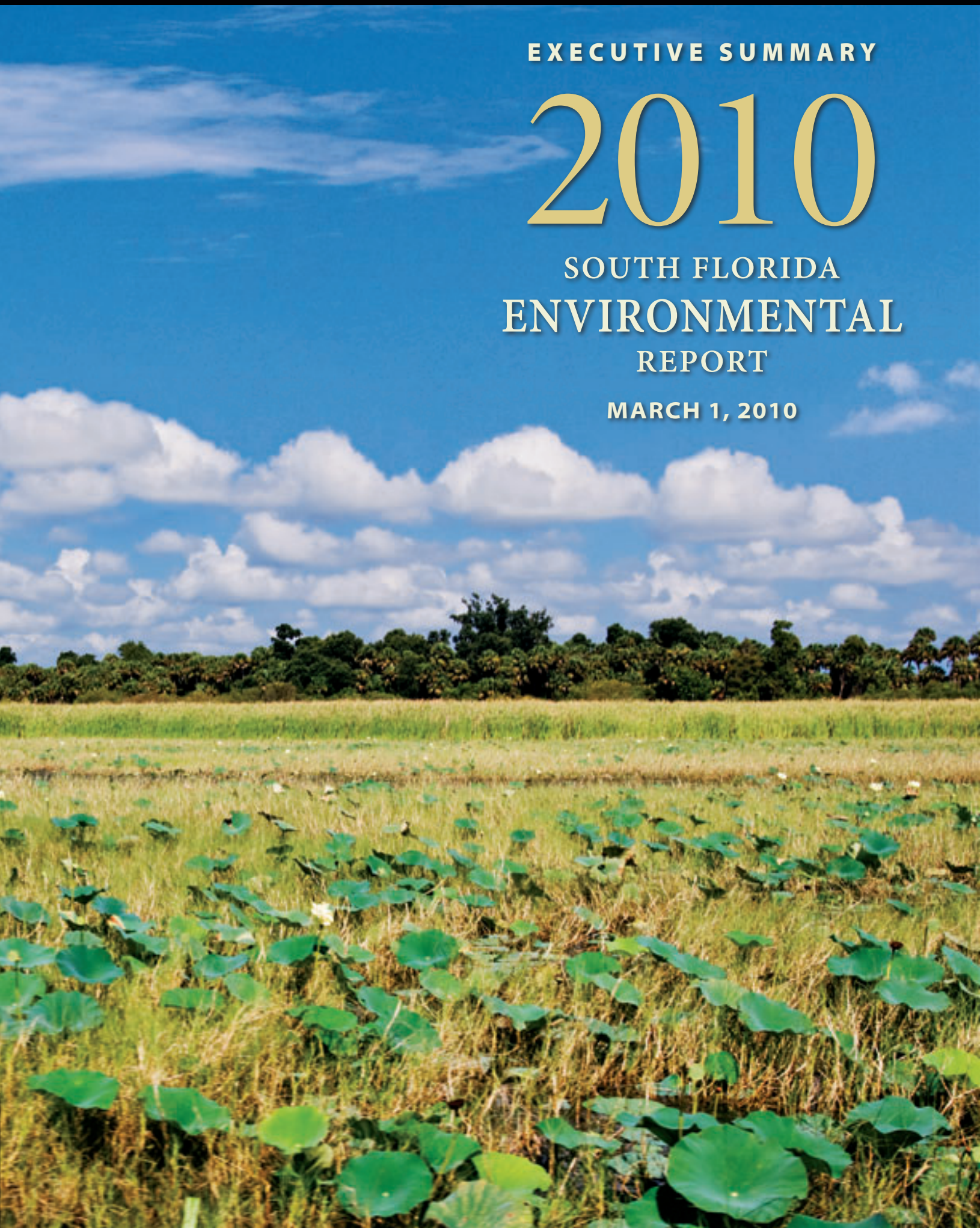
SOUTH FLORIDA WATER MANAGEMENT DISTRICT



EXECUTIVE SUMMARY

2010 SOUTH FLORIDA ENVIRONMENTAL REPORT

MARCH 1, 2010

The State of Florida and the South Florida Water Management District achieved another year of significant environmental restoration progress in 2009. The sound science, technologies, and coordination behind the successes are detailed in this report.

In a major step that lays critical groundwork for Everglades restoration in the decades ahead, the District's Governing Board and U.S. Army Corps of Engineers approved landmark partnership agreements, including a Master Agreement, that allow federally funded work to move forward on key Comprehensive Everglades Restoration Plan projects. With this umbrella accord in place, work can now fully utilize an infusion of congressional appropriations for project construction.

The State and the District also continue to pursue a historic opportunity to broaden Everglades restoration on a scale never before envisioned. The Governing Board approved a contract to acquire 73,000 acres of strategic lands to benefit the *River of Grass*, with options to purchase an additional 107,000 acres in the future. This pending acquisition has the very real potential to serve as a defining moment for America's Everglades and South Florida's environment.

Efforts to improve Everglades water quality also continue. The existing 45,000 acres of effective Stormwater Treatment Areas treated about 1.1 million acre-feet of runoff water in Water Year 2009. Since 1994, constructed wetlands and agricultural Best Management Practices have together prevented more than 3,200 metric tons of phosphorus from entering the Everglades. Construction on an additional 12,000 acres of valuable treatment marshes is under way.

We are seeing the results of restoration initiatives in the field as substantial progress was made on the Kissimmee River Restoration Program to backfill an additional four miles of canal. In previously restored areas, plant and wildlife responses are meeting or exceeding expectations. In the Everglades, District scientists documented wading bird nesting four times higher in 2009 than in 2008 — the largest number recorded in more than 60 years and a strong indicator of an improving ecosystem.

It is with an eye on the future that we present this report on South Florida ecosystem restoration progress. We hope that it inspires you to share our commitment to environmental restoration.

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2010 SOUTH FLORIDA

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Foreword

The *2010 South Florida Environmental Report* (SFER) marks the twelfth year of consolidated reporting by the South Florida Water Management District and the Florida Department of Environmental Protection, pursuant to Chapter 2005-36, Laws of Florida, and Subsection 373.036(7), Florida Statutes. Continuing with the format of earlier years, the annual SFER is streamlined into a comprehensive two-volume publication, complemented by this high-level Executive Summary. It distinctly serves the public and decision makers with thorough, up-to-date information on the many advances toward South Florida's environmental restoration and other key agency accomplishments over the reporting year.

Volume I, The South Florida Environment, documents relevant scientific and engineering efforts throughout South Florida, spanning diverse areas of the interconnected Northern and Southern Everglades systems. This volume satisfies the annual reporting mandates required by the Everglades Forever Act, the Comprehensive Everglades Restoration Plan, the Northern Everglades and Estuaries Protection Program, and other federal and state laws and permits.

Volume II, District Annual Plans and Reports, comprises eight annual plans and reports required of Florida's five water management districts. This volume captures the South Florida Water Management District's milestones in implementing the many programs and projects outlined in the agency's Strategic Plan. Now in its sixth year, a web-accessible, consolidated database is also included to provide cohesive reporting and accessible project-related information.

The complete 2010 report, along with all previous consolidated reports, is available on the District's web site (www.sfwmd.gov/sfer) and on the compact disc inside the back cover of this booklet. Overall, the details highlighted in the SFER provide the scientific foundation of agency programs and projects that ultimately support prudent environmental and fiscal decision making. With the ongoing support of stakeholders and the public, the *2010 South Florida Environmental Report* proudly showcases the progress achieved toward sound management and restoration of the entire South Florida region.

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ENVIRONMENTAL REPORT

The Bottom Line

As the flagship of consolidated agency reporting, the *2010 South Florida Environmental Report* unifies dozens of reports into a single, two-volume publication. Spanning the entire South Florida region, Volume I findings were derived from various monitoring and research projects during Water Year 2009 (WY2009) and highlight the District's financial management during Fiscal Year 2009 (FY2009). Volume II details the FY2009 planning and project status for eight annual reports statutorily required of all water management districts. A snapshot of noteworthy updates and accomplishments in the reporting period follows.

Volume I, The South Florida Environment

Water Quality in South Florida

- As required by the Everglades Forever Act, the District continues to implement the Long-Term Plan to achieve water quality goals in the Everglades Protection Area (EPA). As of April 2009, the Everglades Agricultural Area (EAA) Best Management Practices (BMPs) and Everglades Construction Project (ECP) Stormwater Treatment Areas (STAs) together have removed more than 3,200 metric tons of total phosphorus (TP) from water entering the EPA.
- Like earlier years, Everglades water quality in WY2009 generally met state criteria, with a few excursions limited to specific EPA areas. Since the last water year, the annual flow-weighted mean inflow TP concentration decreased from 9.5 to 8.1 parts per billion in Everglades National Park. In WY2009, the TP load into the EPA was 77 percent higher than WY2008. This year's dramatic shift up was primarily due to increased flow volumes (63 percent) associated with Tropical Storm Fay and other subsequent rains that occurred during severe drought. Despite the increased loading, the reduced inflow concentrations demonstrate the efficacy of BMP and STA nutrient removal.
- Mercury levels in fish from northern water bodies, such as the Kissimmee Basin, vary across the region but tend to be lower than those in the EPA. Over the past decade, mercury concentrations in about half of the largemouth bass collected from the Water Conservation Areas have exceeded the federal criterion for human consumption. In 2008, encouraging results were found in northern Everglades National Park, where mercury levels in bass and sunfish markedly dropped in certain areas from the previous year. Future management options include a focus on reducing inputs of atmospheric mercury and assessing alternatives for reducing sulfur loading to the ecosystem.

Everglades Stormwater Treatment Areas

- During WY2009, the six Everglades STAs collectively treated about 1.1 million acre-feet of water — roughly 1.5 times that of WY2008 — and reduced inflow TP levels from a flow-weighted mean concentration of 152 to 25 parts per billion in the outflow. The STAs retained 180 metric tons of TP and reduced the inflow TP load to the EPA by 82 percent.
- With lingering water shortage conditions in WY2009, drought contingency planning continued to minimize negative impacts to the STAs. Despite proactive measures to maintain minimum water levels in the treatment cells, many areas had extended dryout periods that stressed vegetation and lowered treatment performance. However, it appears that there has been minimal sustained impact to the vegetation.
- Ongoing agency research is focused on optimizing and sustaining STA performance. In STA-5, rehabilitation activities to establish desired plant communities and improve outflow TP levels were initiated in WY2009. Diverse recreational opportunities are available at all the STAs, including duck hunting at the newly installed, disabled-accessible boardwalk at STA-5.

Phosphorus Source Controls in South Florida

- During WY2009, under the Northern Everglades and Estuaries Protection Program, the District continued with rule development to enhance the nutrient source control program for the Lake Okeechobee watershed. Conceptual plans to develop source control BMP programs for the Caloosahatchee and St. Lucie River watersheds were also completed.
- The application of source control BMPs in the ECP basins continues to be a successful approach to reducing TP inputs to the Everglades. With WY2009 marking the fourteenth consecutive year of basin compliance, the EAA basin achieved a 68 percent reduction in its TP load. The C-139 basin did not achieve compliance with its TP load performance target. In this basin, the District proceeded with on-site inspections and outreach to ensure uniform BMP implementation and progressed with rule development regarding the BMP compliance rule.

- The District continues to apply source controls for non-ECP basins and track progress toward achieving water quality standards. In FY2009, the majority of TP loading from non-ECP basins came from the Feeder Canal, and coordinated actions to improve water quality in this basin are ongoing.

Hydrology and Ecology Issues in South Florida

- Drought conditions persisted throughout WY2009 despite significant rainfall and temporary relief from Tropical Storm Fay in August 2008. In one of the driest dry seasons on record, rainfall in most regional areas was well below average. Because of the prolonged drought, water shortage management remained in place throughout the year.
- Dozens of Everglades research projects are being conducted on plant, landscape, wildlife, and ecosystem ecology to support and influence natural resource and water management decisions. Notably in 2009, wading bird nesting in South Florida was the largest number recorded in more than 60 years. The four-fold increase over the last year is attributable to shifting drought and flood conditions in preceding years, coupled with favorable hydrologic conditions during the nesting season.
- The District is working with other agencies to help manage the ever-growing number of South Florida's nonindigenous species to minimize their damaging effects on Everglades restoration. While control programs for melaleuca, Australian pine, and other aggressive plants have shown positive results, management responsibilities are expanding as other harmful invasives are discovered. To address the persistent influx of new invasions, the District and other stakeholders continue to engage policy makers on developing more effective strategies and regulations toward prevention.

Everglades Restoration

- In summer 2008, the state of Florida unveiled a strategy for reviving the *River of Grass* by acquiring agricultural land south of Lake Okeechobee. In May 2009, the District's Governing Board approved a contract to purchase thousands of acres of land, subject to financing. This pending acquisition would allow water storage and treatment on a scale never before envisioned, providing a monumental opportunity for restoration that would benefit the Everglades, Lake Okeechobee, and the St. Lucie and Caloosahatchee rivers and estuaries.
- As a leap forward in Everglades restoration, the Comprehensive Everglades Restoration Plan (CERP) Master Agreement — governing all CERP projects between the District and U.S. Army Corps of Engineers — was signed by the Governing Board in August 2009. The Governing Board also formalized the Picayune Strand Project Partnership Agreement, which outlines project-specific details and assigned responsibilities for restoring Picayune Strand in Southwest Florida. These agreements permit the U.S. Army Corps of Engineers to spend federal funds on construction of the Picayune Strand Restoration and other authorized restoration projects.
- In FY2009, the District began construction for Compartments B and C to expand the existing Everglades STAs by nearly 12,000 acres. The District and its partners made significant progress in the planning and design of several Everglades restoration projects to lay the foundation for planned construction over the next fiscal year. The federal government also committed additional FY2009 and FY2010 funds to support construction of the CERP Picayune Strand Restoration, C-111 Spreader Canal, Indian River Lagoon – South, and other priority restoration projects.

Lake Okeechobee Management and Restoration

- Lingering drought in WY2009 was most pronounced in Lake Okeechobee, whose stage declined to a low of 9.25 feet National Geodetic Vertical Datum in June 2008. Subsequently, there was a dramatic increase in lake levels due to intense rainfall from Tropical Storm Fay, which brought the stage to over 15 feet — the highest of the year. With increased wet season inflows, lake outflows in WY2009 overall were significantly higher than WY2008.
- From WY2005–WY2009, the average TP load to the lake was 572 metric tons, which is roughly four times greater than the established Total Maximum Daily Load. Under the Northern Everglades initiative, the Phase II Technical Plan for the Lake Okeechobee Watershed Construction Project is being implemented as a comprehensive, watershed-based approach to help protect the lake and downstream estuaries. The 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 the lake's target load.
- Lake Okeechobee continues to show signs of recovery from the enduring impacts of the 2004–2005 hurricanes, including lower nearshore turbidity and TP concentrations, more submerged aquatic vegetation beds, and no severe algal blooms. While continued recovery is expected to occur naturally if a desirable range of lake levels can be maintained, this process may require several years for some drought-sensitive species such as the Florida apple snail, a key species in the lake's food web.

Kissimmee Basin Restoration

- During WY2009, substantial progress was made on Kissimmee River restoration. Work is nearly complete on the third phase of construction, which involves backfilling an additional four miles of the C-38 canal and recarving four miles of river channel to reestablish flow to six miles of reconnected river channel. Comprehensive monitoring of environmental responses to restoration is ongoing. Looking ahead, the final phase of construction is scheduled for completion in 2015.
- Scientific work to support developing Water Reservations for the protection of fish and wildlife in the Kissimmee Basin moved forward in 2009 with a peer-reviewed, technical document. The rulemaking process for establishing Water Reservations in the Kissimmee River and Chain of Lakes region is under way.

Coastal Ecosystem Management and Restoration

- Various monitoring, applied research, and modeling activities were undertaken in WY2009 to establish freshwater inflows that will protect and restore South Florida's coastal ecosystems. For example, a suite of ecological models have been developed for Florida Bay to help predict system responses to restoration. Work also began on updating the science plan for the Loxahatchee River and Estuary.
- Under the Northern Everglades initiative, the Caloosahatchee and St. Lucie River Watershed Protection Plans were completed in January 2009. These plans are being implemented to bolster existing monitoring systems and identify strategies for improving water quality and ecosystem restoration in the estuaries. Under the Caloosahatchee River Watershed Protection Plan, planning began in WY2009 for construction of the C-43 Water Quality Treatment and Testing Facility.

Everglades Financial Report

- As of the end of FY2009, the Long-Term Plan's initial, 13-year phase has a projected total cost of $1.2 billion. Overall, the total projected cost of implementing the Everglades Forever Act program is approximately $2 billion through FY2016. Over the next five years, program costs will total roughly $656 million, of which about half is slated for constructing the STA Compartments B and C build-outs and will be supplemented with proceeds from previously issued Certificates of Participation.

Volume II, District Annual Plans and Reports

- During FY2009, the District collected a total of approximately $662 million in revenue (excluding personnel and reserves). The agency spent 65 percent of the total FY2009 budget — a decrease of 23 percentage points from the FY2008 expenditure rate. Eighty-two percent of District projects and processes were on schedule as of the end of the fiscal year, and success indicators showed measurable progress toward the agency's strategic goals.
- The District has adopted Minimum Flows and Levels for 12 water bodies, and has authorized Restricted Allocation Area rules for the Everglades and Loxahatchee River watersheds and the Lake Okeechobee Service Area. In 2009, the District approved its first Water Reservation for the Picayune Strand and Fakahatchee Estuary, and is working toward the adoption of Water Reservations for the Kissimmee River and Chain of Lakes and St. Lucie River.
- The District's total budgeted capital expenditures for FY2010 are $1.05 billion, which is 69 percent of the total annual budget of $1.53 billion, and 48 percent of the projected five-year Capital Improvements Plan budget of $2.2 billion. The FY2010 capital budget represents a decrease of $1.19 billion from last year's budget of $2.24 billion, mainly attributed to a reduction in the acreage proposed for the *River of Grass* land acquisition.
- The District has allocated $1.8 million in FY2010 and anticipates spending $9.1 million from FY2010–FY2014 on water resource development projects identified in updated regional water supply plans. These projects include groundwater monitoring, resource assessments, feasibility studies, modeling, conservation, and water resource protection activities.
- Due to the economic challenges at the state and local level, the SFWMD's budget for Alternative Water Supply (AWS) projects in FY2010 is limited to six projects in the Big Cypress Basin, costing $1.37 million and providing an additional 2 million gallons per day of water. Another two projects have been carried over from FY2009 at a combined budget of $6.4 million.
- Florida Forever funded projects focus on region-wide restoration through the 61 eligible projects identified in the 2010 Florida Forever Work Plan annual update. Eligible projects fall under programs such as CERP, the Florida Forever/Save Our Rivers Program, the Northern Everglades and Estuaries Protection Program, and expedited projects. Over FY2010–FY2014, funding projections are conservatively estimated to include $430 million from the Florida Forever/Save Our Everglades Trust Fund program.
- The District and its partners manage more than 1.35 million acres of public land while providing recreational opportunities to the public. In FY2009, the District spent $12.4 million for land management, while $3.1 million in revenue was generated from agricultural leases and mitigation banks. Land management costs in FY2010, including capital improvements for recreation, are anticipated to be $14.1 million.
- The District operates two regional mitigation projects to compensate for permitted wetland impacts. These are the Corkscrew Regional Ecosystem Watershed and Pennsuco. Neither project still accepts cash payments but existing funds are used to restore and manage the sites. In FY2009, the District spent more than $2.1 million on restoring and monitoring 7,089 acres in the two areas, and it is anticipated that FY2010 combined expenditures will exceed $1.2 million.

The South Florida Environment

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Introduction to the *2010 South Florida Environmental Report – Volume I*

Major Areas of the South Florida Environment

Consolidated Reports Reach Twelve-Year Mark

In a two-volume Main Report and Executive Summary, the *2010 South Florida Environmental Report* (SFER) unifies more than 50 agency reports into a single document for the twelfth year. The SFER, a consolidation of South Florida Water Management District and Florida Department of Environmental Protection reporting, supports the restoration, management, and protection activities associated with the Kissimmee Basin, Lake Okeechobee, the Everglades, and South Florida's coastal ecosystems. The introductory chapter to *Volume I, The South Florida Environment,* provides a basic understanding of the governmental, scientific, and legal context behind the volume.

Complex issues of water quality, quantity, timing, and distribution must be addressed upstream to effectively improve the health of downstream systems. As such, the region is divided into the Northern and Southern Everglades based on delineated watershed boundaries (see map). The Northern Everglades encompasses the Kissimmee area lakes and rivers, Lake Okeechobee, and the Caloosahatchee and St. Lucie rivers and estuaries. The Southern Everglades covers the Water Conservation Areas, Big Cypress National Preserve, Everglades National Park/Florida Bay, and coastal bays and estuaries south of Lake Okeechobee. This systemwide approach helps integrate the planning and implementation of the agency's many regional programs and projects toward attaining restoration goals of the entire Greater Everglades system.

Addressing the many regional research and monitoring projects, Volume I provides data summaries and status updates on all major South Florida ecosystems during Water Year 2009 (May 1, 2008–April 30, 2009). In 15 chapters, the Volume I reporting conforms to the framework of previous SFERs. Under this structure, Chapter 2 presents supporting hydrologic information for subsequent chapters. Chapters 3 through 9 summarize information linked to Everglades restoration efforts, while Chapters 10 through 12 provide more widespread coverage of the South Florida region. Financial reporting on Fiscal Year 2009 (October 1, 2008–September 30, 2009) for the Comprehensive Everglades Restoration Plan, Lake Okeechobee, and Everglades (Chapters 7A, 10, and 13, respectively) is also included. Dozens of related appendices provide supporting data and more detailed analyses.

Hydrology of the South Florida Environment

The development of South Florida requires a complex water management system to manage flooding and water supply where occasional droughts and hurricanes bring more challenges. Excess water is stored in lakes, detention ponds, wetlands, impoundments, and aquifers, or is discharged to the coast through estuaries. Hydrologic extremes are exemplified by flooding and excess water during wet years, and wildfires and water shortage during drought years. Across the South Florida region, water management is accomplished by the District's operation and maintenance of more than 2,600 miles of canals and levees, about 1,300 water control structures, and 63 pump stations.

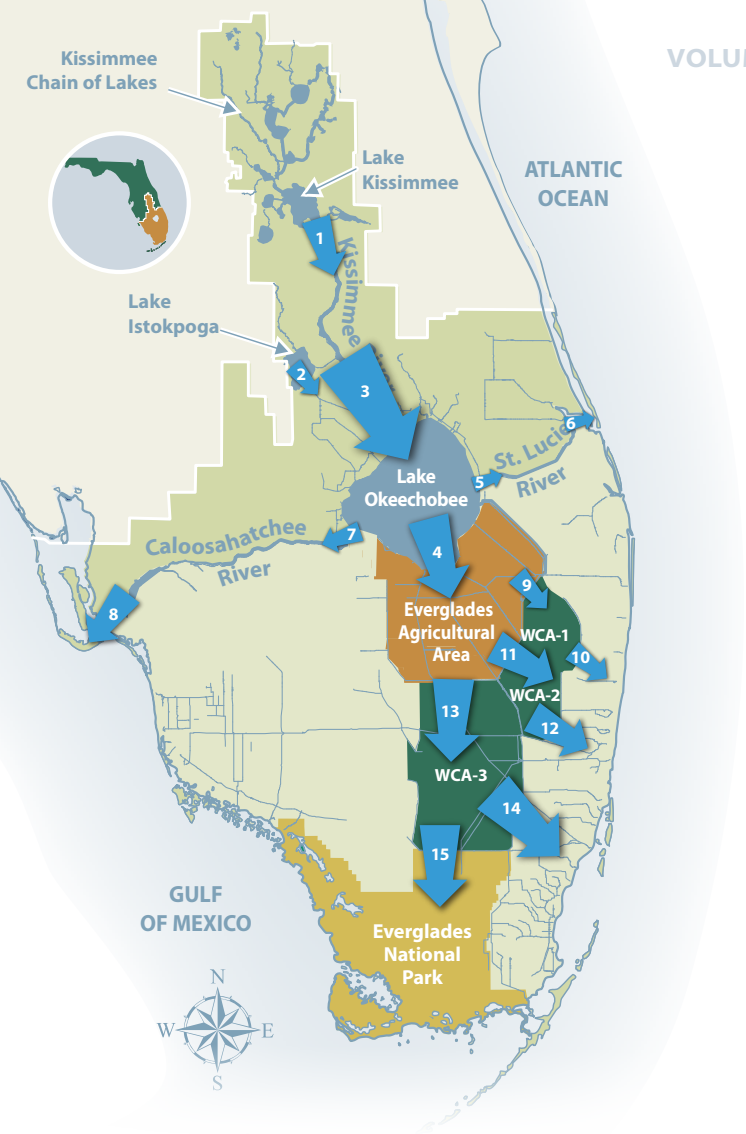
Most topics covered in the 2010 SFER – Volume I are strongly linked to regional hydrology, the subject of Chapter 2. Through a comprehensive update on the hydrology of the area within the District's boundaries, the chapter provides a basis for understanding the regional water management system and water management activities. Water Year 2009 (WY2009) hydrology, including rainfall, potential evapotranspiration, water levels, inflows, and outflows, for all major components of the South Florida regional water management system is presented and compared to the previous water year (WY2008) and historical conditions. This year's chapter also highlights the impact of Tropical Storm Fay, which provided relief to the ongoing severe drought conditions across South Florida.

Tropical Storm Fay Brings Intense Rainfall in Water Year 2009

The District's water managers are constantly faced with the many challenges posed by hydrologic variation when managing the day-to-day operations of the South Florida water management system. In addition, tropical cyclones pose emergency management challenges in the form of widespread and heavy rainfall over a short time that generates runoff, which can cause flooding in urban, agricultural, and ecologically sensitive areas.

Tropical Storm Fay made direct landfall in South Florida during WY2009, moving across the region longitudinally from the southwest to the northeast and impacting all 16 counties of the District. Six days of intense rainfall inundated the system, with Glades, Hendry, Okeechobee, and St. Lucie (see photo) counties experiencing extreme rainfall amounts not typically observed more than once a century. For example, one rainfall station in Glades County recorded 15.5 inches of rain from Tropical Storm Fay, with 11.7 inches on a single day, August 20, 2008.

Runoff generated by Fay created flooding in certain areas of the District, and raised Lake Okeechobee's water levels almost 4 feet in 30 days, which is an extreme event for the lake. In all, 40 counties in Florida were named disaster areas due to flooding and damage from Fay. The storm skewed the average rainfall figures for the water year, but drought conditions quickly returned.



Regional Inflows and Outflows

WATER FLOW (ACRE-FEET IN THOUSANDS)	Water Year 2009*	Water Year 2008
1. Lake Kissimmee Outflows	495	302
2. Lake Istokpoga Outflows	289	31
3. Lake Okeechobee Inflows	2,091	1,013
4. Lake Okeechobee Outflows	1,141	177
5. St. Lucie Canal Inflows	173	14
6. St. Lucie Canal Outflows	165	0
7. Caloosahatchee Inflows	376	42
8. Caloosahatchee Outflows	1,016	87
9. Water Conservation Area 1 Inflows	336	243
10. Water Conservation Area 1 Outflows	335	214
11. Water Conservation Area 2 Inflows	906	488
12. Water Conservation Area 2 Outflows	737	512
13. Water Conservation Area 3 Inflows	1,212	798
14. Water Conservation Area 3 Outflows	1,556	246
15. Everglades National Park Inflows	1,393	343

* Water Year 2009 flows are reflected on map

South Florida's Prolonged Drought Continues Despite Tropical Rains

In WY2009, despite the rainfall contribution from Tropical Storm Fay, drought conditions persisted. Rainfall across the District for WY2009 was 45.2 inches, lower than WY2008 (49.0 inches) and 7.6 inches below the historical average.

Similar to WY2007 and WY2008, 13 rainfall areas and Everglades National Park had below-average rainfall for WY2009. Only the Lower Kissimmee experienced average rainfall for the year, with Palm Beach County having the biggest deficit at 14.2 inches. Dry season rainfall was far below the historical average in the District as a whole. Very low rainfall in the Upper Kissimmee, Lake Okeechobee, Martin/St. Lucie, East Everglades Agricultural Area, West Everglades Agricultural Area, Palm Beach, Broward, Miami-Dade, Water Conservation Area 3, and Everglades National Park areas indicated a severe drought.

Runoff from the wet season rains, including Tropical Storm Fay, replenished Lake Okeechobee and the Water Conservation Areas' storage temporarily, allowing for some water use restrictions to be lifted during the water year and flood management activities to be initiated. However, due to far below-average rainfall after Fay, drought conditions returned, placing constraints on regional water management.

2009 Lake Okeechobee Inflow and Outflow Spikes Felt Systemwide

During WY2009, water levels in lakes in the Kissimmee and Okeechobee watersheds and the Water Conservation Areas increased as a result of high rainfall during the wet season and declined through the dry season. On September 15, 2008, Lake Okeechobee's water level rose to 15.16 feet National Geodetic Vertical Datum, the maximum for the water year; 94 percent of the inflows to the lake occurred in the wet season. As shown in the table, the lake's inflow was twice as high as the previous water year and subsequent outflows were almost seven times those of WY2008. The intense wet season rainfall over the lake's watershed resulted in further dramatic increases in flow throughout the rest of the system during WY2009. As lake levels increased, the amount of available water for water storage and supply increased for the entire South Florida region and kept up with demand even as drought conditions returned. Despite this temporary increase in storage, lawn watering restrictions remained in place. By the end of the water year, lake levels had returned to 11.14 feet National Geodetic Vertical Datum. Because of the unique hydrology of South Florida, proactive management of regional water resources is expected to continue into the foreseeable future.

Status of Water Quality in the Everglades Protection Area

In the 2010 SFER – Volume I, Chapter 3A presents an assessment of water quality within the Everglades Protection Area (EPA) and describes water quality parameters that exceeded state Class III water quality criteria during Water Year 2009 (WY2009). The chapter also evaluates potential factors affecting water quality in this region and provides an update on nitrogen and phosphorus levels in surface waters in the EPA, including a comparison of total phosphorus (TP) levels to the requirements in the phosphorus criterion rule. Specifically, it fulfills numerous reporting requirements of the Everglades Forever Act, the non-Everglades Construction Project (non-ECP) permit, and the Interim Operational Plan (IOP) for Protection of the Cape Sable Seaside Sparrow for inflows to Everglades National Park (Park). The IOP involves rerouting water to maintain suitable water-level conditions in the Park, particularly in open, sawgrass prairie areas that serve as critical habitat for the federally and state endangered Cape Sable seaside sparrow *(Ammodramus maritimus mirabilis*).

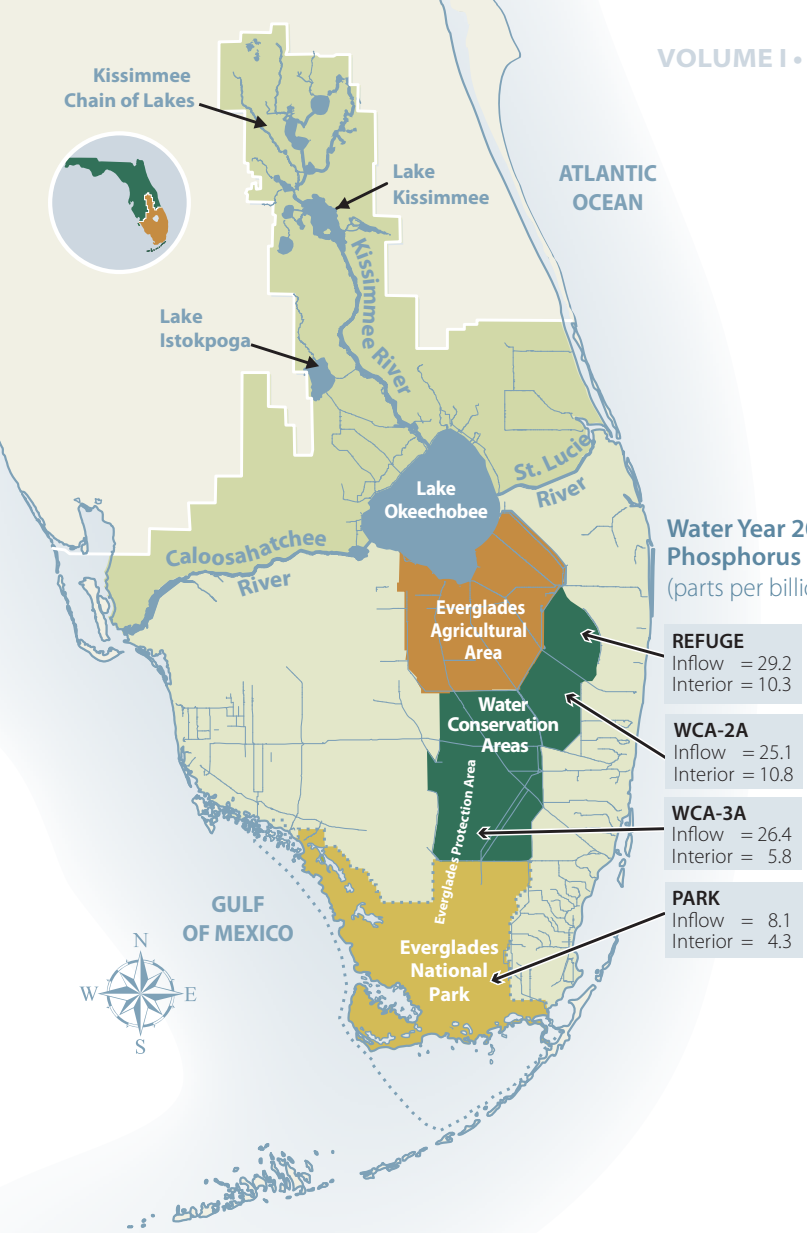
The State Tracks Water Quality Compliance in the Everglades

The District monitors over 100 water quality parameters in the EPA. For this chapter, the Florida Department of Environmental Protection compares water quality data for parameters with state Class III water quality criteria specified in Chapter 62-302, Florida Administrative Code. In WY2009, most water quality data from the EPA met their applicable water quality criteria. Excursions were identified for dissolved oxygen (DO), alkalinity, pH, specific conductance, turbidity, and un-ionized ammonia. Atrazine, a pesticide, was detected once at a level slightly above its toxicity-based guideline concentration at the Water Conservation Area 3A (WCA-3A) S-8 inflow structure. Similar to earlier years, a few parameters exceeded state criteria with the number and type of excursions varying across different EPA regions due to local environmental conditions and water management activities. In WY2009, these excursions were generally localized to specific areas of the EPA, with the exception of DO, which exhibited excursions in all regions except the Park. For WY2009, an evaluation of the non-ECP basin data and IOP-related data indicates that the quality of water discharging into and within the EPA is generally acceptable.

Everglades Nutrient Controls Perform Well Despite Increased Loading

Surface water concentrations of phosphorus and nitrogen were extensively monitored during WY2009 to continue efforts to evaluate the status and trends of nutrients in the EPA. Like previous years, surface water concentrations of TP and total nitrogen (TN) in WY2009 showed a decreasing trend from north to south across the EPA. As shown on the map on page 10, the highest TP levels were observed for the inflows to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) (29.2 parts per billion, or ppb), with TP concentrations decreasing to a minimum within the Park (8.1 ppb).

During WY2009, TP concentrations in the inflows to the Refuge, WCA-2, and WCA-3 were lower than the historical reporting periods. Notably, since the last water year, the annual



Water Year 2005–2009 Mean Phosphorus Concentrations (parts per billion)*

EVERGLADES AREAS	INFLOW	INTERIOR
REFUGE	89.9	10.9
WCA-2A	31.0	13.0
WCA-3A	33.7	8.3
PARK	9.6	5.4

* Inflows are flow-weighted mean concentrations; interiors are geometric mean concentrations.

Water Year 2009 Mean Phosphorus Concentrations* (parts per billion)

Total Phosphorus Concentrations in the Everglades Protection Area

flow-weighted mean inflow TP concentration decreased from 9.5 to 8.1 ppb in the Park. During WY2009, interior geometric mean TP concentrations ranged from 10.8 ppb in WCA-2 to 4.3 ppb in the Park, with the concentrations in WCA-2, WCA-3, and the Park being the lowest among the reporting periods.

During WY2009, geometric mean TN concentrations at the Refuge and WCA-2 interior marsh sites were lower than those observed for the historical reporting periods. In general, TN levels at interior sites were comparable to those reported for WY2008 and ranged from 0.96 parts per million (ppm) in the Park to 1.77 ppm in WCA-2. Overall, the lower TP and TN concentrations are likely related to several factors, including lower volumes of nutrient-enriched inflows from the Everglades Agricultural Area and Lake Okeechobee during dry periods observed during much of WY2009 and improved nutrient-removal effectiveness of the Stormwater Treatment Areas, particularly during low-water conditions.

During WY2009, TP loads from surface sources to the EPA totaled approximately 65 metric tons, with a flow-weighted mean concentration of 25.9 ppb — a load increase of 77 percent compared to WY2008 (36.7 metric tons). In contrast to the sharp decline reported for WY2008, the increased loading observed for WY2009 was primarily caused by increased flow volumes (63 percent) associated with recovery from recent drought conditions. Despite the increased TP loading, the effectiveness of Best Management Practices and Stormwater Treatment Area phosphorus removal efforts continues to be demonstrated.

Phosphorus Criterion Test Reveals Continuing Trend

As outlined in Chapter 62-302.540, Florida Administrative Code, the phosphorus criterion rule establishes a numeric TP criterion of 10 ppb for the EPA as well as a specific method to assess achievement of the criterion. Now in its fourth year of application, the assessment is based on a four-part test, which provides TP concentration limits for individual monitoring stations and groups of monitoring stations and uses available data collected during the most recent five-year period from a specified network of monitoring sites in the EPA.

Similar to the last three water years, the results of the four-part assessment using WY2005–WY2009 data showed that the unimpacted portions of each WCA met the TP criteria by passing all parts of the test. In contrast, portions of the WCA that have been impacted by phosphorus enrichment failed one or more parts of the test and did not meet the criterion. Similar findings will likely continue for some time because the soils within the impacted portions of the WCAs have been enriched with high levels of phosphorus which will require decades to be restored to more natural levels.

Mercury and Sulfur Monitoring, Research and Environmental Assessment in South Florida

Methylmercury is a highly toxic form of mercury that bioaccumulates in aquatic food chains and presents risk to fish-eating wildlife and human consumers of fish. Sulfur affects the rate of methylmercury production in aquatic ecosystems and, as a biogeochemically active element, has forms that are toxic (sulfide) to aquatic life or that may promote phosphate releases from sediments (sulfate). On a statewide basis, there are "do not eat" advisories for several fish species in numerous lakes and for all of Florida's coastal waters due to elevated mercury levels. In the Everglades, elevated concentrations of both mercury and sulfur are evident and may pose significant health risks to humans and wildlife that consume fish.

To address these concerns, the Florida Department of Environmental Protection and the South Florida Water Management District are continuing coordinated efforts to better understand the sources, transformations, and toxicity of mercury and sulfur in the Everglades. The 2010 SFER – Volume I, Chapter 3B updates the status of mercury and sulfur science in South Florida, highlighting recent collaborative research findings and results.

Fish Mercury Levels Dip in Northern Region of Everglades National Park

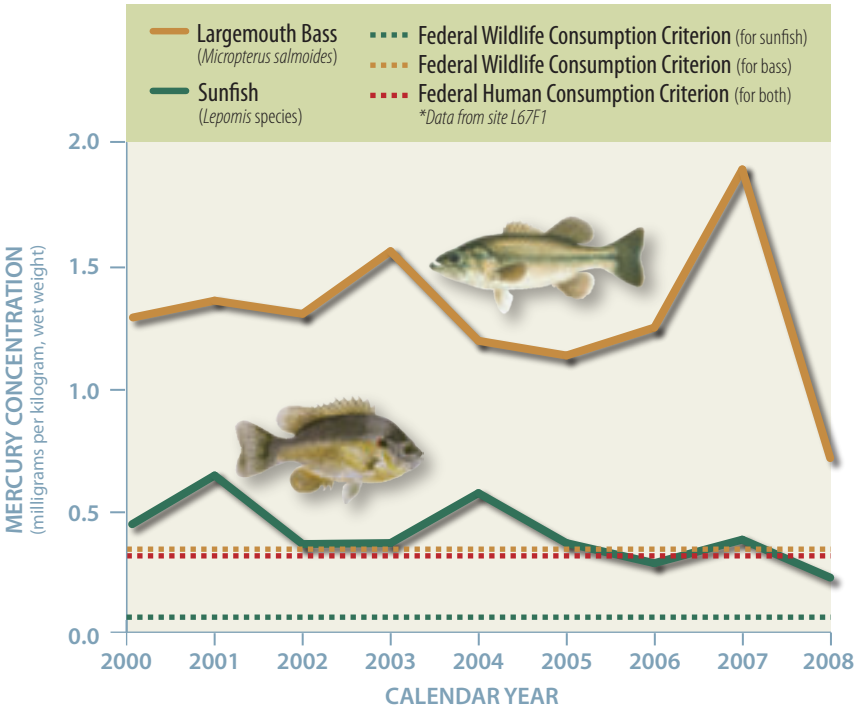
Fish mercury concentrations in water bodies north of the Everglades Protection Area vary greatly but tend to be lower than those in the Everglades. In the Water Conservation Areas (WCAs), median mercury levels in Everglades largemouth bass declined by 62 percent between 1998 and 2008. However, these levels averaged 0.38 milligrams per kilogram in 2008, which is above the recommended U.S. Environmental Protection Agency's human health criterion of 0.3 milligrams per kilogram for fish consumption. Since 1998, 50 percent of the bass collected from the WCAs have exceeded the federal human health fish tissue mercury criterion.

In contrast to the WCAs, mercury levels in sunfish and largemouth bass from Everglades National Park have generally increased over the past decade, although decreases at a methylmercury "hot spot" in northern Shark River Slough were seen in 2008. Mercury concentrations in bass were over 60 percent lower than in 2007, and in sunfish the levels dropped below the federal human health criterion but remained above the respective wildlife criterion (see graph).

Focused Scientific Research Is Key to Future Management

The mercury issue in South Florida wetlands is closely linked to sulfur-induced methylmercury production. It may not be possible to greatly reduce atmospheric mercury deposition to the Everglades in the near-term as most originates from global sources. To effectively manage issues linked to elevated mercury and sulfur concentrations, dedicated research is needed to determine the causes of Everglades fish mercury hot spots and the sources, fate, and transport of sulfur. Monitoring and research data must also be analyzed to focus priorities and to identify appropriate management options for the region.

Mercury in Fish from Everglades National Park*



Phosphorus Source Controls for the South Florida Environment

One of the chief strategies for improving water quality in South Florida is to require practices that minimize the pollutants generated at the source — known as Best Management Practices (BMPs) — in the Everglades watersheds, including both agricultural and non-agricultural land uses. To date, efforts have been focused mainly on controlling total phosphorus (TP) levels in runoff. The South Florida Water Management District requires the application of source controls using a combination of regulatory, cooperative, and educational initiatives that work together with other local and regional projects. These initiatives are dependent upon several factors, particularly watershed-based water quality goals and statutory requirements for individual elements of source control programs.

In the 2010 SFER – Volume I, Chapter 4 updates the progress made on implementing source control programs during Water Year 2009 (WY2009). These programs address the Lake Okeechobee and Caloosahatchee and St. Lucie River watersheds in the Northern Everglades, and the Everglades and non-Everglades Construction Project (ECP and non-ECP) basins in the Southern Everglades. To also comply with the requirements of the Everglades Forever Act and the Long-Term Plan for Achieving Water Quality Goals in the Everglades Protection Area (EPA), this update covers source controls in the ECP and non-ECP basins, and includes basin-specific reporting of permit compliance status, TP levels and monitoring data, and source control strategies. Along with the opposite map, WY2009 highlights are shown in the summary table.

In the Northern Everglades and Estuaries Protection Program, the expanded Lake Okeechobee watershed is required to have source control programs to reduce TP levels in discharges entering Lake Okeechobee, and the Caloosahatchee and St. Lucie River watersheds are mandated to have nutrient control programs to reduce both phosphorus and nitrogen levels entering the estuaries. In WY2009, the rule development process for the lake's watershed continued with public meetings to seek input from stakeholders, water control districts, improvement districts, and counties that have water management authority in non-agricultural areas. Conceptual project plans that provide supporting information for establishing a regulatory, nutrient source control program for the St. Lucie and Caloosahatchee River watersheds were also completed. While rule development is under way, the discharges from each of the lake's nine sub-watersheds were evaluated to assess the combined performance of existing source control programs. Future SFERs are expected to describe source control efforts for the entire Northern Everglades watershed area.

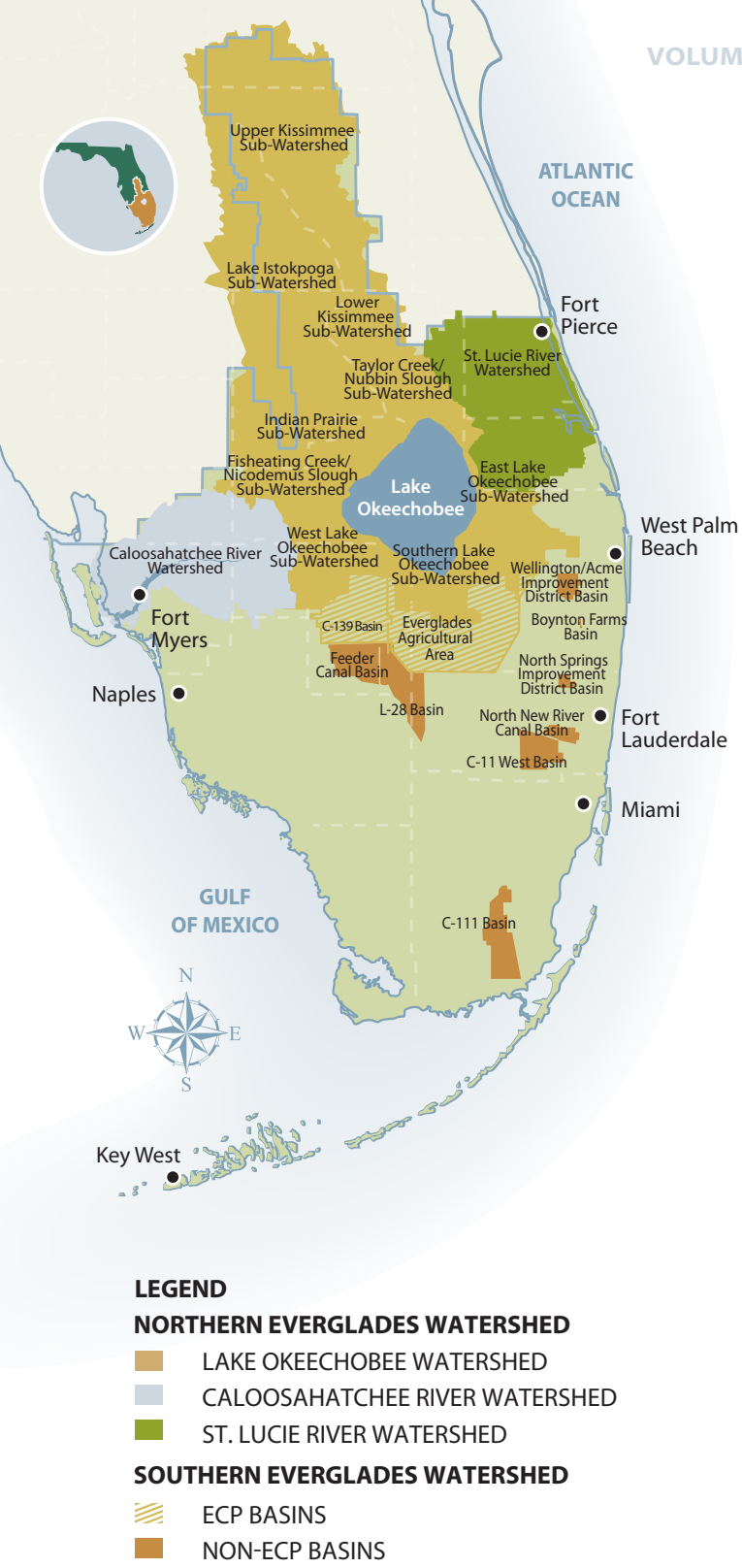
Everglades Agricultural Area Basin Achieves Fourteenth Straight Year of Compliance

As one of the agency's strategic priorities, the Southern Everglades phosphorus source control program is essential to achieving water quality standards in the EPA. Within this program, two ECP basins discharge to the EPA, the Everglades Agricultural Area (EAA) and C-139 basins. In WY2009, the EAA basin showed a slight reduction in TP flow-weighted mean concentration and an overall 54 percent long-term reduction in TP loading, but the C-139 basin exceeded its mandated TP loading level and did not achieve compliance. Vigorous rule development efforts, on-site inspections, and interagency outreach aimed at bringing the C-139 basin into compliance continued in WY2009.

More Efforts Target Phosphorus Reduction in Other Everglades Tributary Basins

In the Southern Everglades, eight other basins flow into the EPA (known as the non-ECP basins): C-11 West, North New River Canal (NNRC), North Springs Improvement District (NSID), Feeder Canal, L-28, C-111, Acme Improvement District, and Boynton Farms. The primary strategy for the non-EPC basins is to enhance the BMP programs initiated a decade ago and to rely on future Everglades restoration projects for holding or diverting flows that would otherwise be released into the EPA.

Compared to the ECP basins, the non-ECP basins contribute a relativley small portion, about 12 percent, of the total loading into the EPA. During WY2009, successful implementation of TP source controls and Water Quality Improvement Plans in the C-11 West, C-111, NNRC, and NSID basins continued. While there was no flow from the NNRC, NSID, or Boynton Farms basins, TP flow-weighted mean concentrations varied widely among the other tributary basins, ranging from 7 to 137 parts per billion (ppb). A total of 26.9 metric tons (mt) of TP load was discharged from these basins to the EPA, with 80 percent contributed by the Feeder Canal and L-28 basins where agricultural land use is predominant.



LEGEND

NORTHERN EVERGLADES WATERSHED

- LAKE OKEECHOBEE WATERSHED
- CALOOSAHATCHEE RIVER WATERSHED
- ST. LUCIE RIVER WATERSHED

SOUTHERN EVERGLADES WATERSHED

- ECP BASINS
- NON-ECP BASINS

Everglades Source Control Program Overview

During Water Year 2009*

NORTHERN EVERGLADES

Lake Okeechobee Watershed	• Continued with regulatory BMP rule development workshops seeking input from stakeholders and coordinated efforts with other state agencies • Developed draft BMP performance measures for nine sub-watersheds • Observed runoff TP load of 207 mt
Caloosahatchee and St. Lucie River Watersheds	• Developed objectives and goals for a regulatory BMP program for each river watershed and outlined those in the River Watershed Protection Plans • Created conceptual project plans detailing the phases, funding, and activities to initiate efforts in 2010 to develop the regulatory BMP program in each river watershed

SOUTHERN EVERGLADES

ECP Basins	**EAA Basin** • Observed runoff TP load of 129 mt • 68% (278 mt) reduction in TP load due to BMP implementation • Continued with prioritized on-site BMP inspections based on farm location, water quality history, and previous inspection date • Progressed with research on improving BMP effectiveness • Continued area-specific water quality data collection to refine source control approach for farms with higher-than-expected phosphorus concentrations • Assisted the Florida Department of Environmental Protection in adopting performance measures for ECP diversion areas discharging to Lake Okeechobee **C-139 Basin** • Observed runoff TP load of 52.3 mt exceeded the performance target • Progressed with the rule development process to revise the BMP compliance rule • Continued post-permit compliance activities through on-site BMP inspections and outreach efforts to ensure uniform implementation • Engaged the University of Florida to conduct demonstration projects in aboveground impoundments to optimize water quality treatment • Executed cooperative agreement with the Hendry Soil and Water Conservation District for implementing phosphorus reduction demonstration projects • Continued integrated regulatory compliance for environmental resource and water use permits to meet water quality goals
Non-ECP Basins	• Total runoff TP load of 26.9 mt • Tracked progress toward achieving water quality standards • Applied TP source controls and water quality improvement plans in the C-11 West, C-111, NNRC, and NSID basins • Maintained Acme basin runoff diversions to STA-1E at 100% • Continued ongoing efforts to initiate C-139 Annex runoff diversion to STA-6 • Continued integrated regulatory compliance in the Feeder Canal basin for environmental resource and water use permits to meet water quality goals

* See text on page 12 for definition of all acronyms in table.

Performance and Optimization of the Everglades Stormwater Treatment Areas

Mandated by the Everglades Forever Act, large freshwater wetlands — known as Stormwater Treatment Areas (STAs) — have been constructed south of Lake Okeechobee in the Everglades Agricultural Area vicinity. As surface water moves through vegetated treatment cells, the STAs retain phosphorus through physical, biological, and chemical processes, thereby reducing total phosphorus (TP) levels in surface waters entering the Everglades Protection Area (EPA). Managed by the South Florida Water Management District, six STAs (STA-1E, STA-1W, STA-2, STA-3/4, STA-5, and STA-6) currently provide approximately 45,000 acres of effective treatment area.

In the 2010 SFER – Volume I, Chapter 5 presents the Water Year 2009 (WY2009) status, performance, operation, and condition of the STAs. The chapter also presents challenges for the STAs, including drought effects, high hydraulic and nutrient loadings, and implementation of the Avian Protection Plan, as well as continuing efforts to optimize performance through research and rehabilitation efforts. It also addresses components identified in the Long-Term Plan for Achieving Water Quality Goals in the EPA (see Volume I, Chapter 8). Along with the opposite map, WY2009 highlights for each STA are presented in the summary table.

Treatment Wetlands Perform Well Despite Lingering Drought

The STAs have continued to significantly reduce TP levels in stormwater discharges to the Everglades. Notably, since 1994 the STAs have retained more than 1,200 metric tons (mt) of TP that would have otherwise entered the EPA. In WY2009, all the STAs combined treated more than 1.1 million acre-feet of water, which is about 1.5 times greater than WY2008. The STAs collectively retained 82 percent (or 180 mt) of the incoming TP load, markedly reducing average flow-weighted mean concentrations from 152 to 25 parts per billion (ppb).

While treatment performance was strong in WY2009, the STAs continued to be affected by the regional drought. As in the previous two water years, the District implemented a drought contingency plan to minimize impacts to the STAs. The plan includes increasing water target stages in critical cells of each STA. By setting higher target stages and delivering supplemental water, many treatment cells maintained a

minimum water level throughout the dry season. Yet even with such proactive efforts, there were some cells that experienced dryout resulting in vegetation stress and reduced treatment performance. Site visits conducted throughout the dry season revealed very little sustained impact to the vegetation in the STAs.

Applied Research Focuses on Optimizing Stormwater Treatment Areas

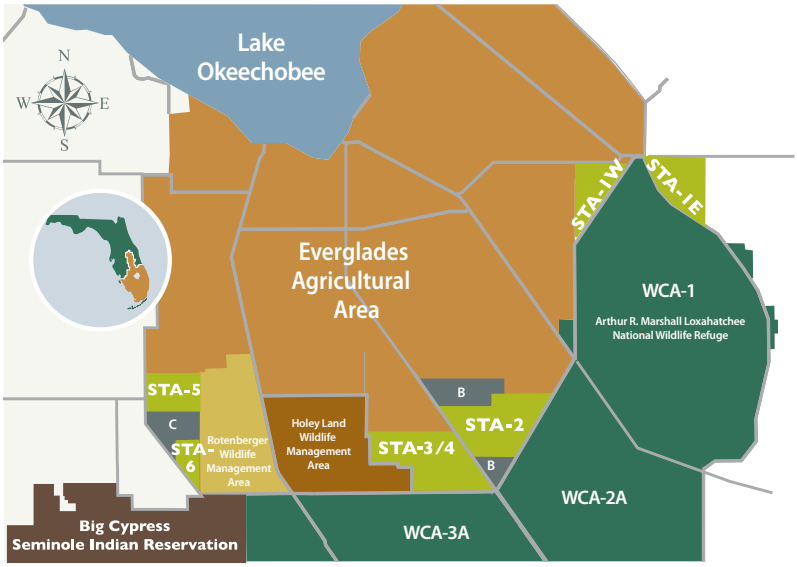
As a component of the Everglades Long-Term Plan, the District continues to conduct various research projects that are aimed at improving and optimizing STA performance. Related studies focus on addressing vegetation issues (such as the response of cattail, *Typha* species, to extreme water conditions), understanding TP removal patterns, evaluating major rehabilitation efforts, and conducting large-scale vegetation conversions in the STAs. Results from these various research efforts are being used in concert with other metrics, such as vegetation coverage, water stage, and hydraulic and phosphorus loadings, to provide operational guidance for optimal STA performance.

Avian Protection Plan Helps Manage Operational Challenges

During the spring, large numbers of migratory birds typically nest within the STAs, which may result in operational modifications due to protections outlined in the federal Migratory Bird Treaty Act. To address this issue, an Avian Protection Plan for black-necked stilts (*Himantopus mexicanus*) and burrowing owls (*Athene cunicularia*) nesting in the STAs was developed by the District. Accepted by the U.S. Fish and Wildlife Service in September 2008, this plan outlines actions to minimize impacts to these migratory birds and their nests in the STAs, while recognizing that these areas are operated for water quality treatment and flood control purposes. In accordance with the plan, nest surveys were conducted in the STAs throughout the nesting season, from April to June 2009. Survey findings were used in regular operational meetings to minimize flows to locations where the greatest numbers of nests were present.

New Wheelchair-Accessible Boardwalk and Recreation Area Opened in 2009

Over the past year, recreational facilities at nearly all the STAs were open for public use. These facilities include boardwalks, informational kiosks, and designated areas for recreational activities such as hiking, biking, alligator and duck hunting, and bird watching. Sport fishing is allowed in waters outside the STA treatment footprint, and catch-and-release bass tournaments were held again this year. In late 2008, a customized boardwalk with a duck blind was constructed in STA-5 (see opposite photo) to provide hunting opportunities for the public, including access for disabled visitors. The boardwalk is accessible for routine bird-watching tours and duck hunting.



STA Overview

During Water Year 2009*

STA-1E	• Reduced inflow TP concentration from 182 to 21 ppb at outflow • Decreased TP load by 88%; retained 29 mt TP • Periphyton-Based STA (PSTA) Demonstration Project operational; STA Cells 1 and 2 operated under restricted flow • Structures S-375, S-365A, S-365B under repair; temporary pumps and gated culverts (G-707) installed to partially replace conveyance through the failed S-375 structure • Public recreational facilities and opportunities available
STA-1W	• Reduced inflow TP concentration from 246 to 36 ppb at outflow • Decreased TP load by 84%; retained 42 mt TP • Improvements in vegetation establishment and water quality continued following 2007 rehabilitation efforts • Public recreational facilities and opportunities available
STA-2	• Reduced inflow TP concentration from 122 to 18 ppb at outflow • Decreased TP load by 83%; retained 31 mt TP • Large-scale vegetation conversion (from emergent to submerged aquatic vegetation) initiated in the southern portion of Cell 2 • Public recreational facilities and opportunities available
STA-3/4	• Reduced inflow TP concentration from 96 to 13 ppb at outflow • Decreased TP load by 86%; retained 45 mt TP • Full-scale PSTA Implementation Project continued operational phase • Phased vegetation conversion (from emergent to submerged aquatic vegetation) continued in Cell 1B • Public recreational facilities and opportunities available
STA-5	• Reduced inflow TP concentration from 254 to 56 ppb at outflow • Decreased TP load by 77%; retained 24 mt TP • Rehabilitation in Cell 1A to improve flow distribution, vegetation establishment, and treatment performance • Recreational facilities, including new boardwalk with access for the disabled, available for public use
STA-6	• Reduced inflow TP concentration from 198 to 94 ppb at outflow • Decreased TP load by 64%; retained 9 mt TP • Structure elevations resurveyed to improve stage and flow estimates

* See text on pages 14 and 15 for definition of all acronyms in table.

Ecology of the Everglades Protection Area

The South Florida Water Management District and other collaborating agencies sponsor dozens of research projects that focus on several principal study areas, including regional hydrology, water quality, and ecosystem structure and function, to support developing performance measures and identifying sound alternatives for Everglades preservation and restoration. In the 2010 SFER – Volume I, Chapter 6 presents information on agency progress of major research studies associated with Everglades plant, landscape, wildlife, and ecosystem ecology in Water Year 2009 (WY2009). Key highlights in each of these subject areas follow.

Plants

Everglades plant studies center on the biological processes that cause vegetation replacement and degradation in relation to nutrient enrichment, hydrology, water quality, and other environmental changes. These studies cover a broad spectrum of issues, from detecting chemicals created by plant-dependent microorganisms to how forested wetlands (that provide habitat for native animals) react to the severe wet-dry cycle of regional weather patterns and associated water management activities.

Understanding plant stress responses to changes in hydrology is an important factor in achieving restoration goals as water managers juggle the demands of ecosystem and human-use needs. In WY2009, District research into how trees on Everglades tree islands respond to flood and drought conditions were conducted, along with an evaluation of whether cyanotoxins (toxins produced by certain blue-green algae) were present in periphyton. In the tree island study, physiological changes, such as leaf moisture respiration and the ability of leaves to create chlorophyll, were established as metrics for evaluating the response of trees to hydrological changes. Study results show that island trees dynamically respond to even small seasonal changes in water flow.

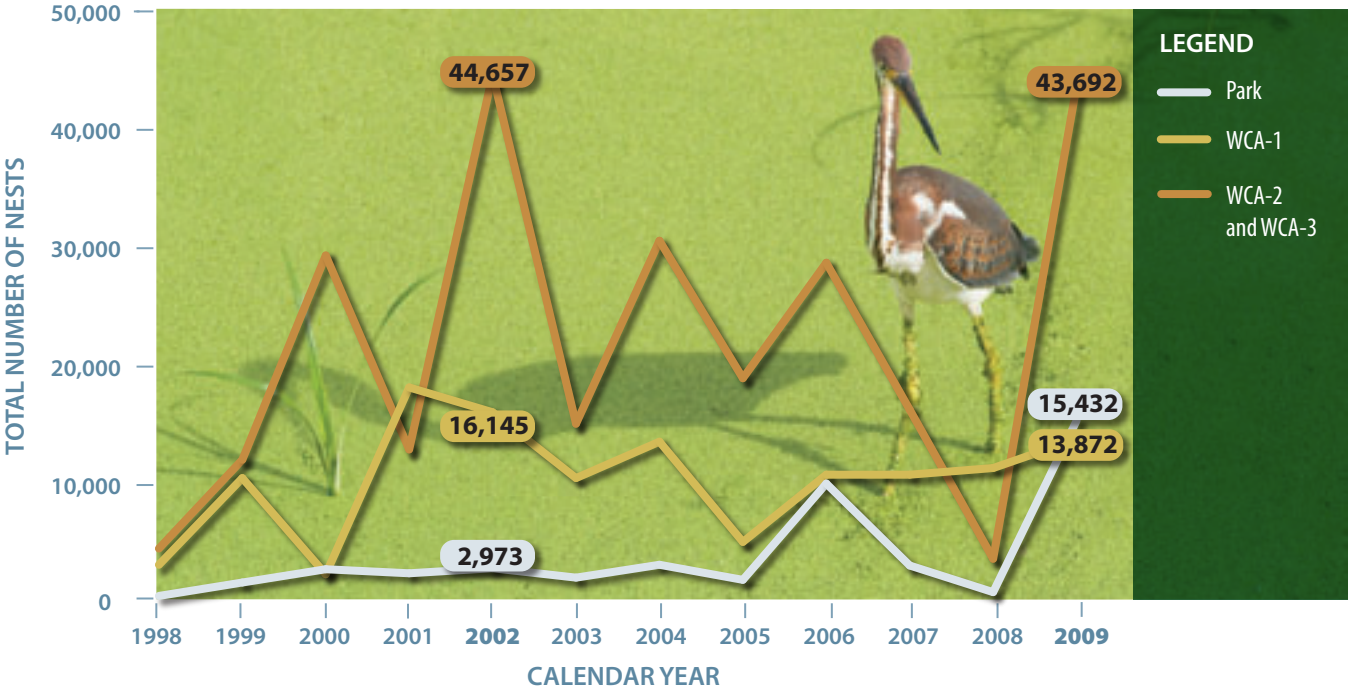
At the chemical level, cyanobacteria are a prominent component of periphyton inhabiting Everglades sloughs and are capable of producing cyanotoxins. In a WY2009 study, periphyton collected from eight locations across the Everglades Protection Area was found to contain several cyanotoxins. While the implications of these cyanotoxins in the Everglades are unknown, in other systems they can affect larval fish survival and adult fish physiology. Further study is planned to examine how concentrations and potential control of these toxins may play a role in regulating the food web.

Landscape

Over a century ago, the historic Everglades was a broad, shallow, flowing freshwater marsh system that covered most of South Florida. Development of the system has not only caused changes in wildlife and water quality, but has also drastically altered Everglades topography, soils, water flow, and overall vegetation composition. Several projects designed to describe these big-picture changes are under way to enhance day-to-day water management and to predict landscape responses to restoration efforts.

For example, a recent study compared soil surfaces of recent and historical periods using field data and models to determine the amount of peat and carbon loss in the Everglades marsh. While peat was abundant historically, this study demonstrated substantial peat loss in the current marsh, which affects hydrology and plant nutrition in the system. Additionally, peat loss might have released carbon dioxide into the atmosphere; conversely, restored peat may act as a carbon-sink under restored conditions.

Wading Bird Nests in the Everglades Protection Area



Wildlife

Everglades wildlife studies largely focus on the interactions between wading birds, aquatic prey, and regional hydrology to help restore historical wildlife populations and prevent further environmental degradation. Spatial and temporal variations in Everglades macroinvertebrates are difficult to understand — yet they may play a crucial role in the availability of prey for birds and other wildlife. During WY2009, wildlife research focused on understanding crayfish population dynamics, with completion of a baseline survey of their behavior in the slough communities of the Loxahatchee Impoundment Landscape Assessment facility, and studying variation in macroinvertebrate communities in the Water Conservation Areas.

Annual monitoring of annual wading bird nesting patterns also continued this past year. In 2009, the estimated number of wading bird nests in South Florida was nearly 80,000 (see graph). As the largest nesting effort recorded in the region since the 1940s, this year's significant increase is more than four times greater than the last breeding season and surpasses the previous record year, 2002, by approximately 11,000 nests. This high reproductive effort is attributed to a combination of drought and flooded conditions in preceding years and highly favorable hydrologic conditions during this year's nesting.

Ecosystem

Ecosystem research of the Greater Everglades continues to address areas severely affected by excessive nutrients, primarily through two ongoing research projects — the Cattail Habitat Improvement Project (CHIP) and the Accelerated Recovery of Impacted Areas (Fire) Project. CHIP, a large-scale study that began in 2006, focuses on rehabilitating cattail (*Typha domingensis*) habitat in Water Conservation Area 2A (see opposite photo) with application to other areas of the Greater Everglades. The Fire Project, a research component of the Everglades Long-Term Plan, evaluates prescribed burns as a management tool to speed the recovery of phosphorus-impacted areas of Water Conservation Area 2A.

During WY2009, CHIP analyzed the structure and function of artificially opened areas compared to those of the natural Everglades. Two years after creating openings within densely vegetated areas, field sampling shows that beneficial ecological changes to the structure and function of these areas have been sustained. Additionally, open plots supported higher wading bird foraging than the surrounding cattail habitat.

A study conducted under the Fire Project in WY2009 examined the physical and biological factors affecting cattail mass and nutrient loss after controlled burning. Results demonstrate that almost 40 percent of aboveground mass and nutrients were removed by fire. Mass, carbon, and nitrogen loss were more than twice as high during the initial fire than the second, and phosphorus loss was 3.5 times higher at the highly enriched plot than the moderately enriched plot but was not significantly different between fires.

Everglades Restoration Update

The South Florida Water Management District and the U.S. Army Corps of Engineers (USACE) are partners in the largest ecosystem restoration program in the nation, the Comprehensive Everglades Restoration Plan (CERP). The District also collaborates with other governmental agencies on complementary water quality and ecosystem restoration projects, including Kissimmee River Restoration, Lake Okeechobee Protection Plan, Northern Everglades and Estuaries Protection Program, and Everglades Forever Act and Long-Term Plan projects. With more project details in other Volume I chapters, related efforts are designed to work together to benefit the Greater Everglades by increasing the total spatial extent of natural areas, enhancing habitat and functional quality, and improving native species abundance and diversity. Most projects meet multiple objectives, such as increasing water storage, reducing seepage, and improving water quality.

Withstanding the major economic downturn over the past year, marked progress on Everglades restoration is continuing. In the 2010 SFER – Volume I, Chapter 7A provides an update on this progress during Fiscal Year 2009 (FY2009) for programs, partnerships, and projects to restore the Everglades as well as the entire South Florida ecosystem. The chapter also reports on the FY2009 status of CERP implementation and financial information, fulfilling the statutorily mandated CERP Annual Report and related permits. Looking ahead, some emerging restoration challenges and opportunities are also covered.

Restoration Milestones Were Reached in Fiscal Year 2009

Since the launch of CERP and other subsequent Everglades restoration initiatives, project planning has taken place, project sites have been identified and acquired, and design and construction activities are moving ahead. Along with these integrated actions, the District and the USACE are working together to implement the planning, design, and construction of Everglades restoration projects. Laying the groundwork for planned construction in FY2010, some key Everglades restoration achievements during FY2009 are highlighted below.

- Over the past year, the federal government committed an increase in FY2009 and FY2010 funding to the USACE and provided an additional $60 million under the 2009 American Recovery and Reinvestment Act. This funding will provide needed support for construction of the Picayune Strand Restoration Project – Merritt Pump Station, C-111 Spreader Canal features, Indian River Lagoon – South Project, L-31 Seepage Management Pilot Project, continued monitoring and adaptive management activities, melaleuca (*Melaleuca quinquenervia*) eradication in the Everglades, and other essential restoration projects.
- The District completed design and permitting requirements for two expedited projects, the C-111 Spreader Canal Western Project and the Biscayne Bay Coastal Wetlands – Phase I Project features. Under CERP, the design and plans for the Merritt Pump Station at Picayune Strand were finalized and construction responsibilities were transferred to the USACE. As part of the CERP North Palm Beach County – Part 1 Project, the conceptual pump station and inflow structure design for the L-8 reservoir additional capacity was also completed.
- Under Phase II of the Lake Okeechobee Watershed Construction Project, steps forward continued on Lake Okeechobee watershed restoration and preservation. The District initiated the Fisheating Creek Feasibility Study, which identifies alternatives that meet storage and water quality goals of this most significant source of total phosphorus loading to Lake Okeechobee. To address basin runoff treatment before entering the lake, the Lakeside Ranch Stormwater Treatment Area design was also completed.
- Advances on the Long-Term Plan activities continued, with construction under way on the Compartments B and C build-outs, which are expansions of the existing Everglades Construction Project Stormwater Treatment Areas. The completed build-outs will add nearly 12,000 acres to the STAs. Also designed to improve Everglades water quality, the Acme Basin B Discharge Project construction started on the Section 24 detention area.

Reviving the *River of Grass*

Key Benefits from the Pending Acquisition Include:

- Increasing water storage to reduce harmful discharges from Lake Okeechobee to Florida's coastal rivers and estuaries
- Improving the delivery of cleaner water to the Everglades
- Preventing tons of phosphorus from entering the Everglades
- Reducing the need for back-pumping water into Lake Okeechobee
- Managing Lake Okeechobee within a more desirable ecological range

- As key elements of the Northern Everglades and Estuaries Protection Program, the Caloosahatchee and St. Lucie River Watershed Protection Plans were timely completed and submitted to the Florida legislature. The plans identify required storage and water quality features, areas for restoring wetlands, urban and agricultural Best Management Practices, and options for removing muck from water bodies to achieve water clarity and quality goals.

Signed Agreements Bring Momentum for Federal/State Partnership

As an important step forward in Everglades restoration, the CERP Master Agreement was approved by the District's Governing Board in August 2009. This signed agreement serves as the umbrella accord between the District and USACE to govern all CERP projects. It is also an essential step for the USACE to begin work using $115 million received this year in congressional appropriations for CERP project construction. While the Master Agreement provides the framework for restoration work, project-specific agreements (Project Partnership Agreements) are also planned. These are required for the federal government to initiate construction on specific projects and to provide credit to the District for its land acquisition and project construction efforts completed to date.

In August 2009, the District's Governing Board approved the Picayune Strand Project Partnership Agreement, defining the terms, conditions, and responsibilities specific to this CERP restoration project. Significantly, the agreement allows the USACE to begin investing $65 million in federal funding and appropriations to continue construction on the 55,000-acre project site within the Picayune Strand State Preserve. It also allows the District to request credit for expenditures toward fulfilling its 50 percent cost-share obligation under the Picayune Strand Project Partnership Agreement with the USACE.

Historic Plan to Revive the *River of Grass* Presses Forward

In June 2008, the South Florida Water Management District entered into negotiations with the United States Sugar Corporation to acquire land for the purpose of Everglades restoration. Following extensive negotiations, due diligence, and public deliberation, in May 2009 the District's Governing Board approved a contract to initially acquire 73,000 acres of land, with an option over the next 10 years to purchase an additional 107,000 acres, subject to financing. The pending acquisition offers water managers the potential to store, clean, and manage water on a massive scale.

With full public involvement, the *River of Grass* restoration project planning was launched in FY2009. Under the Phase I planning process, a series of public, technical workshops began in January 2009 and continued throughout most of the year. This initial process began identifying common elements and features for constructing a managed system of water storage and treatment to support ecosystem restoration of the Greater Everglades system. This was achieved through stakeholder input on conceptual storage and treatment options, with development of preliminary modeling information and implementation costs. Building on the Phase I findings, the next phase of the public planning process (Phase II) was launched in fall 2009. This second phase will focus on continued forecasting for the land acquisition. It is anticipated that further updates on the pending acquisition and progress made during planning efforts will be presented in future SFERs. More information on the *River of Grass* initiative is available at www.sfwmd.gov/riverofgrass.

RECOVER Activities Update

RECOVER (Restoration Coordination and Verification) organizes and applies scientific and technical information to support CERP's goals. Composed of interagency teams sponsored by the U.S. Army Corps of Engineers and the South Florida Water Management District, RECOVER's primary objectives are to (1) evaluate CERP's performance, (2) improve the plan during its implementation, and (3) ensure that activities maintain a regional perspective throughout the restoration program. In the 2010 SFER – Volume I, Chapter 7B provides an update on RECOVER's progress during Fiscal Year 2009. Some key activities include updating the CERP Monitoring and Assessment Plan, developing needed data management tools, and producing the second System Status Report, which integrates scientific data and will serve as a baseline to measure ecological impacts as Everglades restoration projects unfold.

New Adaptive Management Process Guides Future Restoration

CERP is progressing and being refined using adaptive management principles, and RECOVER's mandates and activities are united by this adaptive process. RECOVER's Adaptive Management Strategy contains the principles and guidelines for how adaptive management will operate during CERP's implementation. Coordinated efforts are weaving the concepts of the strategy's framework into a practical series of steps to guide the program and use adaptive management on systemwide and project levels.

In support of these efforts, in 2009 RECOVER drafted an Adaptive Management Guidance Document. The document breaks down the CERP Adaptive Management Process (see diagram) into distinct activities that correspond to phases of the U.S. Army Corps of Engineers' project planning process. It also establishes clear roles and responsibilities for practicing project- and program-level adaptive management, and ensures that stakeholders have ample opportunities to provide input into the process. As a result, scientific information will be applied and feedback will be explicitly used to refine and improve future management decisions on comprehensive Everglades restoration efforts.

CERP Adaptive Management Process

Implementation of the Long-Term Plan for Achieving Water Quality Goals in the Everglades Protection Area

The long-term Everglades water quality goal is for all surface water discharges to the Everglades Protection Area (EPA) to achieve and maintain water quality standards, in accordance with the Everglades Forever Act. To attain this goal, the South Florida Water Management District is strategically implementing projects outlined in the 2003 Long-Term Plan for Achieving Water Quality Goals in the EPA (known as the Long-Term Plan) and its subsequent amendments.

In the 2010 SFER – Volume I, Chapter 8 updates the agency's progress on fulfilling the Long-Term Plan requirements. The diverse activities in this plan are covered in several Volume I chapters, including Chapter 3A (Everglades water quality), Chapter 4 (phosphorus source controls for Everglades tributary basins), Chapter 5 (performance and enhancements of the Stormwater Treatment Areas), Chapter 6 (research on impacted Everglades ecosystems), Chapter 7A (STA expansions under Everglades restoration), and Chapter 13 (financial reporting on Long-Term Plan activities).

Total Phosphorus Reductions Continue to Exceed Water Quality Expectations

The Everglades Long-Term Plan is the road map for achieving water quality standards, including the total phosphorus (TP) criterion. Substantial progress toward reducing TP levels discharged into the EPA has been made by the state of Florida and other stakeholders. Since their inception and through the end of April 2009, the Everglades Agricultural Area's Best Management Practices and the Stormwater Treatment Areas have collectively removed more than 3,200 metric tons of TP that otherwise would have entered the Everglades. Of this amount, approximately 400 metric tons of TP were removed in Water Year 2009. To augment this progress, further measures are necessary to meet water quality goals and, therefore, continuing phosphorus source controls are being carried out strategically in urban and other tributary basins in the Everglades.

Further Enhancements to the Long-Term Plan Optimize Process

Consistent with the Everglades Forever Act requirements, the Long-Term Plan is revised in an adaptive manner to ensure that new information is incorporated as expeditiously as possible. To date, nine revisions to the plan have been approved by the Florida Department of Environmental Protection. All these revisions are highlighted in Volume I, Chapter 8, of the 2005–2009 SFERs. All revisions have been done through collective input from the state, stakeholders, and the public, and will aid in the state's comprehensive efforts to meet the Everglades water quality goals. During Fiscal Year 2009, no requests for Long-Term Plan revisions were submitted for approval.

Status of Nonindigenous Species in the South Florida Environment

Restoration Success Hinges on Invasive Management and Control

Nonindigenous plants and animals often aggressively invade natural habitats and drastically alter the ecology of natural systems. Nonnative species have not only become one of the most serious global environmental concerns, but are also a grave issue throughout Florida. In Fiscal Year 2009 (FY2009), the South Florida Water Management District spent roughly $25 million on the prevention, control, and management of priority invasive plants. Yet escalating costs are only part of the problem, as South Florida has roughly 200 introduced animal species — more than any other U.S. region — and ranks high in this regard globally. This presents a huge challenge for the District and other governmental agencies tasked with managing and restoring South Florida's ecosystems.

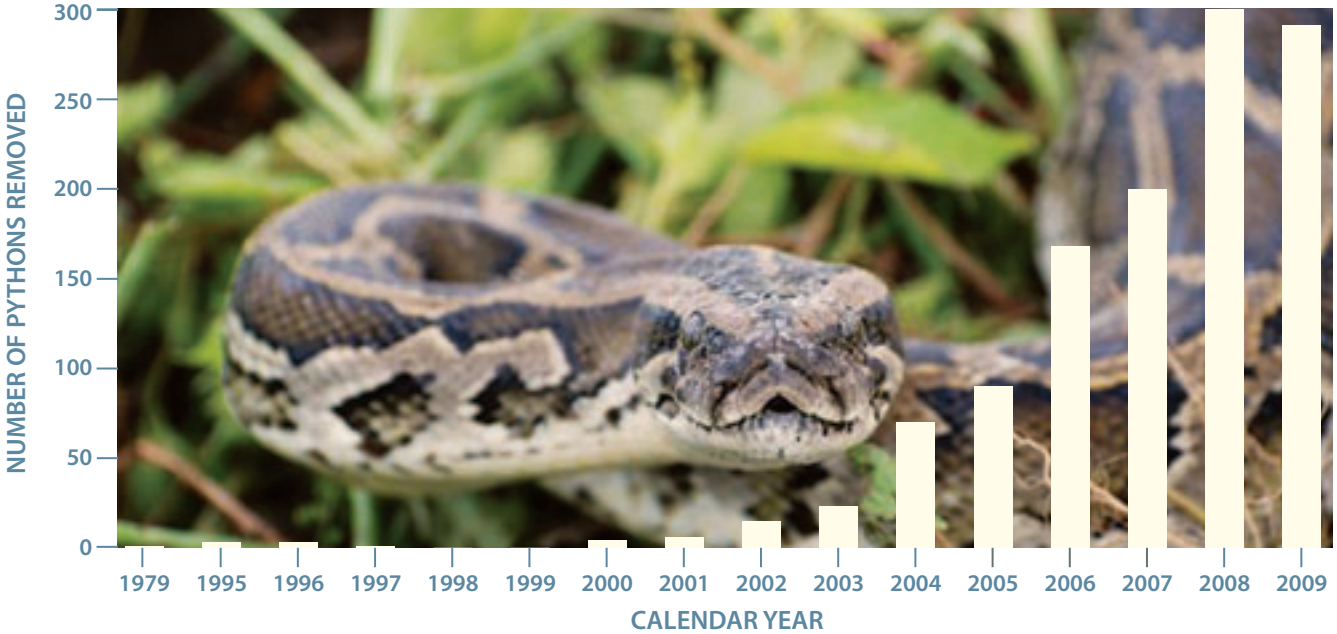
In the 2010 SFER – Volume I, Chapter 9 reviews broad issues of key "District-centric" nonindigenous plants and animals plaguing South Florida and related restoration, management, planning, organization, and funding. The chapter also highlights recent progress and successes that have been made to date, and identifies where future programmatic efforts are critically needed to bridge data gaps and improve interagency coordination to help manage the complex, ever-growing problem of invasives. Key issues and findings during FY2009 follow.

Fiscal Year 2009 Highlights of South Florida's Invasive Species

Nonindigenous Plants

- A total of 66 species of nonindigenous plants are District priorities for control. Old World climbing fern (*Lygodium microphyllum*, see photo), melaleuca (*Melaleuca quinquenervia*), and Brazilian pepper (*Schinus terebinthifolius*) are generally a priority in the entire region, while aquatic plants such hydrilla (*Hydrilla verticillata*) and water hyacinth (*Eichhornia crassipes*) are high priorities in the Kissimmee Basin and Lake Okeechobee.
- Widespread efforts to control invasive plants are continuing. The District has the country's largest aquatic plant management program, managing floating and submerged aquatic vegetation regionwide. During FY2009, the District treated nearly 65,000 acres of priority exotic plants across South Florida ecosystems. As part of widespread efforts, the agency's melaleuca management program is truly integrated and has become a national model for successful interagency coordination in dealing with a weed species. Melaleuca has been systematically cleared from Water Conservation Areas 2 and 3, and Lake Okeechobee and is now under maintenance control in these regions.
- Biological control of several invasive plants is showing promising results, with two additional melaleuca-feeding insects approved for release in 2009. Such insects have been introduced across Florida to limit seed production and spread, including a *Lygodium*-feeding moth that has shown the ability to establish itself and significantly damage the invasive fern. More insects are also being studied in the laboratory and field abroad for aspects related to their biology and host-specificity that may be useful for local applications.
- More information is needed about downy rose myrtle (*Rhodomyrtus tomentosa*), a fast-growing shrub that is spreading more prolifically in South Florida's native pinelands than other invasive plants. Shoebutton ardisia (*Ardisia elliptica*), another highly invasive shrub, is of increasing concern in the Greater Everglades, where collaborating agencies are working to address major infestations.
- Difficult-to-control cogongrass (*Imperata cylindrical*) is now infesting one million acres in Florida and aggressively displacing understory plants in native pine and marsh

Burmese Pythons Removed from Everglades National Park



habitats, particularly in the Kissimmee and Caloosahatchee watersheds. Dense strands of torpedograss (*Panicum repens*) and the newly discovered tropical watergrass, *Luziola subintegra*, are also readily spreading to and disrupting native wetlands, especially around Lake Okeechobee.

Nonindigenous Animals

- Considerable numbers of nonindigenous animals are known to occur throughout South Florida, ranging from approximately 55 species in the Kissimmee Basin to more than 150 species in the Greater Everglades. Ranking animals for control is a serious challenge, and prioritizing animal-related threats across regulatory agencies is needed.
- The Florida Fish and Wildlife Conservation Commission has an emerging exotic animal management program and coordinates with the District and other partners to manage nonnative animal species in South Florida, such as the purple swamphen (*Porphyrio porphyrio*) in the Greater Everglades and Lake Okeechobee.
- Burmese python (*Python molurus bivittatus*) populations continue to expand at an alarming rate in South Florida, with estimates ranging from 5,000 to over 100,000 in the Everglades. As of October 2009, the total number of snakes removed from Everglades National Park and surrounding areas over the past year was nearly 300, continuing the rising trend seen in recent years (see graph). The District continues to cooperate with federal and state agencies to halt the unprecedented spread of this Reptile of Concern in the Everglades and throughout Florida.
- Coined as one of the "100 World's Worst Invaders," the island applesnail (*Pomacea insularum)* is displacing the Florida apple snail (*P. paludosa*) — primary food of the federally endangered Everglade snail kite, *Rostrhamus sociabilis plumbeous*— with its overwhelming numbers and reported predation upon native snails. Lake Tohopekaliga harbors thousands of island apple snails, and South Florida's rice crops and the vast wetlands of the Everglades may become inhabited by this rapidly spreading pest snail if not controlled.
- Although it is illegal to release nonnative wildlife in Florida per Chapter 39-4.005, Florida Administrative Code, green iguanas (*Iguana iguana*) and other unwanted pets often are released into natural areas. To help with this growing concern, the District is providing information and testimony to lawmakers crafting legislation aimed at addressing the problems associated with ineffective regulation of the nation's growing pet industry.
- With established populations in the vicinity of Cape Coral and near Homestead Air Reserve Base, the African Nile monitor lizard (*Varanus niloticus*) is the target of land managers working to prevent this species from invading the Ding Darling Refuge on Sanibel Island — one of Florida's most important bird sanctuaries. While popular in the exotic pet trade, localized efforts are under way to encourage reports of any sightings in order to rapidly remove individuals.
- Since its introduction 20 years ago, the Mexican bromeliad weevil (*Metamasius callizona*) is now a high priority to control across South Florida. Weevil larvae destroy native bromeliads, many of which are listed as threatened or endangered species. Preventing new introductions and possible biological controls, such as the parasitic fly (*Metamasius callizona*), are vital to managing this pervasive pest.

Lake Okeechobee Protection Program – State of the Lake and Watershed

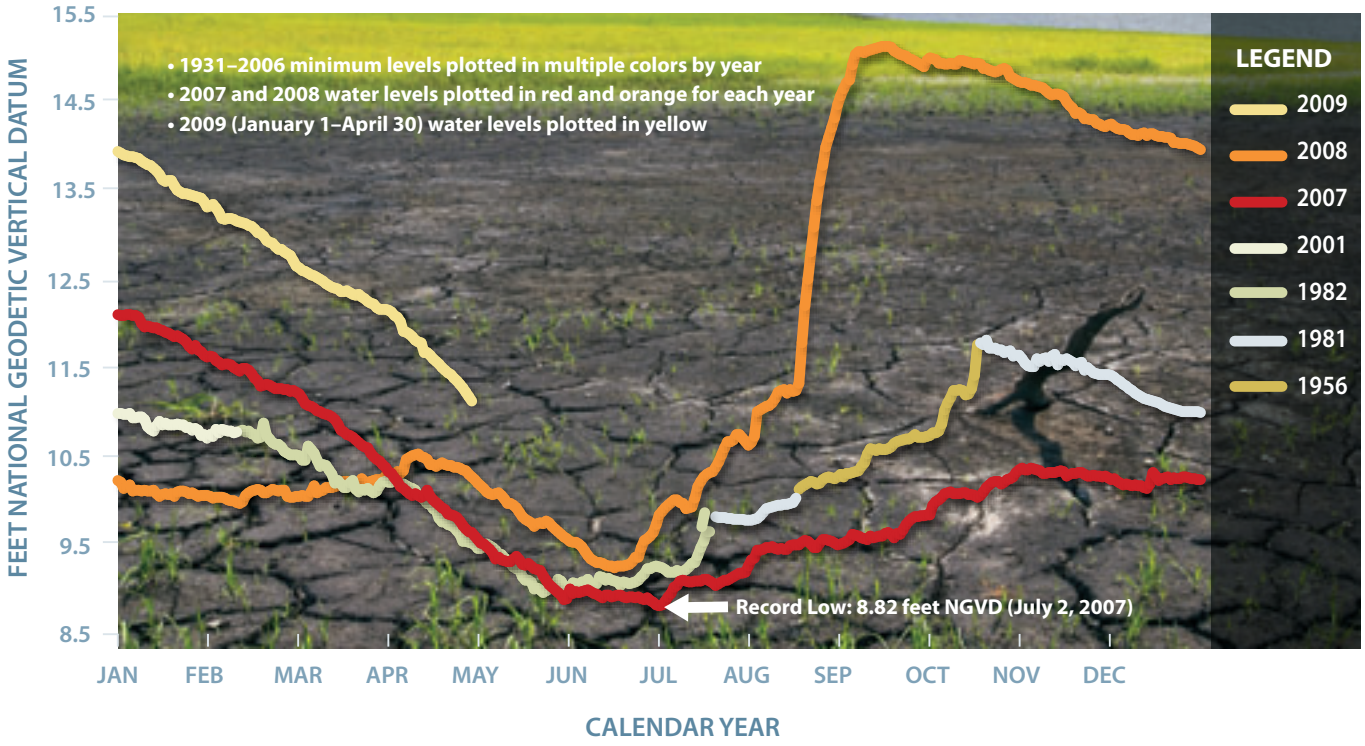
The largest freshwater body in the southeastern United States, Lake Okeechobee is a central component of South Florida's interconnected hydrological and ecological systems. As a highly valued resource that benefits the region's population and environment, the lake provides water supply and flood control for neighboring areas and recreational fishing, which brings millions of dollars to the local economy each year. Lake management is focused on three key issues facing the lake and its watershed — excessive phosphorus loading, unnatural fluctuations in water levels, and the rapid spread of exotic and nuisance species. The South Florida Water Management District and other state partners are addressing these interrelated issues to rehabilitate the lake and improve its ecological functions. The District and U.S. Army Corps of Engineers are implementing the Comprehensive Everglades Restoration Plan components in the watershed to address elevated total phosphorus (TP) levels and provide alternative water storage areas to properly regulate lake water levels, while maintaining its water supply and other water resource functions.

In the 2010 SFER – Volume I, Chapter 10 presents the Water Year 2009 (WY2009) status of Lake Okeechobee and its watershed. The major focus beyond nutrient management, water quality, and exotic plants has been the regional drought, punctuated by sudden, major rains brought by Tropical Storm Fay. Financial reporting on the program's implementation during Fiscal Year 2009 is also covered.

Lake Waters Rise with Tropical Storm Fay and Fall with Continued Drought

Of all the areas across South Florida, Lake Okeechobee has been most dramatically affected by the prolonged drought. Water flows to Lake Okeechobee in WY2009 were more than 2 million

2009 Lake Okeechobee Minimum Water Levels Compared with Previous Years (1931–2008)



acre-feet, twice that recorded in WY2008 and similar to the historical average. Lake stage declined during the water year to a low of 9.25 feet National Geodetic Vertical Datum on June 17, 2008 — then experienced a rise of 3.9 feet in just four weeks due to intense rainfall from Tropical Storm Fay in August 2008 (see opposite graph). This sudden increase kept Lake Okeechobee's stage above the water shortage management band for the remainder of WY2009, even though the District experienced one of the driest dry seasons on record, returning the region to drought conditions.

Apple Snail Project Continues, While Lake Flora Rebounds Further

The Florida apple snail (*Pomacea paludosa*) is the primary food of the endangered Everglade snail kite *(Rostrhamus sociabilis plumbeous)* and a key component of South Florida's wetland ecosystems. Apple snails are susceptible both to drought and to rapid rises in water levels. Consequently, this native snail has been severely impacted by the extreme low and high water conditions that have occurred repeatedly in Lake Okeechobee over the past decade. Agency efforts to restore Florida apple snail populations continued in WY2009 with laboratory-bred individuals being tagged (see photo) and placed back into natural areas. Final data and future directions from this pilot project are anticipated to be reported in future SFERs.

In addition to providing essential habitat, the types and distribution of plants within Lake Okeechobee are strong indicators of overall lake health. Notably, the lake's plant communities continue to recover from recent hurricanes and drought, as evidenced from routine biological monitoring during WY2009. This has been most prominently seen in the increased presence of submerged aquatic vegetation, a key component of ecosystem recovery. Lake-wide coverage of submerged aquatic vegetation in August 2008 was 35,834 acres, a substantial increase over the 28,180 acres found in late summer 2007 and almost 12 times more acreage than observed in post-hurricane 2006.

Broad Measures Are Under Way to Improve Lake and Estuary Health

Despite a long history of regulatory and voluntary incentive-based programs to control phosphorus inputs into Lake Okeechobee, no substantial reduction in loading has occurred since the 1990s. Therefore, the 2000 Lake Okeechobee Protection Act mandates that the lake's Total Maximum Daily Load of 140 metric tons per year — considered necessary to achieve the in-lake TP target of 40 parts per billion — be met by 2015. As part of the Northern Everglades and Estuaries Protection Program launched in 2007, the Lake Okeechobee Watershed Protection Program is being implemented using a comprehensive, interconnected watershed approach to protect the lake and the downstream Caloosahatchee and St. Lucie estuaries. This watershed-based program is intended to address the reduction of pollutant loadings, restoration of natural hydrology, and compliance with applicable state water quality standards. Routine water quality monitoring, particularly for total phosphorus, is a key aspect of fulfilling the program's many requirements. Based on the most recent, five-year period (WY2005–WY2009), the average TP load to the lake was 572 metric tons per year, which is nearly four times higher than its established Total Maximum Daily Load. In-lake TP concentrations declined in WY2009 but continue to be elevated due to sediments suspended during the 2004–2005 hurricanes, although this effect continues to diminish.

Kissimmee Basin

Encompassing approximately 3,000 square miles, the Kissimmee Basin forms the headwaters of the Kissimmee-Okeechobee-Everglades system. The watershed consists of a diverse group of wetland and lake ecosystems within its Upper Basin — with more than two dozen water bodies and their tributary streams, known as the Kissimmee Chain of Lakes — and the Kissimmee River and floodplain in the Lower Basin. In the 1960s, the meandering Kissimmee River was channelized to prevent catastrophic flooding and much of the original floodplain was drained. This resulted in pronounced impacts on the ecosystem, including drastic declines in wetlands and wintering waterfowl, wading bird, and fish populations, as well as associated loss of ecosystem functions.

In the 2010 SFER – Volume I, Chapter 11 highlights major projects and key activities during Water Year 2009 (WY2009) associated with the Kissimmee River Restoration Project and other Kissimmee Basin initiatives. The chapter also summarizes the mission-critical activities of the South Florida Water Management District for flood control, water supply, water quality, and natural systems in the Upper and Lower Kissimmee basins.

Third Phase of Kissimmee River Restoration Is Almost Complete

The South Florida Water Management District and the U.S. Army Corps of Engineers are collaborating on the Kissimmee River Restoration Project. This large-scale project and associated projects will (1) reestablish the river-floodplain system's ecological integrity by reconstructing the river's physical form and reestablishing pre-channelization hydrologic characteristics (stage and discharge), (2) provide the water storage and regulation schedule modifications needed to approximate the system's historical flow, and (3) increase the quantity and quality of shoreline habitat in Lakes Kissimmee, Hatchineha, Tiger, and Cypress for the benefit of fish and wildlife.

The first of four major phases of canal backfilling was completed in early 2010, resulting in 14 continuous miles of reconnected river channel and reclamation of almost 6,000 acres of floodplain wetlands. Completed in September 2007, the second phase of construction (Phase IVA) backfilled two additional miles of the C-38 canal, reconnected an additional four miles of river channel, and reestablished 512 acres of floodplain wetlands. The third phase of construction (Phase IVB) involves backfilling an additional four miles of the C-38 canal and recarving four miles of river channel to reestablish flow to six miles of reconnected river channel (see opposite photo). Phase IVB is expected to be completed in early 2010. The final phase of construction (Phase II/III) is currently projected for completion in 2015. In total, the Kissimmee River Restoration Project will affect approximately 40 square miles of river/floodplain habitat and restore flow to more than 40 continuous miles of meandering river channel. Monitoring studies to characterize pre-restoration conditions and support future post-restoration evaluations are under way in the two largest construction phases (Phase I and Phase II/III).

Monitoring Continues to Show Progress Toward Restoration Goals

A key element of the Kissimmee River Restoration Project is a comprehensive, multi-phased evaluation program for tracking ecological responses to restoration. To address the goal of ecological integrity, the evaluation program has a broad scope encompassing hydrology, water quality, and major biological communities, including plants, invertebrates, fish, birds, reptiles, and amphibians. Prior to the first phase

Kissimmee River Restoration

of restoration construction, monitoring was conducted for all these components to establish a baseline for evaluating future changes. A set of associated restoration expectations was developed to predict changes anticipated to result from restoration. Although the first phase of restoration has been in place for only a few years, many positive responses are now being observed in river channel and floodplain hydrology, geomorphology, dissolved oxygen levels, littoral and floodplain vegetation, and aquatic invertebrate, fish, wading bird, and waterfowl communities.

Kissimmee River Bird Densities Trend Down in Water Year 2009

The District continues to conduct monthly bird surveys along completed sections of the Kissimmee River floodplain as part of the Kissimmee River Restoration Evaluation Program. During WY2009, densities of long-legged wading birds and waterfowl on the Phase I restoration area floodplain were roughly half of those observed in WY2008. However, during the time of the 2009 surveys, large flocks of wading birds were attracted to newly available wetland habitat in the active Phase IVB construction area, which may have reduced the number of wading birds using the Phase I area. The impact of construction on waterfowl was likely minimal, as density estimates in the Phase I and construction areas were similarly low. Foraging conditions may have been more suitable in nearby lakes, such as Lakes Okeechobee and Istokpoga, and isolated wetlands than on the river due to below-average rainfall and low water levels in the Kissimmee Basin in WY2009.

Technical Accomplishments Pave the Way for New Water Reservations

Due to rapid population growth in the Kissimmee Basin, it is projected that the limit of sustainable water withdrawal from the Upper Floridan aquifer will be reached in 2013. To address this issue, the District is working cooperatively with adjacent water management districts, counties, and Central Florida utilities to identify Alternative Water Supply projects that can provide additional water supply sources for future use. Modeling tools and performance measures developed for the Kissimmee Basin Modeling and Operations Study are being used to evaluate proposed surface water withdrawal scenarios and to develop Water Reservations for the Kissimmee Basin. In June 2008, the agency's Governing Board approved a resolution to begin rule development for the Kissimmee Basin Water Reservations needed for the protection of fish and wildlife in the Kissimmee River, its floodplain, and seven Lake Management Areas in the Kissimmee Chain of Lakes. Water Reservations technical work moved forward in 2009 with a favorable peer-reviewed document. The rulemaking process is under way, and the final rule is expected to be published in 2010 (see Volume II, Chapter 3).

Management and Restoration of Coastal Ecosystems

South Florida's coastal resources encompass 10 major watershed-estuarine systems: Southern Indian River Lagoon including the St. Lucie River and Estuary, Loxahatchee River and Estuary, Lake Worth Lagoon, Caloosahatchee River and Estuary, Southern Charlotte Harbor, Estero Bay, Naples Bay, Biscayne Bay, and Florida Bay and the Florida Keys. One of the South Florida Water Management District's primary goals is to manage freshwater discharges to coastal estuaries in a way that preserves, protects, and where possible, restores these critical ecosystems. Three major issues — altered delivery of fresh water, declining water quality, and continued habitat loss — considerably impact South Florida's coastal areas. The cumulative impact of these stresses has altered ecosystem structure and impaired function throughout the region. The District is working with many organizations to produce a broad range of information and tools for better managing freshwater inputs to coastal systems. In the 2010 SFER – Volume I, Chapter 12 highlights aspects of this progress and related collaborative management and restoration efforts, with a special focus on the Caloosahatchee and St. Lucie River estuaries.

Coastal Ecosystem Management Faces Multidimensional Challenges

Coastal estuaries depend on fresh water for their existence and health. Over the past year, the District continued its efforts to better understand the links between healthy estuarine function and inflow of fresh water to help guide day-to-day management, restoration projects, and long-term planning. These objectives are achieved by working with partnering agencies and through a combination of monitoring, applied research, and model development. Work also continued in support of establishing technical criteria for the development of Minimum Flows and Levels (MFLs) and Water Reservations for several water bodies (see Volume II, Chapter 3). Water quality continues to be a major concern, and the District routinely coordinates with the Florida Department of Environmental Protection to address regional water quality concerns. Ongoing investigations are being conducted to quantify controls on coastal water quality, particularly the effects of freshwater inflow and its management on water quality.

Monitoring, Modeling and Research Are Crucial for Evaluating Ecosystems

In WY2009, the District moved forward in developing criteria for Biscayne Bay's MFLs and Water Reservations. Conditions remained stable in the bay with just a few annual hypersaline events in the southwestern area. In Naples Bay, salinity monitoring at three stations continued, while monitoring of freshwater inflow from the Golden Gate Canal resumed in April 2008. Data from both sources will be used to calibrate a hydrodynamic/salinity model of Naples Bay. Ecological models, which have the capability to predict system responses to restoration, have been developed for Florida Bay to study pink shrimp (*Farfantepenaeus duorarum*), lobster (*Panulirus argus*), and seagrass and mangrove communities. These models are being used to support RECOVER activities (see Volume I, Chapter 7B) and for MFL planning.

Since fall 2005, an algal bloom had persisted in eastern Florida Bay, but during WY2009 the bloom completely subsided. Chlorophyll a returned to background levels, and concentrations of nutrients were at or below long-term averages. Low rainfall in the watershed led to continued elevated salinities in the bay. Notably, the removal of a causeway that had restricted circulation in Lake Surprise for a century resulted in declines in chlorophyll, organic carbon, and nutrient levels in the lake. To better understand waterfowl abundance trends, a study was also recently conducted. Study results suggest that declines in bird populations in recent decades might not be linked to global pressures, but to habitat degradation at wintering sites within the Everglades.

In cooperation with state and local partners, the District began work on an updated science plan for the Loxahatchee River and Estuary in WY2009. Studies of fish communities relative to freshwater inflow and salinity were completed, as well as several other cooperative monitoring and restoration projects. Importantly, a map of seagrasses in the Lake Worth Lagoon for the year 2007 was produced using the same techniques as in 2001, creating the first true, large-scale trend comparison of this system. Little net change in the areas covered by seagrasses has occurred since 2001. In Estero Bay, the successful oyster reef restoration program continued with the installation of shell substrate near the mouth of Spring Creek.

2010 SFER Special Focus: Caloosahatchee and St. Lucie Rivers and Estuaries

The Northern Everglades and Estuaries Protection Program requires the District, in collaboration with the Florida Department of Environmental Protection and the Florida Department of Agriculture and Consumer Services, and in cooperation with local governments, to develop the St. Lucie River Watershed Protection Plan and the Caloosahatchee River Watershed Protection Plan. Both plans were submitted to the Florida legislature in January 2009, and include an assessment of existing monitoring systems and needs, delineate science strategies for water quality improvement and ecosystems restoration, and provide recommendations for additional numeric modeling tools. During WY2009, key activities related to these regions follow.

St. Lucie River and Estuary. In WY2009, work began on a Water Reservation for the Indian River Lagoon – South Project under the Comprehensive Everglades Restoration Plan. A suite of well-calibrated models was used to help develop the reservation, including a watershed model that provided input to the St. Lucie River Reservoir Operation and Optimization Model. The latter model was used to simulate freshwater flows to the lagoon from the watershed. Output from this model was then used to drive an estuarine hydrodynamic/salinity model. From the results of these modeling efforts, a set of salinity and hydrologic performance measures were developed to determine if flows are beneficial to larval and juvenile fish in the North Fork of the St. Lucie Estuary.

Caloosahatchee River and Estuary. In 2007, as part of the Caloosahatchee River Watershed Protection Plan, land was purchased along the Caloosahatchee River (C-43) for the construction of a water quality treatment and testing facility. The purpose of this project is to remove nitrogen and improve the water quality in the Caloosahatchee River and Estuary. During WY2009, planning was initiated for the design of a pilot test treatment facility that should provide information to optimize the design of a full-scale water treatment facility. As a component of the protection plan, a research and water quality monitoring plan has been developed to collect data in support of establishing Total Maximum Daily Loads and refining flow and salinity envelopes. Guided by this plan, research addressing water quality and freshwater inflows were under way in WY2009.

Everglades Forever Act Annual Financial Report

Pursuant to the 1997 Everglades Oversight Act, the South Florida Water Management District is required to annually provide detailed financial information on Everglades restoration. The Everglades Forever Act (EFA) also requires the District to account for all monies used to fund the Everglades Construction Project (ECP) and the Long-Term Plan for Achieving Water Quality Goals for Everglades Protection Area Tributary Basins (Long-Term Plan) and to provide a comparison annually of actual versus projected revenues and a projection of costs and revenues over the next five-year period. These annual financial reports are central to the 2010 SFER – Volume I, Chapter 13.

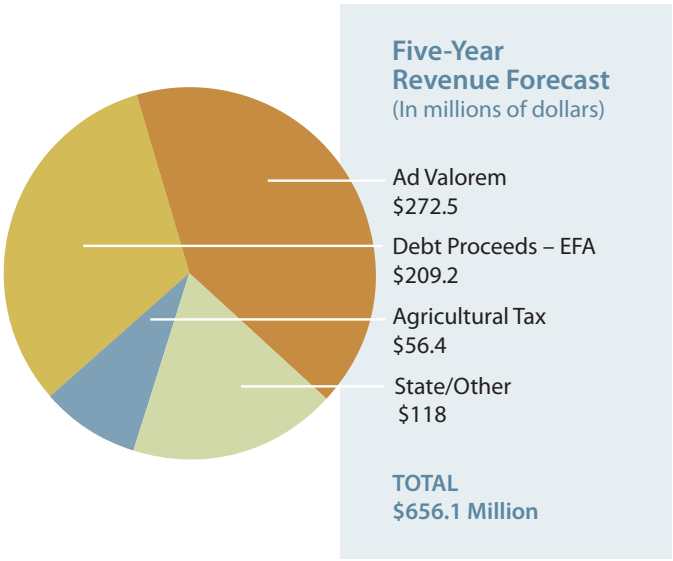
Dedicated Funds Continue to Support Everglades Restoration

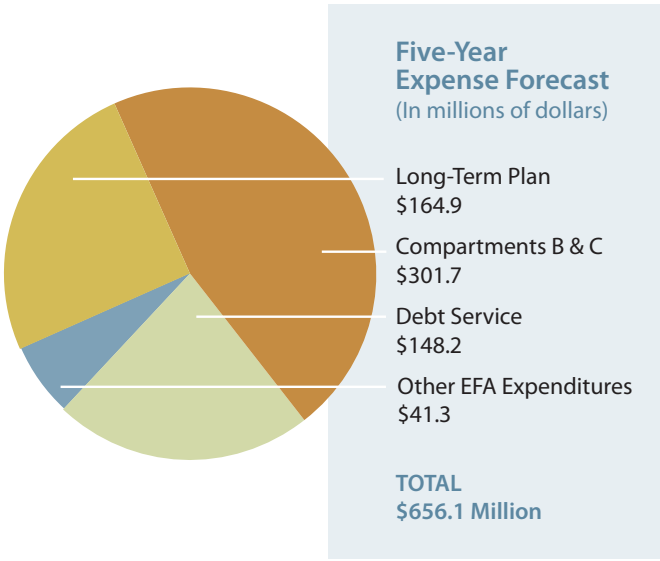
As a major element of the Everglades Restoration Program and Everglades Forever Act, the ECP is one of the nation's largest environmental restoration projects. The 1994 ECP capital projects were completed in FY2007 for a total cost of $514.8 million. When combined with the federal share of $198.9 million, the total capital cost associated with the 1994 ECP is $713.7 million. The 2003 Long-Term Plan continues and expands the goals and objectives of the 1994 ECP and is a critical component of the overall effort to restore and protect the Everglades. In the EFA, the 1/10 mill *ad valorem* tax includes the initial phase of the Long-Term Plan. For Fiscal Year 2010 (FY2010), the EFA millage rate was reduced to 0.0894 mill, resulting from legislative-mandated, state property tax changes in 2007. The Long-Term Plan's initial, 13-year phase has a projected total cost of approximately $1.2 billion, reflecting approved plan revisions through the end of FY2009. When combined with the ECP, the total estimated cost of implementing the EFA program is roughly $2 billion.

As shown in the pie charts, the five-year forecast (FY2010–FY2014) of revenues by source and expenditures for the EFA program totals just over $656 million. The expenditure forecast includes $614.8 million for the overall Long-Term Plan, of which $301.7 million is for the construction of the Stormwater Treatment Area Compartments B and C build-outs and will be supplemented with the proceeds from Certificates of Participation issued in FY2007. A total of $164.9 million is for Long-Term Plan related activities such as source control, optimization, operations, and maintenance of the Stormwater Treatment Areas, and $148.2 million is for the payment of debt service associated with previously issued Certificates of Participation. The remaining $41.3 million is for other EFA-related projects such as monitoring, assessment, research, and evaluation.

Five-Year Everglades Forever Act Program

(Fiscal Years 2010–2014)





District Annual Plans and Reports

VOLUME II

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Introduction to the *2010 South Florida Environmental Report – Volume II*

In the *2010 South Florida Environmental Report* (SFER) – *Volume II*, Chapter 1 provides an overview of the reporting objectives, as well as a basic understanding of the governmental and legal basis for this volume. This chapter has been prepared in accordance with Chapter 2005-36, Laws of Florida, and Subsection 373.036(7), Florida Statutes, which direct each of the state's water management districts to consolidate its annual plans and reports submitted to Florida's governor and legislature.

Statewide Consolidated Reporting Reaches Six-Year Mark

Since 2005, Volume II incorporates plans and reports that are required annually by each of Florida's five water management districts. All the districts consolidate these documents to improve reporting efficiency, quality, and accessibility. This unified reporting facilitates communication by making information more accessible to policy makers, stakeholders, and the public. Consistent with chapter topics and content in corresponding reports of the other districts, Volume II chapters cover the following eight reports:

- Annual Work Plan Report
- Priority List and Schedule for Minimum Flows and Levels, Water Reservations and Restricted Allocation Area Rules
- Five-Year Capital Improvements Plan
- Five-Year Water Resource Development Work Program
- Alternative Water Supply Annual Report
- Florida Forever Work Plan, Annual Update
- Land Stewardship Annual Report
- Mitigation Donation Annual Report

In addition to fulfilling mandated reporting requirements, this single submission is designed to facilitate comparisons to earlier separate reports and enable state-wide evaluations with corresponding chapters in other agencies' consolidated reports. The project-related information in this volume is described on a fiscal-year basis (October 1 through September 30), representing the 12-month period for which the District's Performance Management cycle — the Strategic Plan, Annual Work Plan, Annual Budget, and Reporting and Evaluation — is developed and implemented.

Web-Accessible Database Bolsters Reporting Efficiency

Now in its sixth year, the Consolidated Project Report Database provides an update on descriptions of many District projects (activities with start and end dates) and processes (ongoing activities) that are referenced in the 2010 SFER. The comprehensive database is designed to uniformly describe projects and processes linked to report-related planning efforts and provide these details only once rather than repeating them in several reports. It also enables rapid data sorting, searches, and retrieval for efficient information and project management. The 2010 database is available at www.sfwmd.gov/sfer, under the Database tab.

Fiscal Year 2009 Annual Work Plan Report

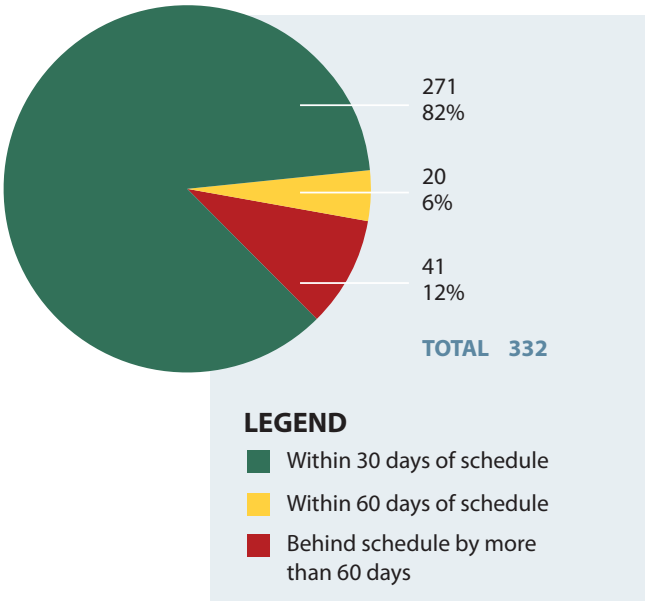
District's Annual Work Plan Performance Remains Strong

The South Florida Water Management District's annual business cycle is composed of four key elements: the Strategic Plan, Annual Work Plan, Annual Budget, and Reporting and Evaluation. Under this process, Work Plan Reports are prepared routinely, with the fourth quarter report representing the status at the end of the fiscal year. In the 2010 SFER – Volume II, Chapter 2 presents the year-end report of the Fiscal Year 2009 (FY2009) Annual Work Plan, the final step of the annual reporting cycle. The chapter highlights the FY2009 status of project schedules, financial summaries, and success indicators.

As in previous fiscal years, adherence to the planned schedules during FY2009 for all District projects and processes was categorized using color-coded criteria (see pie chart). Using these criteria, 82 percent of these activities were green, 6 percent were yellow, and 12 percent were red. In total, 88 percent of all green and yellow items collectively were within 60 days of their planned schedules, which is comparable to the 90 percent mark achieved in FY2008.

Fiscal Year 2009 Status of Major District Projects and Processes

(October 1, 2008–September 30, 2009)



Gross Revenues and Expenditures Decrease in Fiscal Year 2009

The Annual Work Plan Report includes the status of revenue collection and expenditure rates. During FY2009, the District collected 93 percent of budgeted revenue, or $688 million. While the percentage collected for FY2009 was up from 91 percent in FY2008, this amount was $172 million less than in FY2008. FY2009 revenue collection rates were 98 percent of budgeted taxes (both *ad valorem* and agricultural privilege taxes), 59 percent of budgeted intergovernmental revenues, 259 percent of budgeted investment earnings, and 206 percent of other budgeted items such as leases, licenses, permits, fees, sales of District property, and self-insurance charges.

Expenditure rates are tracked as an indicator of overall program activity. In FY2009, the District spent 65 percent of the total budget of $662 million (excluding personnel and reserves). This is 23 percentage points less than the 88 percent spent in FY2008. Both FY2009 discretionary (80 percent) and restricted (58 percent) expenditure rates decreased from FY2008 levels (90 and 87 percent, respectively). More specifically, of the 11 FY2009 programs, seven experienced lower overall expenditure rates than in FY2008. Key factors contributing to this reduced performance include delays in several restoration projects, such as the C-111 Spreader Canal, Lakeside Ranch Stormwater Treatment Area, and Compartments B and C build-outs, as well as capital refurbishment and Caloosahatchee Basin projects.

Success Indicators Measure Progress for Agency Programs

Linked to the District's Work Plan and Strategic Plan, success indicators have been established for each agency program, and measured targets are used to assess year-to-year progress of the projects and processes making up these programs. These program-specific indicator values are summarized in the chapter for FY2008 and FY2009 as well as planned targets for FY2010. Further details on success indicators, including definitions, targets, and other related information, is available on the District's web site at www.sfwmd.gov/budget.

2010 Priority List and Schedule for Minimum Flows and Levels, Water Reservations and Restricted Allocation Area Rules

The diverse natural systems in the South Florida region include wetlands, rivers, lakes, estuaries, bays, and aquifers. The South Florida Water Management District uses three primary mechanisms to protect water supplies for these natural systems: (1) Minimum Flows and Levels (MFLs), (2) Water Reservations, and (3) Restricted Allocation Area rules. In the 2010 SFER – Volume II, Chapter 3 highlights the general process and legal requirements for applying these rules to specific water bodies and other designated areas in the region. The chapter also summarizes current rules in effect during 2009 as well as the priorities and schedule for developing new rules planned for 2010–2013 (see map).

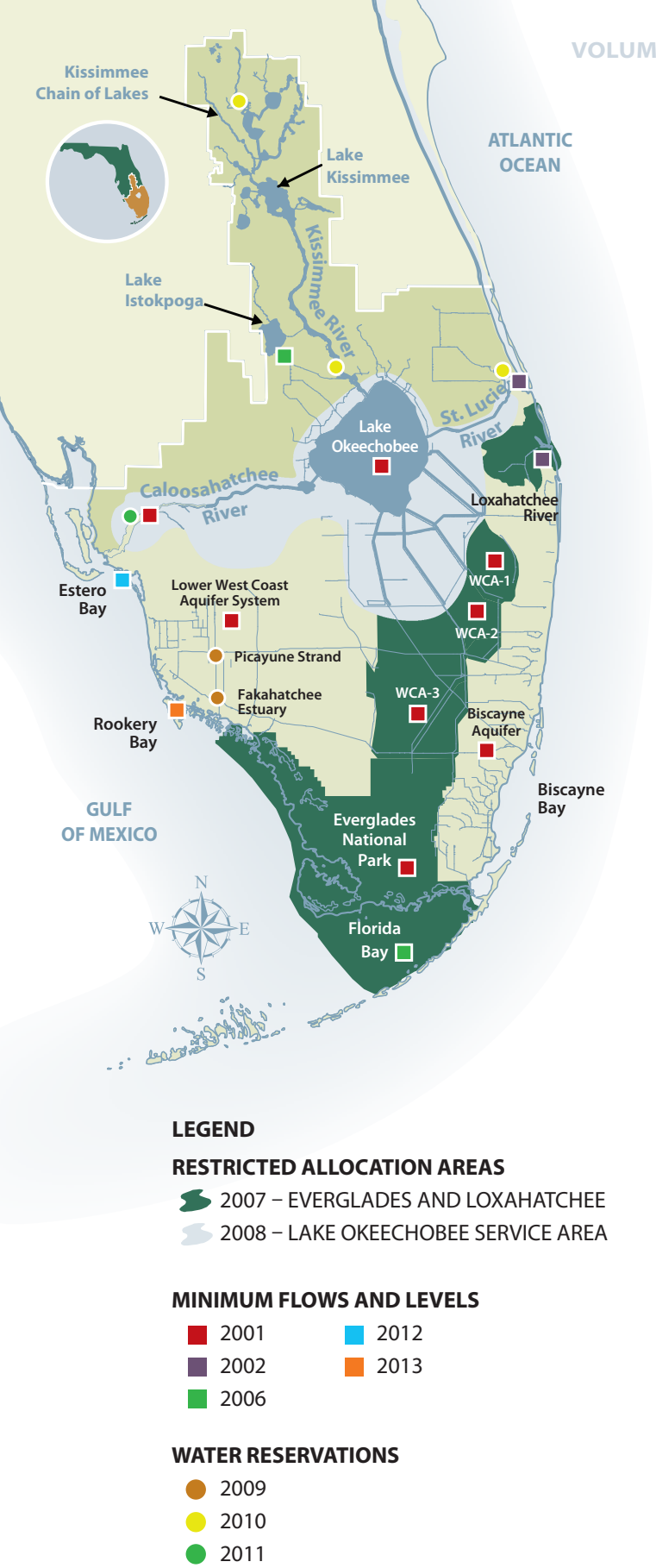
Minimum Flows and Levels Are in Place for 12 Regional Water Bodies

Florida law requires that all water management districts establish MFLs for surface waters and aquifers within their jurisdiction. As depicted on the opposite map, MFL criteria have been adopted for 12 water bodies within the South Florida Water Management District's boundaries, including eight water bodies in 2001, two in 2002, and two in 2006. These water bodies include Lake Okeechobee, four areas of the Everglades (including Water Conservation Areas 1, 2, and 3, and Everglades National Park), Florida Bay, most of the Biscayne aquifer, Lower West Coast aquifers, Caloosahatchee River and Estuary, St. Lucie River and Estuary, the Northwest Fork of the Loxahatchee River, and Lake Istokpoga.

The District's First-Ever Water Reservation Is Approved in 2009

In 2007 and 2008, the South Florida Water Management District took proactive steps to establish two new types of rules — Restricted Allocation Area and Water Reservation rules — designed to set aside water needed for natural systems in South Florida. In February 2007, the District's Governing Board adopted the first Restricted Allocation Area rule (also known as the Regional Water Availability rule), which restricts permitting of additional consumptive uses of water taken from the Everglades and Loxahatchee River watersheds. In October 2008, the second Regional Water Availability rule was authorized to expand coverage to the Lake Okeechobee Service Area (see map).

In accordance with state law, the District is also developing Water Reservation rules based on the evaluation of existing water availability and consideration of future water that may be made available by Comprehensive Everglades Restoration Plan (CERP) and other restoration projects. The District is required to use its reservation or allocation authority to protect water for the natural system prior to executing specific agreements with the U.S. Army Corps of Engineers to construct planned CERP projects. In 2009, the agency's first Water Reservation rule was adopted for the Picayune Strand and Fakahatchee Estuary.



Regional Priority Water Bodies

2010 Priority List and Schedule Highlights

Looking ahead, the District's priorities outlined in the 2010 list are to:

- Complete rule development for the Kissimmee River and Chain of Lakes Water Reservation in 2010 to support Kissimmee Basin restoration. Water bodies addressed in this rulemaking include the Kissimmee River and its floodplain, as well as 19 designated lakes.
- Complete rulemaking for the North Fork of the St. Lucie River Water Reservation in 2010 to support the CERP Indian River Lagoon – South Project.
- Initiate rule development for the Caloosahatchee Estuary in 2009, and adopt a Water Reservation rule in 2011 to support the CERP Caloosahatchee (C-43) West Basin Storage Reservoir Project.
- Initiate rule development for Biscayne Bay in 2010 to support the CERP Biscayne Bay Coastal Wetlands Project.
- Apply the Restricted Allocation Area rule to the C-111 Western Spreader Canal, Site 1 Impoundment (Fran Reich Preserve), and Broward County Water Preserve Areas to support CERP projects in these three areas.
- Compile information and conduct the necessary studies to support development of MFL rules for Estero Bay in 2012 and for Rookery Bay in 2013.

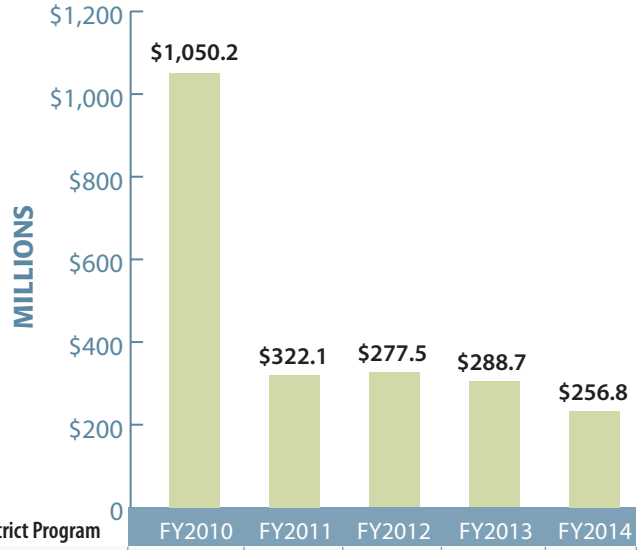
The 2010 MFL Priority List and Schedule was adopted by the District's Governing Board in October 2009, and subsequently was submitted to the Florida Department of Environmental Protection for review and approval. Concurrently, a second list containing other rule development activities under Water Reservations and Restricted Allocation Area rules was also presented to the Governing Board. These lists may be modified in the future, as necessary, to reflect federal authorizations and appropriations by the U.S. Congress for certain regional restoration projects.

Five-Year Capital Improvements Plan

The Five-Year Capital Improvements Plan (CIP) includes estimated capital project expenditures and anticipated revenues over the five-year period from Fiscal Years 2010–2014 (FY2010–FY2014). The CIP reflects the South Florida Water Management District's priorities as outlined in its Strategic Plan, provides a formal mechanism for decision making, and serves as a financial management tool and reporting document. It reflects management plans to support the agency's mission by efficiently directing resources to District programs based on strategic priorities. Capital improvement projects include improvement/refurbishment, construction, and land acquisition for the District's programs.

Five-Year Annual Capital Budget Estimates

(Fiscal Years 2010–2014)



District Program	FY2010	FY2011	FY2012	FY2013	FY2014
Restoration	$982.8	$252.6	$205.8	$220.5	$189.7
Operations & Maintenance	$67.1	$68.3	$70.5	$68.1	$66.9
Mission Support	$0.3	$1.2	$1.2	$0.1	$0.2
Total	**$1,050.2**	**$322.1**	**$277.5**	**$288.7**	**$256.8**

In the 2010 SFER – Volume II, Chapter 4 updates information presented in last year's CIP. Specifically, this chapter covers the five-year financial schedule of revenues and expenditures for those capital projects approved for FY2010, along with the four-year (FY2011–FY2014) forecast. Descriptions of the capital projects are provided in the Consolidated Project Report Database at www.sfwmd.gov/sfer.

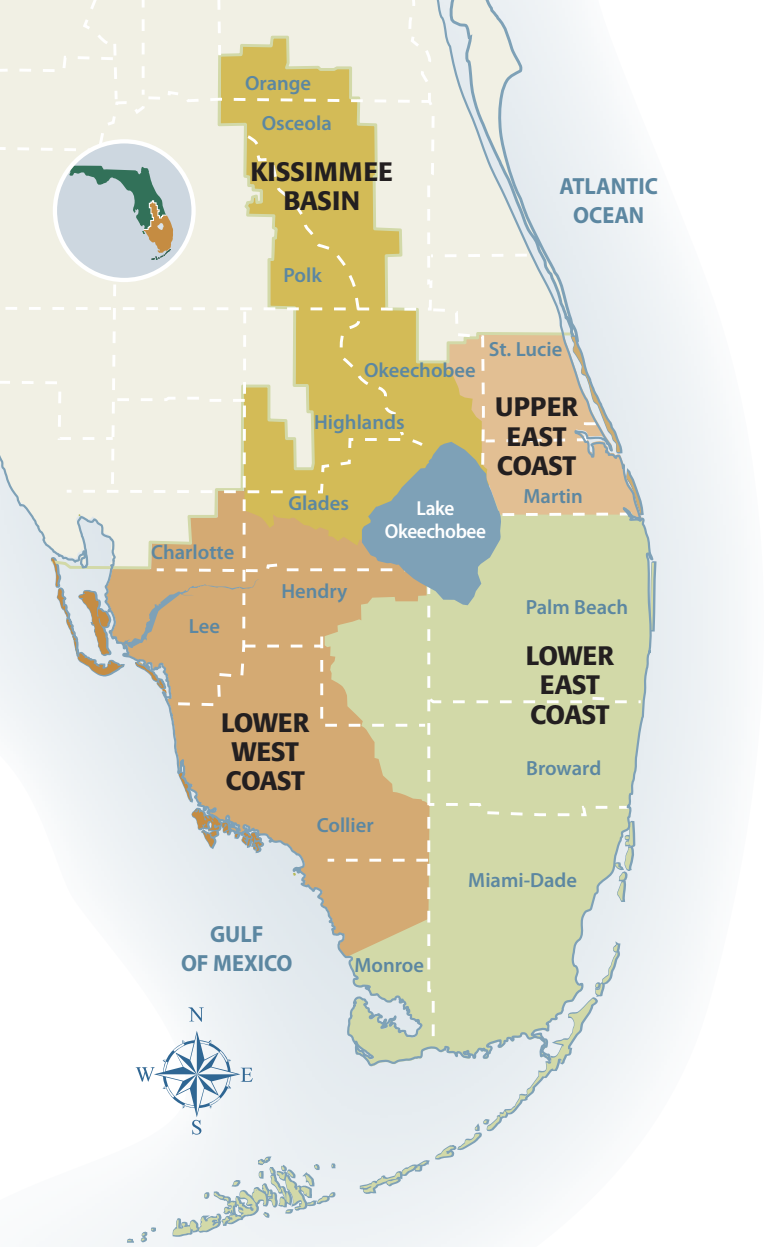
Strategic Priorities Guide Funds for Agency Programs

The annual capital budget is consistent with the strategic priorities established by the District's Governing Board and administered by overarching District programs. Beginning in FY2010, agency programs were consolidated from eleven to four, out of which three include planned capital projects or land purchases reflected in the CIP (see table). Aligned with the Strategic Plan, targeted priorities are to (1) restore the Northern and Southern Everglades by expanding and improving water storage capacity and water quality treatment, completing construction of existing key projects, and implementing the Long-Term Plan to achieve Everglades water quality standards; and (2) refurbish, replace, and improve the regional water management system by implementing the 50-year plan and incorporating new structures into the system. Everglades restoration is planned to receive the major share of projected funds.

Plan Forecasts 2.2 Billion Costs for the Next Five Years

The five-year CIP represents approximately $2.2 billion of planned project costs. As reflected in the table, the total FY2010 budgeted capital expenditures are $1.05 billion, which represents 69 percent of the total District FY2010 budget of $1.53 billion and 48 percent of the total five-year CIP projected budget. The FY2010 capital budget is $1.05 billion, which represents roughly a 53 percent decrease from last year's budget of $2.24 billion. This reduction is primarily attributed to a marked decrease in the Restoration Program as a result of the proposed *River of Grass* land acquisition, which has been restructured to acquire less acreage than initially budgeted in FY2009. Funding for the Operations and Maintenance Program has been increased in FY2010 to refurbish regional water control structures. The Mission Support Program is funded at the same level in FY2010 as in FY2009.

Five-Year Water Resource Development Work Program



District Water Supply Planning Areas

Water Supply Plans Are Being Updated to Meet Future Water Demands

The purpose of water supply planning is to develop strategies to meet existing and future water demands of urban and agricultural users while still meeting the needs of the environment. Regional water supply plans are updated every five years for each of the agency's four planning regions (see map) and encompass a 20-year planning horizon. State law requires that water management districts prepare an annual Five-Year Water Resource Development Work Program to update the agency's implementation strategy for the water resource development component of each approved regional water supply plan. The Work Program is included in the 2010 SFER – Volume II, Chapter 5A, to fulfill various reporting requirements on planning, projects, and funding related to water supply.

The first water supply plan for the Upper East Coast was completed in 1998, updated in 2004, and amended in 2006. In 2000, regional water supply plans were developed for each of the District's other three planning areas — the Kissimmee Basin, Lower West Coast, and Lower East Coast — and updates were completed in 2006 and 2007. Currently, the District is updating the regional water supply plans for all four regions, with anticipated completion dates for the Upper East Coast and Lower West Coast planning areas in FY2011 and for the Kissimmee Basin and Lower East Coast planning areas in FY2012. Plan updates identify Water Resource Development and Water Supply Development projects that are expected to meet the needs of all reasonable-beneficial uses through 2030 during a 1-in-10 year drought event, while sustaining the region's water resources and related natural systems.

The District has allocated $1.8 million in FY2010 for Water Resource Development projects and anticipates spending $9.1 million on these projects over the next five-year (FY2010–FY2014) period. These allocations include $580,000 in FY2010 and $5.1 million from FY2010–FY2014 to implement the Comprehensive Water Conservation Program. The conservation program carries out the recommendations of Florida's Water Conservation Initiative to improve efficiency in all water use categories. Expenditure projections do not include Comprehensive Everglades Restoration Plan projects, Aquifer Storage and Recovery projects, and projects not identified in the 2006 plan amendment and updates.

Alternative Water Supply Annual Report

Alternative Water Supplies Are Critical to Balancing Future Regional Needs

Due to the limitations that exist on establishing traditional freshwater sources within the South Florida Water Management District, most future water demands will be met primarily through developing Alternative Water Supply (AWS) sources. Such alternative sources include reclaimed water, storm water, salt water and brackish water, surface water captured predominately during wet-weather flows, and sources made available through additional storage capacity. To proactively address future needs, the District has been implementing a well-recognized grant program to provide dedicated funds to support the development of regional AWS projects for more than a decade. This program has invested approximately $196 million since 1996 for the construction of more than 400 AWS projects. In the 2010 SFER – Volume II, Chapter 5B provides an annual update on the agency's AWS funding efforts during Fiscal Year 2010 (FY2010).

Daily Water Capacity Increases Nearly Fourfold Over the Past Four Years

In 2005, the Florida legislature created the Water Protection and Sustainability Program (WPSP), which provides annual recurring state funding, when available, to the South Florida Water Management District for the construction of AWS projects. This included $30 million in FY2006 (the first year of the program), $18 million in FY2007, $15.6 million in FY2008, and $4.25 million in FY2009. The District's AWS Funding Program, which administers WPSP funding, continues to be a success. During the three years prior to the WPSP legislation (FY2003–FY2005), the District funded 79 projects with $14.8 million that created 109 million gallons per day (mgd) of additional alternative water capacity. From FY2006–FY2009, the District approved more than $156 million in funding, including WPSP funds for 254 projects that created 403 mgd of additional alternative water capacity — nearly four times more than the previous three years combined.

Due to revenue constraints, the state of Florida did not allocate funding for Alternative Water Supply projects for FY2010. Facing revenue shortfalls similar to the state's, the District also severely cut back its AWS funding. Consequently, there was no FY2010 solicitation process, and applications were not accepted by the agency. Overall, the District's budget for AWS projects in FY2010 consists of six projects in the Big Cypress Basin, costing $1.37 million and providing an additional 2 mgd. Also for FY2010, two projects — the City of Doral's JC Bermudez Park Reclaimed Graywater Irrigation Project and the City of Hialeah's Reverse Osmosis Water Treatment Plant — have been carried over from the previous fiscal year with a combined budget of $6.4 million.

Florida Forever Work Plan, 2010 Annual Update

In the 2010 SFER – Volume II, Chapter 6A presents the Florida Forever Work Plan, 2010 Annual Update. This chapter identifies projects eligible for funding under the Florida Forever Act (Section 259.105, Florida Statutes) as well as projects eligible for land acquisition monies from state-appropriated accounts or trust funds under Section 373.139(3)(c), Florida Statutes, along with five-year projected revenues and expenditures for Fiscal Years 2010–2014 (FY2010–FY2014). Land acquisition activity during FY2009 is also provided in this chapter. An overview of regional lands purchased by the South Florida Water Management District through FY2009 to support future restoration projects is shown in the summary table.

Florida Forever Projects Focus on Region-Wide Restoration

The 2010 Florida Forever Work Plan identifies 61 eligible projects. These include the Comprehensive Everglades Restoration Plan, Florida Forever/Save Our Rivers, Northern Everglades and Estuaries Protection Program (NEEPP), and expedited projects. The NEEPP Hybrid Wetland Treatment Technology Project and Lake Trafford Critical Restoration Project were added to the list of eligible projects, and the Lake Okeechobee Watershed Construction Project Phase II Technical Plan was removed. Also, the Lake Okeechobee and Estuary Recovery Plan projects were shifted from a separate plan into NEEPP.

For FY2010–FY2014, projected expenditures for eligible Florida Forever projects total $660 million, of which $266 million is designated for land acquisition, $376 million for construction, and $18 million for other water quality and supply initiatives. Five-year funding projections are conservatively estimated to include $55 million and $375 million from the Florida Forever/Save Our Everglades Trust Fund (FF/SOETF) funds, respectively. As a result of declining property-tax revenues and keeping the current millage rate, these estimates are well below the legislatively allowable yearly amounts for this period. It is hoped that in future years, FF/SOETF funds will remain a dependable source of funding for Everglades restoration projects. The District will also continue to seek additional funding alternatives, such as other state funds and *ad valorem* taxes.

More Land Is Acquired in Fiscal Year 2009 for Greater Everglades Programs

In addition to negotiating the proposed *River of Grass* acquisition, the District obtained 173 acres of land, including 87 acres acquired through donations and exchange transactions and 86 acres purchased for $4.6 million, during FY2009. The purchased acres were funded by the FF/SOETF program and other state funds. Additionally, FF/SOETF funds totaling $38.7 million were used to accelerate final payments on land bought in prior fiscal years, avoiding more than $1 million of interest payments. As of the end of FY2009, a total of 232,767 acres of land have been obtained for Comprehensive Everglades Restoration Plan projects, representing nearly 60 percent of the land needed.

District-Acquired Land by Region
(as of September 30, 2009)

REGION (project lands only)	ACRES
Kissimmee River	102,160
Lake Okeechobee Watershed	14,197
Lower West Coast	66,753
Upper East Coast	54,484
Everglades Agricultural Area	51,069
Everglades, Florida Bay, and the Florida Keys	31,251
Miami-Dade County	13,379
North Palm Beach County	4,263
Water Preserve Area	13,354

Land Stewardship Annual Report

Land Stewardship Provides Benefits for Ecosystem Restoration and Public Use

The Land Stewardship Program is responsible for planning and managing the South Florida Water Management District's lands. This includes Save Our Rivers and other lands for natural system conservation, as well as those lands being held for future water resource projects. The Land Stewardship Program is also responsible for implementing and administrating mitigation banks and regional off-site mitigation areas, as well as for overseeing recreation on District lands. The program's principal funding source is the Water Management Lands Trust Fund, which uses a portion of the state's documentary tax revenue to pay for land management activities. Other funding sources include off-site mitigation, mitigation bank revenues, lease revenues, grants for wetland restoration and exotic control projects, the Everglades Restoration Trust Fund, and *ad valorem* tax revenues for Comprehensive Everglades Restoration Plan recreational programs.

Each year, the District is required to report on land management activities for all agency-owned properties and associated project areas. In the 2010 SFER – Volume II, Chapter 6B highlights the 22 Save Our Rivers and Florida Forever natural lands projects for the District's five land management regions — Upper Lakes, Kissimmee/Okeechobee, East Coast, Everglades, and West Coast — and the Fiscal Years (FY) 2009 and 2010 land management activities and acquisition status for each region. The chapter also includes project-specific descriptions for each of the Land Stewardship Program's major components — hydrologic and habitat restoration, vegetation management, exotic species control, prescribed burning, wildlife management, public use, environmental education, law enforcement, mitigation, infrastructure management, planning, monitoring, and the management of project lands — which are those lands acquired for future implementation of the Comprehensive Everglades Restoration Plan and other water resource projects.

Multiagency Partnerships Manage 1.35 Million Acres of Public Lands

Over the course of its history, the South Florida Water Management District and its partnering agencies have acquired nearly 1.2 million acres of environmentally sensitive lands. These lands span across the South Florida region from the northern reaches of the Kissimmee Chain of Lakes to the Southern Glades Wildlife and Environmental Area near Everglades National Park. As of September 2009, the District owns, and with its partners, manages 1.35 million acres of Save Our Rivers and other valued lands, including key designated areas for planned Everglades restoration projects. To support extensive land management efforts, the District uses more than 100 separately managed contracts, agreements, and leases with other governmental agencies and private entities. The FY2009 budget for the Land Stewardship Program was $12.4 million. Revenue generated from agricultural leases, sale of products, mitigation banks, and other alternative sources for FY2009 was in excess of $3.1 million. Management activities for FY2010 are anticipated to cost a total of $14.1 million.

Mitigation Donation Annual Report

Mitigation is the acquisition, creation, restoration, or enhancement of wetlands to compensate for permitted wetland impacts. Each year, Florida's water management districts are statutorily required to report on the expenditure of funds received as mitigation for wetland impacts. Mitigation funding allows the South Florida Water Management District to direct funds toward priority restoration that benefits the South Florida ecosystem at costs that are comparable to or less than other forms of mitigation.

In the 2010 SFER – Volume II, Chapter 7 presents the District's mitigation fund expenditures for Fiscal Year 2009 (FY2009) and the use of mitigation funds anticipated for FY2010 for two regional mitigation projects: Corkscrew Regional Ecosystem Watershed (CREW) and Pennsuco. The chapter also highlights the restoration, monitoring, and management efforts for both of these projects. Spanning over 60,000 acres in Lee and Collier counties, CREW contains some of the largest remaining pristine cypress wetlands in the United States, providing habitat to many protected species. Covering about 13,000 acres in Miami-Dade County, Pennsuco is an impaired wetland ecosystem that likely will continue to degrade and further impact adjacent natural areas unless invasive exotics are reduced. Importantly, continued enhancements to these vital wetlands offer regional ecological benefits and contribute to overall Everglades restoration goals.

Mitigation Funds Provide Regional Environmental Benefits

In 1995, the District began accepting cash payments for the CREW and Pennsuco projects to offset impacts to other wetlands. Mitigation funding has since enabled land acquisition, chemical treatment of exotic plants, hydrologic enhancement, environmental monitoring, security, and land management. Although both projects no longer accept mitigation funds, existing dedicated funds continue to provide mitigation efforts at these sites.

Environmental benefits of land acquisition in CREW and Pennsuco contribute to corridor building and improved wildlife habitat for threatened and endangered species. During FY2009, mitigation funding provided $120,000 toward the $260,000 purchase price of CREW project lands bought by the District, acquiring six of the 13 acres with the balance provided by Florida Forever funds. FY2009 mitigation funds also provided reimbursed costs totaling $50,000 for 145 acres in Pennsuco.

In FY2009, the District expended over $2.1 million on restoration for the two mitigation projects. FY2009 funding supported exotic treatments on 3,681 acres in CREW and 3,408 acres in Pennsuco. Ongoing restoration efforts in both areas are proving successful. Native vegetation is showing a strong recovery in Pennsuco, with sawgrass (*Cladium jamaicense*) coverage at 31 percent, and invasive melaleuca (*Melaleuca quinquenervia*) coverage notably decreasing from 1 to 0.5 percent. To date, there has been little change in vegetative composition in CREW, although a general decline in exotic and woody shrub species continues along with an increase in native species such as common carpetgrass (*Axonopus fissifolius*), sand cordgrass (*Spartina bakeri*), and turkey tangle fogfruit (*Phyla nodiflora*).

For the two projects, the anticipated total expenditures for FY2010 are $1.25 million. Of this amount, $411,000 is budgeted for restoration, security, and monitoring in CREW, and $837,000 is reserved for exotic treatment, security, and monitoring in Pennsuco.

Glossary

Acre-feet (ac-ft): The volume required to cover one acre to a depth of one foot, commonly used to express large volumes of water (1 acre-foot = 325,900 gallons).

***Ad valorem* tax:** A tax imposed on the value of real and personal property, as certified by the property appraiser in each county.

Alternative Water Supply (AWS): A supply of water that has been reclaimed after municipal, commercial, and/or agricultural uses; or a supply of storm water, or brackish or salt water, that has been treated in accordance with applicable rules and standards sufficient to supply an intended use.

Aquifer Storage and Recovery (ASR): The injection of fresh water into a confined saline aquifer when water supply exceeds demand, and recovering the water when there is a supply deficit.

Best Management Practices (BMPs): Land, agricultural, industrial, and waste management techniques that reduce pollutant export from a specified area.

Certificates of Participation (COPs): As defined by Florida law (Section 373.584, Florida Statutes), a type of revenue bond that water management districts may issue to finance undertaking of any capital or other project for purposes permitted by the state's constitution.

Compliance monitoring: In a water quality management program, compliance is associated with meeting permit conditions as well as ambient standards. Periodic monitoring provides water quality data that are used to assess compliance.

Discharge (or Flow): The rate of water movement past a reference point, measured as volume per unit time (usually expressed as cubic feet or cubic meters per second).

Drought: An extended period of low rainfall , below-normal streamflow, and depleted surface and subsurface storage.

Estuary: The part of the wide lower course of a river where its current is met by ocean tides or an arm of the sea at the lower end of a river where fresh and salt water meet.

Everglades Agricultural Area (EAA): An area extending south from Lake Okeechobee to the northern levee of Water Conservation Area 3A, from its eastern boundary at the L-8 canal to the western boundary along the L-1, L-2, and L-3 levees. The EAA incorporates almost 3,000 square kilometers (1,158 square miles) of highly productive agricultural land.

Everglades Construction Project (ECP): The foundation of a large ecosystem restoration program, composed of 12 interrelated construction projects between Lake Okeechobee and the Everglades, currently including nearly 45,000 acres of Stormwater Treatment Areas with roughly 12,000 additional acres under construction. It also contains four hydropattern restoration projects that will improve the volume, timing, and distribution of water entering the Everglades.

Everglades Forever Act (EFA): A 1994 Florida law (Section 373.4592, Florida Statutes), amended in 2003, to promote Everglades restoration and protection. This will be achieved through comprehensive and innovative solutions to issues of water quality, water quantity, hydroperiod, and invasion of exotic species to the Everglades ecosystem.

Everglades Protection Area (EPA): As defined in the Everglades Forever Act, the EPA comprises Water Conservation Areas 1, 2A, 2B, 3A, and 3B, the Arthur R. Marshall Loxahatchee National Wildlife Refuge, and Everglades National Park.

Expenditure: The disbursement of appropriated funds to purchase goods or services.

Fiscal Year (FY): The 12-month period for which the annual budget is developed and implemented. The fiscal year for the District begins on October 1 and ends on September 30.

Florida Forever Act: A 1999 Florida law (Section 259.105, Florida Statutes) authorizing the issuance of bonds to fund land acquisition, water resource development, stormwater management projects, water body restoration activities, recreational facilities, public access improvements, and invasive plant removal.

Florida Statutes (F.S.): A permanent collection of state laws organized by subject area into a code made up of titles, chapters, parts, and sections. The Florida Statutes are updated annually by laws that create, amend, or repeal statutory material.

Flow-weighted mean concentration: The average concentration of a substance in water, corrected for the volume of water flow at the time of sampling. Samples taken when flow is high are given greater weight in the average.

Geometric mean: A statistical average of a set of transformed numbers, often used to represent a central tendency in highly variable data, such as water quality. It is calculated from data transformed using powers or logarithms and then transformed back to original scale after averaging.

Loading (or mass loading): The amount of material carried by water into a specified area, expressed as mass per unit of time. One example is phosphorus loading into WCA-2A, measured in metric tons per year. Note that 1 metric ton (mt) is equivalent to 1,000 kilograms, or 2,205 pounds.

Minimum Flows and Levels (MFLs): Florida law (Chapter 373, Florida Statutes) requires the state's water management districts to set water levels for each major body of water "…at which further withdrawals would be significantly harmful to the water resources or ecology of the area."

Northern Everglades and Estuaries Protection Program (NEEPP): As defined by Florida law (Section 373.4595, Florida Statutes), an initiative to holistically restore the Everglades through increased focus and integration of regional projects in the Northern Everglades, including the Lake Okeechobee watershed, and the Caloosahatchee and St. Lucie River watersheds and estuaries.

Parts per billion (ppb): A unit of measure, equivalent to micrograms per liter (1 ppb = 1 µg/L).

Periphyton: The biological community of microscopic plants and animals attached to surfaces in aquatic environments. Algae are the primary component in these assemblages, which naturally reduce phosphorus levels in water.

Revenue: Monies received from all sources, with the exception of fund balances, that will be used to fund expenditures in a fiscal year.

Stage: The height of a water surface above an established reference point. This vertical control measurement is usually expressed as feet National Geodetic Vertical Datum of 1929 or feet North American Vertical Datum of 1988.

Stormwater Treatment Area (STA): A large, constructed wetland designed to remove pollutants, particularly nutrients, from stormwater runoff using natural processes.

Submerged aquatic vegetation (SAV): Wetland plants that exist completely below the water surface.

Total Maximum Daily Load (TMDL): The maximum allowed level of pollutant loading for a water body, while still protecting its uses and maintaining compliance with water quality standards, as defined in the Clean Water Act.

Total Phosphorus (TP): An estimate of the concentration of phosphorus in both organic and inorganic forms in a water sample. In freshwater environments, increased levels of this nutrient can promote the growth of algae and other plants.

Water Conservation Areas (WCAs): Diked areas of the remnant Everglades that are hydrologically controlled for flood control and water supply purposes. The primary targets of the Everglades restoration, and major components of the Everglades Protection Area.

Water quality: The physical, chemical, and biological condition of water as applied to a specific use, typically propagation of fish and wildlife, public water supply, industry, or recreation.

Water quality criteria: Constituent concentrations based on scientific data and judgments on the relationship between pollutant concentrations and environmental and human health effects.

Water Reservations: As defined by Florida law (Section 373.223(4), Florida Statutes), water set aside or designated for use, in a certain location, time, or quantity, as may be required for protecting fish and wildlife or public health and safety.

Watershed: A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.

Water Year (WY): The period from May 1 through April 30, during which water quality and other data are collected and reported in the South Florida Environmental Report.

Acknowledgments

The South Florida Water Management District wishes to gratefully acknowledge the outstanding contributions of the many professionals who have made the *2010 South Florida Environmental Report* a reality.

Authors: Teamwork and collaboration across organizational units and agencies for the SFER reporting process is world-class and highly recognized. The 2010 SFER could not exist without the competence of more than 200 authors and contributors who have played an important role in the development of this large, complex document. The professionalism and dedication of these many individuals are greatly valued.

Editorial and Production Team: To organize the development of this lengthy report under tight deadlines, sound project management and close teamwork by the SFER production management team is required throughout the entire production process. The team provides meaningful contributions and demonstrates efficient organization in expertly guiding this annual process. The exceptional cooperation and productivity of the 2010 SFER editorial and production team are respectfully acknowledged, as well as the support of the District's Creative Services Division in producing the 2010 SFER Executive Summary. The outstanding work performed under contract by Aquent, Inc., for technical editing and graphic design is also immensely appreciated.

Project Team: The management of Volume I is centered in the District's Restoration Sciences Department. The Volume I staff works closely with the Florida Department of Environmental Protection's Water Quality Standards and Special Projects Program to jointly coordinate the creation of Volume I, Chapters 3A and 3B, and associated appendices. The District's Budget Office provides oversight and support for the development of Volume II. Along with the significant contributions of these project management teams, this large, multidisciplinary document could not be produced without the guidance of our agencies' executive managers.

Peer Review: The depth of knowledge and experience of the expert panel assembled for the 2010 SFER peer review is well-regarded. All six panelists provided insightful and thorough scientific peer review in the major subject areas covered in Volume I. The SFER production staff is also recognized for its assistance in overseeing this year's streamlined, peer-review process.

Other Contributors: The extensive amount of data and other information provided throughout Volume I is largely supported by the divisions of the District's Restoration Sciences Department. Many individuals throughout these divisions have contributed to the essential data collection, monitoring, analyses, validation, and technical assessments for multiple Volume I chapters and appendices. They play a key role in the success of this report, and their efforts are deeply appreciated. Project managers and chapter authors are also recognized for updating the 2010 SFER Consolidated Project Report Database.

For further reference, a detailed list of all authors and contributors is presented on the acknowledgments page of the 2010 Main Report.

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EXECUTIVE SUMMARY

2010 SOUTH FLORIDA ENVIRONMENTAL REPORT

MARCH 1, 2010

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On the Cover

Lake Tohopekaliga, or Lake Toho — meaning "sleeping tiger" for sudden storms that appear locally during summer — is located southeast of the City of Kissimmee in Osceola County. As one of the largest lakes in Florida, Lake Toho covers about 20,000 acres (8,000 hectares) and has 33 miles (53 kilometers) of shoreline. Forty percent of the lake is less than 5 feet (1.5 meters) deep, making it one of Florida's best for bass fishing. Lake Toho is part of the 50-mile-long Kissimmee Chain of Lakes, which forms the headwaters of the Everglades and is the principal source of water flowing through the Kissimmee River into Lake Okeechobee. Home to more than 150 species, including the American lotus, *Nelumbo lutea* (front), the lake ecosystem provides critical habitat for birds, such as the endangered Everglade snail kite, *Rostrhamus sociabilis plumbeus* (right), and other native wildlife.

For more information on the Kissimmee Chain of Lakes, visit www.sfwmd.gov/kissimmee

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