIPs are consistent with the Long-Term Plan and are considered BAPRT.

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 4-11**, and the location of non-ECP basins and associated structures that discharge into the EPA are depicted in **Figure 4-12**. During WY2008, all Acme Basin B [Village of Wellington (VOW)] discharges were diverted to the C-51W canal instead of directly discharging to the EPA. **Figure 4-11** reflects this diversion by not reporting the VOW load as a direct inflow to the EPA.

As required by the EFA, the non-ECP permit is expected to be modified to require compliance with the TP concentration limits for the C-111 basin and with TBELs for the C-11 West, NNRC, Feeder Canal, and L-28 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 based upon TBELs established through BAPRT through December 2016. A TBEL is defined as the minimum waste treatment requirement, established by the FDEP, based on treatment technology. Effluent limitations means any restriction established by the FDEP on quantities, rates, or concentrations of chemical, physical, biological, or other constituents which are discharged from sources into Florida waters.

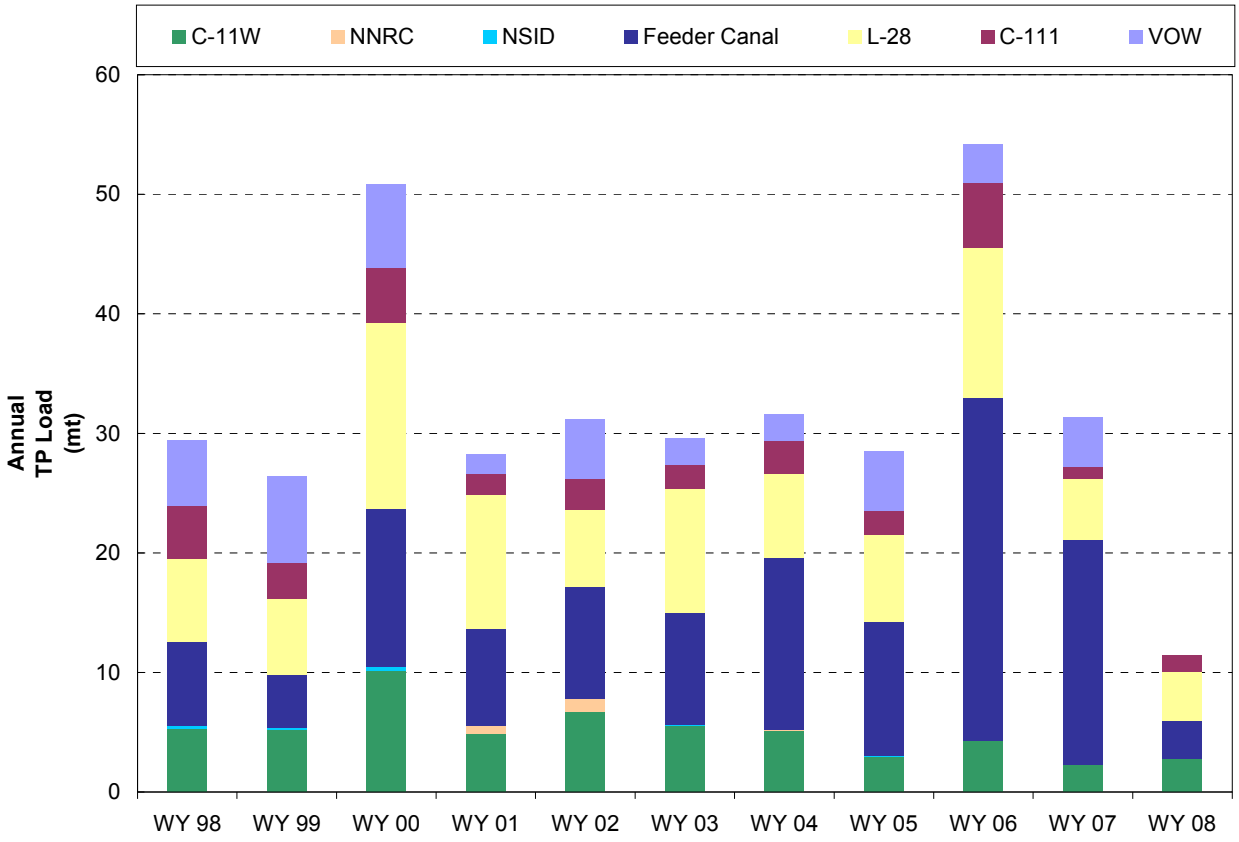


Figure 4-11. Non-ECP basin TP loads into the EPA for WY1998–WY2008.

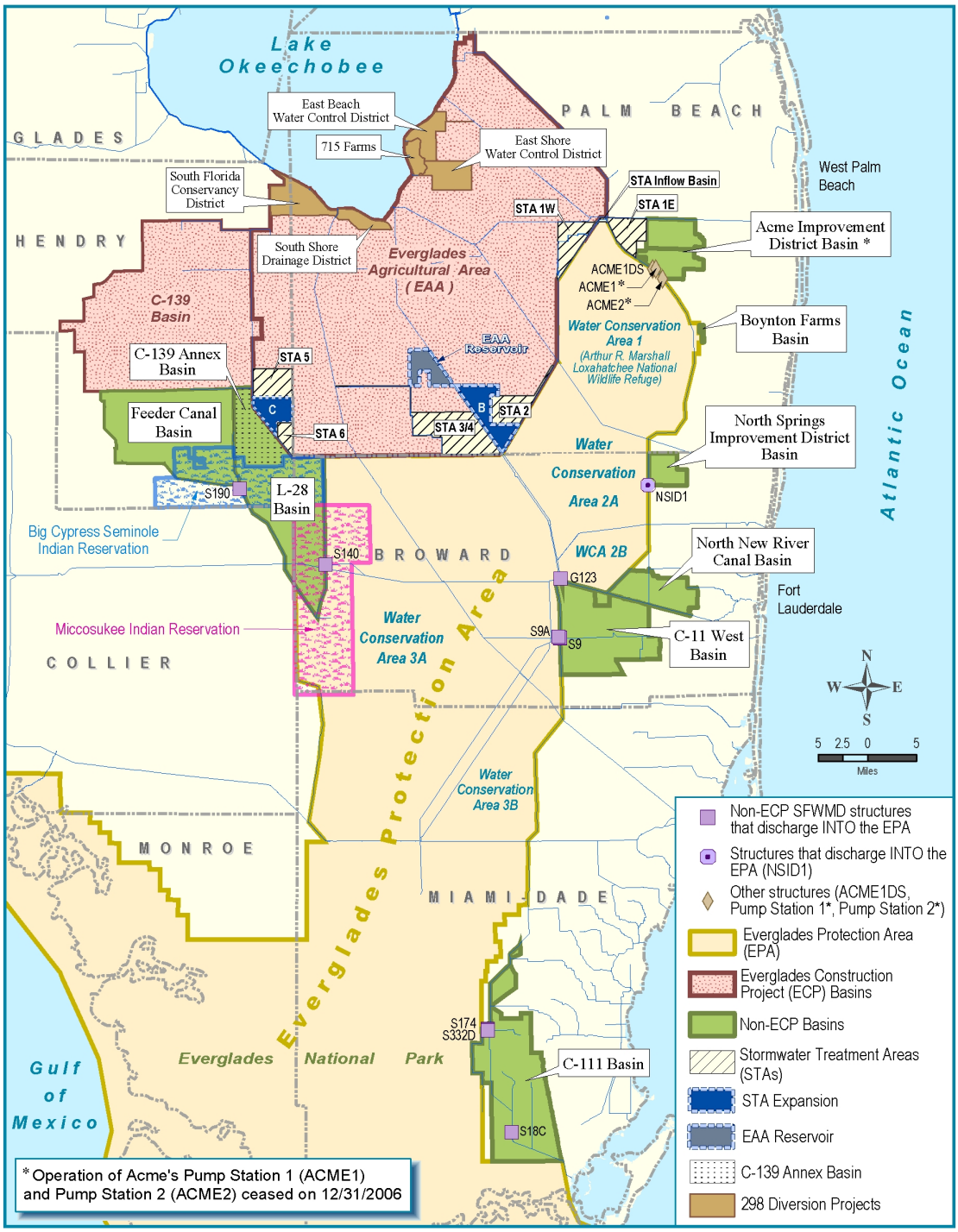


Figure 4-12. The non-ECP basins and primary compliance water control structures discharging to the EPA.

FEEDER CANAL BASIN UPDATES

Water Year 2008 Phosphorus Results for Feeder Canal Basin

The Feeder Canal basin is located in Hendry County. This basin is divided into three major areas: the McDaniel Ranch area (comprised of several private landowners), a portion of the Big Cypress Seminole Indian Reservation, and the West Feeder area (comprised of multiple private landowners). The canals and structures within this basin provide flood protection and conveyance of runoff to 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 4-4 summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall (at station S-190), and flow volume in WY2008 for the S-190 structure. Figure 1b of Appendix 4-4 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the S-190 structure from WY1998 through WY2008. The S-190 FWM TP concentration and TP load for WY2008 were 101 ppb and 3.15 mt, respectively. This TP concentration is approximately 53 percent lower than last water year's TP concentration (215 ppb) and the TP load (3.15 mt) is the lowest recorded for the last 10 water years (see Figure 1b of Appendix 4-4). The WY2008 TP concentration exceeds the 50 ppb levels expected based on activities described under the current WQIP and the Long-Term Plan.

Upstream water quality data to identify high phosphorus areas within the Feeder Canal basin are collected from the McDaniel Ranch area, the West Feeder area, and the Seminole Tribe, and maps are available in Appendix 4-4 of this volume.

Feeder Canal Basin Source Control Strategy

During WY2008, the source control strategy for the Feeder Canal basin continued as summarized in the 2007 SFER – Volume I, Chapter 4. In addition, a minor revision to the Long-Term Plan strategies for the Feeder Canal basin was approved on December 7, 2007, in order to ensure continued progress toward meeting the phosphorus goals of the Long-Term Plan. This revision is discussed below.

Feeder Canal Basin Source Control Activities

Summary of Water Year 2008 Activities

During WY2008, the District and stakeholders continued the implementation of the WQIPs for the Feeder Canal basin, as detailed in the 2006 SFER – Volume I, Chapter 3. Following is an update on each of these activities:

1. **Long-Term Plan Revisions:** The Long-Term Plan component for the Feeder Canal basin was revised on December 10, 2007. The revision included the initiation of rulemaking for a Feeder Canal basin BMP regulatory program should the WQIPs not result in basin discharges achieving TP concentrations of 50 ppb or less, and the provision of additional funding for FY2009 and FY2010 for the implementation of source controls. The text of this revision can be found in Chapter 8 of this volume.

2. **Seminole Tribe WCP Project:** The District continues to track the progress of the project. The Seminole Tribe and the U.S. Army Corps of Engineers (USACE) started construction contracts for some components of the Seminole Tribe WCP project. It is anticipated that the project completion will occur in 2009. The project is designed to improve water quality, restore wetland hydrology, increase water storage capacity, and enhance flood protection within the reservation.
3. **McDaniel Ranch:** The McDaniel Ranch SWM system has been substantially completed. The District is working with the landowners to certify the system and to ensure appropriate water quality treatment and implementation of BMPs.
4. **Integrated Permit Compliance:** The Integrated Permit Compliance efforts within the basin aim to ensure that landowners are in compliance with ERP, Surface Water Management (SWM) permit, and Water Use Permit (WUP) requirements as well as requiring implementation of BMPs. This effort is similar to the effort being implemented in the C-139 basin. The effort was initiated with a landowner workshop held on February 22, 2007. During WY2008, the District conducted one-on-one consultations with landowners to ensure that they comply with these permits as well as to facilitate implementation of phosphorus source control BMPs. A total of seven one-on-one consultations were conducted with the landowner permittees that perform intensive row crop farming and citrus production within the basin. This represents approximately 31 percent of the total acreage in the basin (excluding the McDaniel Ranch area and the Seminole Tribe reservation area). Significant portions of the remaining acreage to be targeted consist of native, pasture and federal conservation lands.
5. **Big Cypress/L-28 Interceptor Modifications CERP Project:** The District continued to pursue alternatives to accelerate this project currently scheduled for completion after 2020 (CERP Band 4, 2020–2025).
6. **Upstream Monitoring:** The District continued collecting water samples (grabs) at six locations within the West Feeder Canal sub-basin. A summary of the water quality results, collected since September 2005, is included in Appendix 4-3. The parameters tested are TP, total dissolved phosphorus (represents TSP), and ortho-phosphorus (represents SRP).
7. **Feeder Canal Basin Phosphorus Water Quality and Hydrology Analysis Contract (Long-Term Plan Project "Feeder Canal Basin," FY2007–FY2009):** This contract was initiated in May 2008. The purpose of the contract is to evaluate the sources of phosphorus within the basin and to understand the relationship between TP load and concentrations with rainfall and runoff conditions. This study will evaluate TP trends and contributing factors with the objective of developing and optimizing the source control program. The contract is expected to be completed by October 2008.

Anticipated Activities for Water Year 2009

1. **McDaniel Ranch:** The District will continue working with McDaniel Ranch area owners to ensure discharges from this area meet a TP concentration of 50 ppb.
2. **Integrated Permit Compliance:** District's regulation staff will continue meeting with landowners to ensure they comply with the required permits as well as to facilitate implementation of phosphorus source control BMPs.
3. **Feeder Canal Basin Phosphorus Water Quality and Hydrology Analysis (Long-Term Plan Project "Feeder Canal Basin," FY2007–FY2009):** Depending on the results and recommendations of the Feeder Canal Basin Phosphorus Water Quality and Hydrology Analysis, the District will consider an additional water quality and/or hydrology analysis.
4. **Long-Term Plan Revisions:** Because TP concentrations in discharges from the Feeder Canal basin continue to exceed 50 ppb, the District will initiate rulemaking in WY2009 and will propose a Long-Term Plan revision to provide additional funding for a source control program requiring Feeder Canal basin landowners to implement BMPs under a regulatory phosphorus source control program.

L-28 BASIN UPDATES

Water Year 2008 Phosphorus Results for 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 WY2009 as a result of the diversion of the C-139 Annex flow into STA-6.

Figure 2a of Appendix 4-4 summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall (at station S-140), and flow volume in WY2008 for the S-140 structure. Figure 2b of Appendix 4-4 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the S-140 structure from WY1998–WY2007. The S-140 FWM TP concentration and TP load for WY2008 were 36 ppb and 4.05 mt, respectively. This TP concentration and load includes flow and TP loads from the C-139 Annex.

Upstream water quality data for the C-139 Annex sub-basin and the Seminole Tribe, and maps is available in Appendix 4-4.

L-28 Basin Source Control Strategy

During WY2008, the source control strategy for the Feeder Canal basin continued as summarized in the 2007 SFER – Volume I, Chapter 4.

L-28 Basin Source Control Activities

Summary of Water Year 2008 Activities

During WY2008, the District and stakeholders continued the implementation of the WQIPs for the L-28 basin, as detailed in the 2006 SFER – Volume I, Chapter 3. Following is an update on each of these activities:

1. **C-139 Annex Diversion:** The District was working with the C-139 Annex landowner on regulatory compliance requirements to be included in the modified ERP, authorizing discharges from the C-139 Annex into STA-6. The goal of the compliance requirements is to maintain TP loads in discharges into STA-6 at or below historical discharge levels.
2. **Seminole Tribe Water Control Plan (WCP) Project:** The District continues to track the progress of this project, scheduled for completion in calendar year 2010. The 2003 Long-Term Plan recommended modification of the plan to convert Water Retention Area 7 (WRA-7) to an STA by 2010 at a cost of approximately $20 million; however, as of July 2008, this modification had not been authorized.
3. **Miccosukee Tribe Water Management Plan (WMP) Project:** The 2003 Long-Term Plan recommended the accelerated completion of the Miccosukee WMP by 2010; however, as of July 2008, funding for this project has not yet been authorized and the project is currently scheduled to be completed after calendar year 2015.

Anticipated Activities for Water Year 2009

1. **C-139 Annex Diversion:** It is expected that the District Governing Board will take final action during WY2009 on the modified ERP authorizing discharge from the C-139 Annex into STA-6.
2. **Seminole Tribe WCP Project:** The District will continue to track the progress of this project, scheduled for completion in calendar year 2010.

C-111 BASIN UPDATES

Water Year 2008 Phosphorus Results for the C-111 Basin

The C-111 basin is located in the southernmost portion of Miami-Dade County adjacent to the ENP. Canals in this basin provide drainage and flood protection, water supply, and protection from 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 4-4 summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall (average of stations S-174, S-177, S -18C, S-332, and HOMES.FS), and flow volume in WY2008 from the C-111 basin to the ENP. Figure 3b of Appendix 4-4 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the C-111 basin to the ENP from WY1998–WY2008. The S-18C, S-332D, and S-174 combined FWM TP concentration and TP load for WY2008 were 7 ppb and 1.42 mt, respectively.

In September 2007, the S-174 structure was plugged and the non-ECP permit was amended on April 18, 2008, to remove the S-174 structure from the into structure list and remove its monitoring equipment. 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 can be found in Appendix 4-4.

C-111 Basin Source Control Strategy

During WY2008, the source control strategy for the C-111 basin continued as described in the 2007 SFER – Volume I, Chapter 4.

C-111 Basin Source Control Activities

Summary of Water Year 2008 Activities

During WY2008, the District and stakeholders continued the implementation of the WQIPs for the C-111 basin as detailed in the 2006 SFER – Volume I, Chapter 3. Following is an update on each of these activities:

1. **C-111 Basin Nursery BMP Grant Program:** Due to cuts in the FDACS fiscal year 2007–2008 budget, grants awarded to nursery growers for projects not completed by April 2008 were rescinded.
2. **Mobile Irrigation Lab:** The District, in partnership with the FDACS and NRCS, continues to sponsor the Mobile Irrigation Lab in this area to help local growers improve their irrigation practices. Additional information is available at the District's web site at www.sfwmd.gov under the *What We Do, Water Supply, Water Conservation, Mobile Irrigation* tab as of December 2008. Also, the main sources of training and education in this basin continue to be the University of Florida's Tropical Research and Education Center and UF/IFAS.
3. **C-111 Project:** Construction of a continuous detention area from S-332B to the Frog Pond (northern levee of the S-332D detention area, which is south of S-332B) was scheduled for completion in December 2008 by the USACE. However, construction of the final phase is on hold because the USACE and the District have not agreed on how to value the land acquired by the District for construction of the final northern detention area (between S-332B north and the STA).
4. **C-111 Spreader Canal Project:** The District has completed preparation of the Basis of Design Report for the C-111 Spreader Canal Project, and design drawings are expected to be completed by December 2009. Construction of Phase I of the project is scheduled for completion in calendar year 2011. The ecological system of the Southern Glades and Model Lands including downstream estuaries and Florida Bay are expected to have improved water quantity, timing, and distribution once Phase I of this project is completed. More detail on this project is available in Chapter 7A of this volume, and at the CERP web site (www.evergladesnow.org) as of December 2008.
5. **Combined Structural and Operational Plan (CSOP):** The CSOP is on hold because of a change in the allowable maximum L-29 canal stage associated with the Tamiami Trail component of the Modified Water Delivery Everglades National Park (MWD ENP) project. The original CSOP model runs allowed L-29 canal stages to reach elevations that were too high relative to the proposed Tamiami Trail roadway.

Anticipated Activities for Water Year 2009

1. **Mobile Irrigation Lab:** This program will continue to be available during WY2009 to help growers improve their irrigation practices.
2. **C-111 Spreader Canal Project:** The District will continue the design phase for the C-111 Spreader Canal Project in preparation for the onset of construction, scheduled for completion in calendar year 2011.

C-11 WEST BASIN UPDATES

Water Year 2008 Phosphorus Results for 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 are comprised of 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 4-4 summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall (average of stations S-9 and S-124), and flow volume in WY2008 for structures S-9 and S-9A. The S-9 and S-9A combined FWM TP concentration and TP load for WY2008 were 16 ppb and 2.81 mt, respectively. Figure 4b of Appendix 4-4 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for structures S-9 and S-9A from WY1998 through WY2008.

The FWM TP concentration for C-11 West basin from WY1998–WY2003 was 21.9 ppb. During this period, only the S-9 pump station discharged seepage and stormwater runoff from the basin into the EPA. The FWM TP concentration for C-11 West basin from WY2004 (right after completion of the S-9A pump structure) through WY2008 was 16.2 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 4-4.

C-11 West Basin Source Control Strategy

During WY2008, the source control strategy for the C-11 West basin continued as summarized in the 2007 SFER – Volume I, Chapter 4.

C-11 West Basin Source Control Activities

Summary of Water Year 2008 Activities

During WY2008, the District and stakeholders continued the implementation of the WQIPs for the C-11 West basin, as detailed in the 2006 SFER – Volume I, Chapter 3. Following is an update on each of these activities.

1. **Broward Everglades Working Group:** The District continued to assist Broward County in implementation of the C-11 West Basin Pollution Reduction Action Plan of April 2006, which can be found on the District's Long-Term Plan web site through www.sfwmd.gov under the *Everglades* section*, Long-Term Plan for Achieving Everglades Water Quality Goals* link as of December 2008.
2. **C-11 West Basin Nursery BMP Grant Program (Long-Term Plan Project "C-11 West Basin," FY2007–FY2008):** The District and FDACS paid nursery growers over $220,000 during FY2005–FY2007 for projects implementing nursery BMPs. Due to budget cuts in the FDACS fiscal year 2007–2008 budget, funding became unavailable to nursery growers for projects not completed by April 2008.
3. **Broward County Water Preserve Area (BCWPA) CERP Project:** The USACE completed the Project Implementation Report (PIR) for the BCWPA CERP Project in April 2007. Flows from the C-11 West basin to WCA-3A will be significantly reduced, along with a significant reduction in the resulting TP load to WCA-3A, once this project is completed. More detail on this project is available in Chapter 7A of this volume, at the CERP web site (www.evergladesplan.org) as of December 2008.
4. **South Broward Drainage District (SBDD) Improvements:** Closure of two unrestricted outfalls within SBDD's S-8 basin is expected to be completed during WY2009. The SBDD continued construction and implementation of several components of new drainage facilities for its S-9/S-10 sub-basin including permanent closure of unrestricted outfalls west of the S-381 structure; and completion of two additional control structures and closure of one unrestricted outfall east of S-381.
5. **Central Broward Water Control District (CBWCD) Improvements:** The CBWCD continues the construction and implementation of its capital improvement projects to increase water storage capacity within the CBWCD basin that will result in improved flood control and water quality.
6. **Educational Public Service Announcements (Long-Term Plan Project "C-11 West Basin," FY2007–FY2008):** The District renewed its contract for the fourth year to televise five Everglades educational public service announcements (PSAs) (30-second videos with the theme "From our Gutters to the 'Glades"). The 33,800 PSAs (including over 18,000 Spanish language versions of the educational PSAs) were aired on nine major networks in the Broward County non-ECP basins (C-11 West, NNRC, and NSID) from November 2007 through September 2008. The District also undertook initiatives to have the educational PSAs

aired on local community access channels from cities and towns in Broward County non-ECP basins.

7. **Everglades Web Site Development:** Links to the Districts' Everglades4Ever web site (www.sfwmd.gov/everglades4ever) and Broward County's NatureScape web site (www.broward.org/naturescape) continue to be provided on the web sites of most Broward County stakeholders as of December 2008 (municipalities, 298 Diversion Projects, and others). The Everglades4Ever web site targets residents in general and includes references to water quality, water conservation, and Everglades restoration initiatives being undertaken throughout South Florida.
8. **Indian Trace Development District (ITDD) Improvements:** The District approved an ERP permit modification for ITDD to implement operational changes to its two pump structures that will result in an additional half-inch detention of stormwater runoff for improved water management and water quality treatment.
9. **Broward County Non-ECP Basin Public Information and Education Contract (Long-Term Plan Project "Broward County Source Controls," FY2008–FY2010):** The District and Broward County executed a cost-share agreement to include public information and education outreach activities on water conservation and water pollution prevention 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 and other educational venues. Broward County continued offering monthly Know-The-Flow workshops to property managers, homeowner associations, local government agencies, and other interested parties and individuals. The workshops present information about primary, secondary, and tertiary stormwater management systems as well as plant diversity, fertilization, and irrigation practices in layman terms.

Anticipated Activities for Water Year 2009

1. **C-11 West Basin Nursery BMP Program:** The District will explore opportunities to assist nursery growers in this basin with implementation of nursery BMPs.
2. **Broward County Non-ECP Basin Public Information and Education Contract:** The District and Broward County will continue the previously described public information and education efforts into the second year of the three-year contract.

NORTH NEW RIVER CANAL BASIN UPDATES

Water Year 2008 Phosphorus Results for North New River Canal Basin

The North New River Canal (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 large storm events. In December 2001, the District implemented operational changes to the system to enable the basin to provide water supply to the WCAs. There was no flow or insignificant flow volumes discharged from G-123 during the past five water years, and there was no discharge from the NNRC basin to the EPA during WY2008.

Figure 5a of Appendix 4-4 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 WY2008 for the G-123 structure. Figure 5b of Appendix 4-4 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the G-123 structure from WY2001–WY2008. 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 4-4.

NNRC Basin Source Control Strategy

During WY2008, the source control strategy for the NNRC basin continued as summarized in the 2007 SFER – Volume I, Chapter 4.

NNRC Basin Source Control Activities

Because this basin is also located in Broward County, some of the training and education 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 2008 Activities

During WY2008, the District and stakeholders continued the implementation of the WQIPs for the NNRC basin as detailed in the 2006 SFER – Volume I, Chapter 3.

1. **Broward County Non-ECP Basin Public Information and Education Contract:** The District and Broward County executed the previously described cost-share agreement to include public information and education outreach activities on water conservation and water pollution prevention within Broward County non-ECP basins. Broward County continued offering monthly Know-The-Flow workshops to property managers, homeowner associations, local government agencies, and other interested parties and individuals.

Anticipated Activities for Water Year 2009

In tandem with C-11 West basin efforts, the District and Broward County will continue public information and education for NNRC.

NORTH SPRINGS IMPROVEMENT DISTRICT BASIN UPDATES

Water Year 2008 Phosphorus Results for North Springs Improvement District Basin

The North Springs Improvement District (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 WY2008. 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 4-4 summarizes the daily rainfall and the monthly TP load, FWM TP concentration, rainfall (average of S-38 and S-39 stations), and flow volume in WY2008 for the NSID1 structure. Figure 6b of Appendix 4-4 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the NSID1 structure from WY1998–WY2008. A summary of the upstream water quality data used to identify high phosphorus areas within the basin and a map of the NSID basin depicting these sites are available in Appendix 4-4.

NSID Basin Source Control Strategy

During WY2008, source control strategy for the NSID basin continued as summarized in the 2007 SFER – Volume I, Chapter 4.

NSID Basin Source Control Activities

Because this basin is also located in Broward County, some of the training and education 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 2008 Activities

During WY2008, the District and stakeholders continued the implementation of the WQIPs for the NSID basin, as detailed in the 2006 SFER – Volume I, Chapter 3. Following is an update on each of these activities:

1. **BMP Cooperative Agreement (Long-Term Plan Project "North Springs Improvement District Basin," FY2006):** The NSID submitted a revised version of the BMP implementation plan required by its May 2006 BMP cooperative cost-share agreement with the District. The District has provided $27,610.60 in cost-share funds for implementation of BMPs and operational measures to further improve water quality in discharges to the EPA.
2. **BMP Implementation through Existing Regulatory Process:** The District has utilized the existing ERP program, as opposed to creating a specific program, to require the NSID to submit an ERP permit modification to incorporate a plan including an appropriate long-term or interim phosphorus source controls (BMP) program and revisions to the existing system to meet EFA-required water quality standards. NSID submitted an ERP modification

application on June 21, 2007, and the District and NSID are working together toward the finalization of the permit modification.

3. **Hillsboro Site 1 Impoundment CERP Project:** Detail on this project is available in Chapter 7A of this volume, and at the CERP web site (www.evergladesnow.org).

4. **Broward County Non-ECP Basin Public Information and Education Contract:** The District and Broward County executed the previously described cost-share agreement to include public information and education outreach activities on water conservation and water pollution prevention within Broward County non-ECP basins.

Anticipated Activities for Water Year 2009

1. **NSID BMP Implementation Plan:** The District and NSID will work together on the implementation of NSID's BMP plan for upstream source controls within the NSID basin. Implementation of the cooperative plan is expected to be completed during WY2009.

2. **Broward County Non-ECP Basin Public Information and Education Contract:** The District and Broward County will continue public information and education efforts into the second year of the three-year contract.

VILLAGE OF WELLINGTON'S ACME IMPROVEMENT DISTRICT BASIN UPDATES

Water Year 2008 Phosphorus Results for Acme Basin

The Acme Improvement District basin occupies approximately 30 square miles east of WCA-1 in Palm Beach County. The Acme basin is divided into two sub-basins, basins A and B. Until December 2006, the majority of stormwater from basin B, and limited drainage overflow from basin A, discharged via two pumps ACME1 and ACME2 to the EPA (WCA-1). Since December 2006, runoff from both basins has been discharged into the C-51 canal, and is then generally directed to STA-1E. Direct untreated flows from the ACME1 and ACME2 structures into WCA-1 no longer occur. Therefore, beginning with WY2009, the Acme basin will be designated as an ECP basin.

Figure 7a of Appendix 4-4 summarizes the daily rainfall and the monthly rainfall (average of stations WCA1ME, LOXWS, WPBFS-R, and S-5A), in WY2008 for the ACME1 and ACME2 structures. Figure 7b of Appendix 4-4 summarizes the annual TP load, FWM TP concentration, rainfall, and flow volume for the ACME1 and ACME2 structures from WY1998–WY2008. The ACME1 and ACME2 structures did not discharge to the EPA during WY2008.

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

Acme Basin Source Control Strategy

During WY2008, the source control strategy for the Acme basin continued as summarized in the 2007 SFER – Volume I, Chapter 4.

Acme Basin Source Control Activities

Summary of Water Year 2008 Activities

During WY2008, the District and Acme continued the implementation of the WQIPs for the Acme basin B, as detailed in the 2006 SFER – Volume I, Chapter 3. Following is an update on each of these activities:

1. **BMP Cooperative Agreement (Long-Term Plan Project "Acme Basin B"):** The Village of Wellington (VOW) is in the process of revising the previously issued BMP Implementation Plan required by its July 2005 BMP cooperative cost-share agreement with the District. The agreement was being amended in WY2008 to include the revised BMP Implementation Plan and provides $99,600 in cost-share for implementation of BMPs to further improve water quality in discharges from Acme basins A and B. Implementation of the plan is expected to be completed during WY2009.
2. **Race Track Lake Expanded Water Quality Treatment Marsh Project:** Race Track Lake Expanded Water Quality Treatment Marsh Project: The District partially funded this project with a 2003 cost-share agreement between the VOW and the District. As a result of high construction cost estimates that the VOW received for the project, and improvement in recent water quality results in the vicinity of the project, the VOW elected to cancel the project in 2008. The VOW intends to use the cost-share agreement funds to implement a revised District approved BMP plan.
3. **Acme Basin B Discharge Projects:** Construction of the ACME7 pump station (the permanent structure) is complete. 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. Construction of this second phase has been delayed and is currently scheduled for completion by June 2010. More detail on this project is available in Chapter 7A of this volume, and at the web site (www.evergladesnow.org).

Anticipated Activities for Water Year 2009

1. **Wetland Environmental Project:** The District and the VOW will initiate the design phase for the construction of the 365-acre wetland environmental area within Section 24.

BOYNTON FARMS BASIN UPDATE

Water Year 2008 Phosphorus Results for Boynton Farms Basin

The Arthur R. Marshall Loxahatchee Refuge (Refuge) headquarters property, which is considered part of the EPA, although outside the eastern boundary of WCA-1, has in previous water years received discharges from the Boynton Farms basin. Water quality grab samples for the discharges from this basin have been collected by the District since April 2000 on a limited number of flow events. The pumps located on the Dubois property at the south end of the basin that previously discharged west to the Refuge to provide flood protection for the Dubois agricultural fields were re-located during WY2008 to the east side of the property, and currently discharge to the east to the Lake Worth Drainage District canal system. Pumps located on the Palm Beach County property to the north were inactive during WY2008, as this property was not farmed.

Information regarding historical flow data from these properties is not available to the District; 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 4-4.

Boynton Farms Basin Source Control Strategy

During WY2008, source control strategy for the Boynton Farms basin continued as summarized in the 2006 SFER – Volume I, Chapter 3.

Boynton Farms Basin Source Control Activities

Summary of Water Year 2008 Activities

During WY2008, the District and stakeholders continued the implementation of the WQIPs for the Boynton Farms basin, as detailed in the 2006 SFER – Volume I, Chapter 3. The District 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 phosphorus source controls (BMP) program, and revisions to their existing system to meet EFA-required water quality standards.

During WY2008, an ERP modification application was submitted by Jill Farms, a property formerly known as the Dubois property and located south of the property owned by Palm Beach County. The permit modification reflects the voluntary relocation of the only pump that used to discharge directly to the Refuge property. Also, the permit application provided better topographic information for a retention area adjacent to the Refuge. As a result, discharges from this farm into the Refuge property will no longer occur in future water years, and the property now drains to the Lake Worth Drainage District's E-1 Canal. Consequently, the Jill Farm will be removed from the Boynton Farms basin boundaries in future SFERs.

An ERP modification for the Palm Beach County property, the only remaining farm within the Boynton Farms basin, is pending the leasing of the property to an agricultural entity. The property was not farmed during WY2008.

Anticipated Activities for Water Year 2009

The District will 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 ERP modification for the property will include provisions that discharges to the west no longer occur.

FUTURE EFFORTS FOR THE NON-ECP BASINS

Continued implementation of the WQIPs for the non-ECP basins, which are consistent with the Long-Term Plan, is necessary to ensure significant progress toward improving water quality. The District will continue to track the implementation of the WQIPs and work cooperatively with local governments, the 298 Diversion Projects, 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 Long-Term Plan for the Feeder Canal basin will be revised to recommend additional funding to support the initiation of rulemaking for a basin-specific BMP regulatory program. In the interim, the District's strategy within the Feeder Canal basin continues to utilize existing regulatory programs that include the integration of compliance efforts to ensure that landowners comply with their existing ERP requirements and to incorporate BMPs as conditions of Surface Water Management Permits or ERPs, or through landowner agreements.

Discharges from the Acme basin that previously were directed into the EPA have been diverted to the C-51 canal for eventual treatment in STA-1E. The Acme basin will be designated as an ECP basin in future water years. Also, flows from the C-139 Annex sub-basin (an area within the L-28 basin) are expected to be diverted to STA-6. Once this diversion is effective, this sub-basin will be designated as an ECP basin.

The District will continue coordinating with the FDEP for the non-ECP permit renewal/modification process within the remaining non-ECP basins, which will establish long-term compliance permit requirements as well as TBELs. WQIPs (as described in the 2006 SFER – Volume I, Chapter 3, and as discussed in this chapter) are expected to achieve progress toward meeting established water quality standards.

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