Chapter 8A: Achieving Long-Term Water Quality Goals

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SUMMARY

The South Florida Water Management District (District or SFWMD), Florida Department of Environmental Protection (Department) and other parties are aggressively pursuing the interim and long-term Everglades water quality goals. Interim mandates to reduce phosphorus levels include Everglades Agricultural Area (EAA) landowner Best Management Practices (BMPs; refer to Chapter 3) and construction and operation of Stormwater Treatment Areas (STAs; refer to Chapter 4). The long-term Everglades water quality goal is for all waters discharged to the Everglades Protection Area (EPA) to achieve compliance with state water quality standards by December 31, 2006. Despite the District's best efforts, the 2006 time frame for compliance with all water quality standards, as established by the Everglades Forever Act (EFA), is ambitious, considering the number and complexity of the many inter-related activities. Delays in the timely completion of these activities, many of which are outside the District's control, may result in unintended delays in achieving compliance with state water quality standards. In an attempt to meet the 2006 deadline, the District may be required to make recommendations for long-term solutions based on incomplete science and engineering information, which carries associated environmental and economic risks. This chapter describes the integration of research, planning, construction and other activities designed to achieve this long-term goal, and identifies the remaining key uncertainties and other outstanding challenges.

INTRODUCTION

The long-term Everglades water quality goal is for all waters discharged to the EPA to achieve compliance with state water quality standards by December 31, 2006. If the Everglades Construction Project (ECP) and other discharges to the EPA are not in compliance with state water quality standards, the EFA requires that the District submit an integrated water quality plan by December 31, 2003 to achieve compliance with state standards by December 31, 2006. If discharges to the EPA are in compliance with state water quality standards, the EFA requires that the District submit an integrated plan by December 31, 2003 to maintain compliance with standards. By December 31, 2003 the District must submit to the Department permit modifications and/or permit applications for the long-term water quality measures, including proposed funding mechanisms and implementation schedules.

The 2006 date for achieving compliance with water quality standards in all waters that discharge into the Everglades is ambitious, particularly considering the remaining uncertainties and all the factors outside the control of the District. The EFA intended "to provide a sufficient period of time for construction, testing, and research so that the benefits of the ECP will be

determined and maximized prior to requiring additional measures" (373.4592(1)(g), F.S.). Many scientific, engineering, regulatory and other uncertainties remain that will significantly influence the final plan. Other sections of this Report describe the numerous research, regulatory and construction activities, particularly Chapters 3, 4 and 8B on the Everglades Stormwater Program.

WATER QUALITY IMPROVEMENT STRATEGIES

The District is currently developing water quality improvement strategies to determine the optimal combination of source-control, basin-level and regional solutions to achieve the long-term water quality goal. It is anticipated that there will be four primary components to the water quality improvement strategies:

1. Improvement of source controls, including Best Management Practices (BMPs)
2. Optimization of Stormwater Treatment Areas (STAs)
3. Testing of Advanced Treatment Technologies (ATTs)
4. Synchronization with Comprehensive Everglades Restoration Plan (CERP) Projects.

Basin-specific feasibility studies will evaluate alternative combinations of these components based on technical, environmental, economic and other factors, and will include implementation schedules and preliminary estimates of costs. Thirteen of the 15 hydrologic basins that discharge into the EPA will be included in the basin feasibility studies, presented in **Table 8A-1**; the remainder will be evaluated by others (e.g., the C-111 Basin will be covered by the federal C-111 Project). Baseline flows and phosphorus (P) levels have been developed for the 13 basins that will be included in the basin studies, and these are summarized in **Table 8A-2**. Projected P loads range from 40 kg/y (for the G-123 structure) to 38,650 kg/yr (for the combined S-7/S-8 basins discharging from STA-3/4). For those basins with minimal P loading (G-123 North New River Canal Basin and North Springs Improvement District), diversion of flows and/or source controls may be more cost-effective than regional treatment alternatives.

The basin-specific feasibility studies and subsequent conceptual engineering designs are scheduled to be completed by December 31, 2003. However, successful development and implementation of the water quality improvement strategies will require integration of numerous research, planning, regulatory and construction activities, as introduced in Chapter 1. Despite the best efforts of the District and others, many challenges remain in achieving the long-term water quality goals. Some of the more significant challenges include regulatory issues, uncertainties in source control and regional treatment technologies, synchronization with CERP projects and lack of funding.

Table 8A-1. Everglades Protection Area Tributary Basins Included in Basin Specific Feasibility Studies

Basin	Canal	STA	Receiving Water
S-5A (EAA)	West Palm Beach Canal	STA-1W, STA-1E	A.R.M. Loxahatchee National Wildlife Refuge (WCA-1)
S-6 (EAA)	Hillsboro Canal	STA-2	WCA-2A
S-7 (EAA)	North New River Canal	STA-3/4	WCA-3A
S-8 (EAA)	Miami Canal	STA-3/4	WCA-3A
C-51 West & L-8 Basin	C-51 West	STA-1E, STA-1W	A.R.M Loxahatchee National Wildlife Refuge (WCA-1)
C-139 (including Annex)	L-3 Canal	STA-5, STA-6	WCA-3A
ACME Basin B	N/A	N/A	A.R.M. Loxahatchee National Wildlife Refuge (WCA-1)
North Springs Improvement District	N/A	N/A	WCA-2A
North New River Canal (G-123)	North New River Canal	N/A	WCA-3A
C-11 West	C-11 West	N/A	WCA-3A
Feeder Canal	L-28 Interceptor Canal	N/A	WCA-3A
L-28	L-28	N/A	WCA-3A

Table 8A-2. Summary of Simulated Baseline Flows and Phosphorus (1965-1995)

Basin/STA	Mean Annual STA-Inflow (acre-ft)	STA-Inflow Phosphorus (ppb)	Mean Annual Phosphorus Load (kg)	Mean Annual Discharge to EPA (acre-ft)	Discharge Phosphorus (ppb)	Mean Annual Phosphorus Load (kg)	CERP Project and Date
C-51 West/STA-1 East	133,331	176	28,950	136,406	50	8,406	C-51 Backpump and Treatment (Y)(2010) L-8 Basin (K Ph 1) C-51 & Southern L-8 Reservoir (GGG6)(2014) C-51 & L-8 ASR (K LL) (2020)
S-5A/STA-1 West	160,335	139	27,399	161,902	34	6,815	See above
S-6/STA-2	233,473	100	28,831	229,273	48	13,492	EAA Reservoir (2009)
S-7, S-8/STA-3/4	660,889	88	72,019	637,901	49	38,650	EAA Reservoir (2009) Holey Land WMA Operations (DD) (2008) Pump Station G-404 Modification (II3)(2008)
C-139/STA-5	85,637	167	17,634	83,776	38	3,938	EAA Reservoir (2009) Rotenberger WMA Operations (EE5) (2006)
EAA, C-139 Annex/STA-6 (Sections 1 and 2)	80,532	121	12,050	74,930	34	3,104	Holey Land WMA Operations (DD) (2008) EAA Reservoir (2009) Pump Station G-404 Modification (II3)(2008)
Acme Basin B	N/A	N/A	N/A	31,499	94	3,660	RSTA (A6.3.3.6) (2007)
North Springs Improvement District	N/A	N/A	N/A	6,168	39	293	Impoundment & ASR (M6) (2007/2014)
N. New River Canal Basin	N/A	N/A	N/A	1,781	18	40	Diversion structures (YY4) (2018)
C-11 West Basin	N/A	N/A	N/A	194,167	17	4,063	S-9A Seepage Pump & Divide Structure (A5.5.5) (2002) STA (Q5)(2008)
L-28 Basin	N/A	N/A	N/A	83,806	39	3,982	Miccosukee WMA (A5.5.26) (2008) A6.3.4.6 (2008) STA (CCC6) (2016)
Feeder Canal Basin	N/A	N/A	N/A	77,179	156	14,854	Seminole WCP (A5.5.6) (2008) A6.3.4.1 (2008) STA (CCC6) (2016)

Reference: Goforth and Piccone, 2001

CHALLENGES TO ACHIEVING LONG-TERM WATER QUALITY GOALS

REGULATORY ISSUES

Two vital regulatory issues need to be addressed in an accelerated manner:

1. Establishing numeric criterion for phosphorus in the Everglades
2. Establishing the compliance methodology – the locations and frequency of monitoring for compliance with the phosphorus standard.

The EFA requires the Department to initiate P criterion rulemaking by December 2001, and efforts on rule development were begun during Summer 2001. The EFA establishes a default P criterion of 10 ppb, if rulemaking is not completed by December 31, 2003. Concurrent with P criterion rulemaking, the method for determining compliance with these criteria will be finalized in accordance with the framework described in the EFA (Section 373.4592(4)(e)3, F.S.):

> Compliance with the phosphorus criterion shall be based upon a long-term geometric mean of concentration levels to be measured at sampling stations recognized from the research to be reasonably representative of receiving waters in the Everglades Protection Area, and so located so as to assure that the Everglades Protection Area is not altered so as to cause an imbalance in natural populations of aquatic flora and fauna and to assure a net improvement in the areas already impacted.

Once the numeric criterion and compliance methodology are established, the Department will be able to establish discharge limits or levels for waters entering the EPA. Details on the P criterion development are presented in Chapter 5.

In addition, the Department must complete rulemaking to revise water quality standards for parameters other than P for the EPA and EAA canals, recognizing the existing beneficial uses of the EAA canals. Although the EFA does not set a specific deadline for this rulemaking, it is assumed it will be completed by December 31, 2003. Other regulatory issues are discussed in Chapter 3.

UNCERTAINITIES

Uncertainties in STA Optimization and ATT Research

Current research results have yet to identify ATTs that reliably and consistently produce P levels at or below the default value of 10 ppb at the point of discharge (referred to as "end-of-pipe") under the expected flow and nutrient loading conditions. Chapter 4 presents a summary of STA optimization and ATT research. While critical research is continuing on STA optimization and ATTs, the basin-specific feasibility studies will use a combination of best available information and sensitivity analyses to deal with these key uncertainties.

Uncertainties in Source Control Measures

It is anticipated that the long-term Everglades water quality solutions will contain a combination of source control and regional treatment technologies. While landowners within the EAA have implemented very effective source control BMPs, comparatively little is known about the technical efficacy and economics of controlling P loads from urban and other rural basins. The basin feasibility studies may use best professional judgment and sensitivity analyses to predict the performance and costs of source controls.

Integration With CERP Projects

The majority of Everglades tributary basins contain proposed CERP projects to be completed between 2002 and 2038. While the current CERP projects have been planned under the assumption that the long-term water quality solutions would be implemented independently of the CERP projects, there is significant potential for taxpayer and private cost savings by integrating the water quality improvement strategies with the CERP projects. This integration would require working with the legislature and other parties to synchronize time frames and funding mechanisms.

Funding Issues

Funds need to be appropriated for implementation (land acquisition, design, construction and operation) of the long-term water quality solutions. The EFA allocated several state sources for funding the implementation of the interim solution (e.g., the ECP). However, funding for implementation of long-term solutions has not been appropriated. The District is unable to develop a firm estimate of the total costs until additional research and basin-specific studies and conceptual designs are completed.

RISKS

Risks Associated With Premature Selection of Long-Term Solutions

The EFA establishes an orderly process of research and rulemaking to develop a sound foundation for making decisions regarding long-term water quality solutions. This process was described above and remains the current strategy for achieving long-term compliance with all water quality goals. If the interim water quality program alone cannot achieve the long-term goals, this orderly approach will enable sound, science-based decisions to be made on additional water quality treatment options.

If critical decisions on long-term water quality solutions are made without sufficient time to assess the current water quality program, establish appropriate discharge limits and investigate alternative measures, they carry associated environmental and economic risks.

Examples of potential environmental risks include the possibility that prematurely selected solutions:

- May not achieve the long-term phosphorus target
- May not achieve the long-term water quality goals for parameters other than phosphorus
- May cause or contribute to unintended adverse impacts to the Everglades
- May cause potential sludge or other byproduct disposal problems.

Examples of potential economic risks include the possibility that prematurely selected solutions:

- May incur additional capital and annual costs above those that may have been incurred if additional information had been available
- May incur acquisition of additional lands beyond those that may have been acquired if additional information had been available
- May result in legal challenges to the sufficiency of science and engineering information used in the decision process.

The orderly process of research and rulemaking, established by the EFA, was designed to provide sufficient science and engineering information to reduce the uncertainty and minimize risks associated with long-term water quality solutions. Nevertheless, to meet the ambitious timeframes in the EFA, the District may be required to recommend long-term solutions based on incomplete science, engineering and regulatory information, which carries associated environmental and economic risks. The key gaps in the information base for making decisions on the long-term solutions are summarized below.

INFORMATION GAPS

Key Regulatory Information Gaps

1. Class III numeric P criterion for the Everglades Protection Area (Chapter 5). *Status: Different research groups are proposing different values, ranging from less than 10 to 15 ppb. The Florida DEP will initiate rulemaking by December 31, 2001 with a schedule for adoption no later than December 31, 2003.*

2. Methodology to be used to determine compliance with the Class III numeric phosphorus criterion for the Everglades Protection Area. *Status: The compliance methodology will have significant ramifications on the selection of long-term solutions for meeting water quality goals. It is assumed that the Florida DEP will propose the compliance methodology as part of the phosphorus rulemaking (December 2001-2003).*

3. Revised water quality standards for parameters other than phosphorus applicable to the Everglades Protection Area and EAA canals. *Status: While the Florida DEP has reviewed dissolved oxygen data as part of this effort, it is uncertain what work has been completed on other parameters; no time frame has been established.*

4. Relationship between waters entering the Everglades and the resulting water quality in the Everglades (Chapter 5). *Status: The Florida DEP, the District and other parties are investigating appropriate modeling tools to examine this relationship. While there is no schedule established for completing these investigations, this work is needed as soon as possible.*

5. Basin-specific discharge limits for waters entering the Everglades Protection Area. *Status: The Florida DEP typically establishes discharge limits as part of the permit review and processing. However, since permit applications are mandated to be submitted on the same day as the final adoption of the numeric criterion,* ***it is critical that discharge limits are set as soon as possible to select the appropriate basin-specific long-term solution.*** *It is assumed that the modeling tools discussed in 4 above will be used in setting discharge limits.*

6. Water quality evaluation for tributaries other than those treated by the ECP (later sections in this chapter). S*tatus: Phosphorus data for the 10-yr period covering May 1990-April 1999 have been evaluated as part of the Baseline data set (**Table 8A-2**). Evaluation of other water quality parameters is underway.*

Key Implementation Information Gaps

1. Technical efficacy of ATTs, along with the costs of P reduction alternatives, and implementation schedules (Chapter 4). *Status: The final reports from the initial phase of this critical research are scheduled to be completed by early 2002. Subsequent field testing results should be available by 2003.*
2. The basin-specific optimal combination of BMPs, STAs, ATTs, as needed, and/or additional regulatory programs. *Status: Investigations are underway; alternatives are scheduled to be evaluated by June 2002.*
3. Means to optimize the P treatment performance of STAs (Chapter 4). *Status: The District continues to investigate ways to optimize STA performance. As measures are identified, they will be incorporated into STA operations.*
4. Technical efficacy and cost effectiveness of enhanced BMPs (Chapter 3). *Status: The District continues to work with landowners in various basins to examine BMPs. A manual of general BMP guidelines for urban basins is under preparation by District staff.*
5. Modifications to the flows and P loads, resulting from CERP components, along with implementation schedules. *Status: The basin feasibility studies will estimate the influence on the flows and phosphorus loads to the Everglades as a result of the CERP projects. However, full analysis of CERP flows and loads will be conducted during the subsequent preparation of individual project implementation reports.*
6. Hydrologic regimes from the LEC Plan, along with implementation schedules (Chapter 8F). *Status: Uncertain.*

Key Funding Concern

1. Lack of funding for long-term solutions and time frames, including resolution of the appropriate mix of public/private funding. *Status: Uncertain.*