Chapter 1: Introduction to the *2004 Everglades Consolidated Report*

Garth Redfield, Gary Goforth and Kirk Burns

This introductory chapter provides the reader with a basic understanding of the governmental, scientific, and legal context behind the *2004 Everglades Consolidated Report*. The chapter begins with a geographic overview of the entire Everglades resource, giving the reader an appreciation of the diverse challenges facing environmental management in South Florida. These challenges are discussed from many different vantage points throughout the *2004 Everglades Consolidated Report*.

The chapter next provides a brief section on the history and relationship of the South Florida Water Management District and other agencies overseeing South Florida's water resources. It covers the various components of the Everglades Program, which was established by the 1994 Everglades Forever Act and which includes numerous research and monitoring projects. Updates on these projects for the current reporting year, known as Water Year 2003 (May 1, 2002 through April 30, 2003), are provided throughout the *2004 Everglades Consolidated Report*.

Following discussion of the Everglades Program is an integrative summary of the opportunities and obstacles facing Everglades restoration. This includes an overview of the Everglades restoration strategy, a multifaceted, comprehensive approach that includes interim and long-term plans for achieving water quality goals and for optimizing environmental management.

Objectives, organization, and content of the entire *2004 Everglades Consolidated Report* are described in this chapter as well, including a discussion of the numerous legal and reporting requirements being addressed by this document. Finally, the processes used to create this report and to provide peer and public review are summarized.

Similar to previous versions, the *2004 Everglades Consolidated Report* was subjected to an intensive peer-review process, including three days of public workshops with a panel of outside experts. This report differs from earlier versions in that discussion of the phosphorus criterion development has been deleted, and its chapter (Chapter 5) has been changed to report on the hydrological status of the Everglades Protection Area. The coverage in Chapter 6 now specifically provides information on the ecological effects of altered hydrology. Coverage of the Comprehensive Everglades Restoration Plan (CERP) has been removed from this year's report, although the report of its Restoration Coordination and Verification (RECOVER) function is retained in Chapter 7.

GEOGRAPHIC FEATURES OF THE EVERGLADES PROTECTION AREA AND SURROUNDINGS

AREAS WITHIN THE EVERGLADES PROTECTION AREA

The Everglades is an internationally recognized ecosystem that covers approximately 9,000 square kilometers (3,474 square miles) in South Florida. It represents the largest subtropical wetland in the United States. The historic Everglades extended from the south shore of Lake Okeechobee to the mangrove estuaries of Florida Bay. More than half of the original system has been lost to drainage and development (Davis and Ogden, 1994), including the Everglades Agricultural Area (EAA) located south of Lake Okeechobee. Today's remaining Everglades, which are primarily included within the boundaries of the Everglades Protection Area (EPA), are comprised of Everglades National Park (Park), including Florida Bay and the Water Conservation Areas (WCAs), which include WCA-1, WCA-2A/2B, and WCA-3A/3B (**Figure 1-1**). These areas are the primary targets of the Everglades restoration and are described in this section of Chapter 1, followed by descriptions of areas adjacent to the EPA.

Water Conservation Areas 1, 2, and 3

The three Water Conservation Areas (WCA-1, WCA-2, and WCA-3) are major components of the Everglades Protection Area and provide a valued suite of ecological and hydrological functions for the region. The WCAs, located south of Lake Okeechobee and west of the heavily urbanized Lower East Coast (LEC), comprise an area of about 3,497 square kilometers (1,350 square miles). These remaining Everglades wetlands serve as receiving waters for storm runoff from the surrounding basins, which total about 3,400 square kilometers (1,312 square miles). These basins include the Everglades Agricultural Area, portions of the Lower East Coast, and rural western basins. Regulatory releases from Lake Okeechobee may also be diverted to the WCAs in accordance with the federal operating schedule for the lake. The WCAs are sources of water supply for LEC urban areas and agricultural lands, recharging the Biscayne Aquifer and retarding saltwater intrusion into coastal wellfields. In addition, the WCAs serve as critical sources of water for the Park, important habitats for Everglades wildlife, and valued resources for public recreation.

Water Conservation Area 1 (WCA-1) is within the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) and is managed by the U.S. Fish and Wildlife Service (USFWS). WCA-1 covers an approximate area of 566 square kilometers (218 square miles) and receives treated water from Stormwater Treatment Area 1 West (STA-1W). The U.S. Army Corps of Engineers (USACE) is currently completing construction of STA-1 East (STA-1E). When operational, it will capture, treat, and return to the Everglades ecosystem stormwater from the C-51 West basin that currently is discharged to tide. This WCA has been the subject of extensive monitoring and research, and data and findings from this important resource are summarized primarily in Chapters 2A, 5, and 6 of the *2004 Everglades Consolidated Report*. A discussion of the STAs is presented in Chapters 4A and 4B of this report.

Water Conservation Area 2 (WCA-2) is an extensive sawgrass wetland and the smallest of the three WCAs. It was divided into two smaller units, WCA-2A (442 square kilometers, or 170 square miles) and WCA-2B (95 square kilometers, or 37 square miles) to reduce water seepage losses to the south and to improve the water storage capabilities of WCA-2A. During Water Year 2003 (WY2003) (May 1, 2002 to April 30, 2003), surface inflows to WCA-2A consisted of flows

from WCA-1, treated water from STA-2, and stormwater from the North New River Canal basin in the Everglades Agricultural Area (EAA). STA-3/4 is scheduled to begin initial operations in October 2003; it will subsequently capture and treat runoff from the North New River Canal basin prior to discharge into WCA-2A. WCA-2A has been the site of intensive research and monitoring; data and findings for this conservation area are primarily found in Chapters 2A, 5, and 6 of the *2004 Everglades Consolidated Report*. A discussion of the STAs is presented in Chapters 4A and 4B of this report.

Water Conservation Area 3 (WCA-3) is the largest WCA, with an area of 2,339 square kilometers (903 square miles). The area is predominantly a vast sawgrass marsh dotted with tree islands, wet prairies, and aquatic sloughs. A cypress forest fringes its western border along the L-28 Gap and extends south to Tamiami Trail. Like WCA-2, WCA-3 was divided into WCA-3A (2,012 square kilometers, or 777 square miles) and WCA-3B (327 square kilometers, or 126 square miles) by two interior levees so that water losses due to levee seepage could be reduced. WCA-3A is the only WCA that is not entirely enclosed by levees. The L-28 Gap allows overland flow to enter WCA-3A from the Big Cypress National Preserve and other western basins (SFWMD, 1992b). Other surface inflows to WCA-3A during WY2003 consisted of flows from WCA-2A, treated water from STA-5 and STA-6, stormwater from the northern and western rural agricultural basins, and water from the highly urbanized C-11W basin along the Lower East Coast (LEC). STA-3/4 is scheduled to begin initial operations in October 2003; it will subsequently capture and treat runoff from the Miami Canal basin prior to discharge into WCA-3A. Less information is available on this area than on WCA-1 or WCA-2, but there is substantial new information (e.g., on tree islands, water quality, and mercury) that is being generated, and it is reported in Chapters 2A, 2B, 5, and 6 of the *2004 Everglades Consolidated Report*. A discussion of the STAs is presented in Chapters 4A and 4B of this report.

Everglades National Park

Everglades National Park encompasses 5,569 square kilometers (2,150 square miles) of freshwater sloughs, sawgrass prairies, marl-forming wet prairies, mangrove forests, and saline tidal areas at the southern end of the Florida Peninsula. The Park was formally established by Congress in 1934 to preserve the unique ecology of the Everglades. The Park was designated by the United Nations as a World Heritage Site in 1979. It has also been named a Federal Wilderness Area, an International Biosphere Reserve, and a Wetland of International Significance. Today, Everglades National Park is the second-largest national park in the United States and is one of the nation's 10 most endangered parks (SFWMD, 1992b).

The Park contains three dominant wetland habitat types: sloughs, marl-forming marshes, and mangroves. Sloughs comprise much of the central drainage of the Park. Shark River Slough consists of a broad, southwesterly arc of continuous wetlands, interspersed with sawgrass stands, open water sloughs, wet prairies, and tree islands extending from Tamiami Trial to the mangrove estuaries of Florida Bay. During wet periods, Taylor Slough (also called Taylor River) provides local flow of fresh water from the eastern side of the Park to Florida Bay. Southern marl-forming marshes are characterized by the formation of marl soils (also known as calcitic mud). Marl is formed by the precipitation of calcite by blue-green algae in submerged algal mats (periphyton) under shallow water and short hydroperiod conditions. Marl-forming marshes occur on the eastern and western margins of Shark River Slough as well as in Taylor Slough and the Rocky Glades. These wetlands occur at a slightly higher elevation than Shark River Slough and exhibit corresponding shallow water depths and shorter hydroperiods. Mangroves, the third major wetland system, occupy the southern and western borders of the Park, where freshwater ecosystems merge with the brackish estuaries of Florida Bay (SFWMD, 1992b). Information on

the Park is scattered throughout the *2004 Everglades Consolidated Report*, with specific data and findings included in Chapters 2A, 5, and 6.

Florida Bay

Florida Bay begins at the extreme southern tip of mainland Florida and includes the body of water that lies between the mainland peninsula and the Florida Keys (SFWMD, 1992b). Florida Bay covers a total area of about 2,200 square kilometers (849 square miles), of which approximately 1,800 square kilometers (695 square miles) lie within Everglades National Park. Florida Bay is a broad, shallow expanse of brackish-to-salty water that contains numerous small islands, extensive sandbars, and grass flats. Florida Bay historically supported important commercial and sport fisheries for invertebrates (lobster, shrimp, sponges) and fishes (snook, redfish, tarpon, sea trout, and mullet). In addition, the warm, shallow waters provide habitats for major populations of birds and for endangered species such as crocodiles and manatees. Much of the productivity and diversity of Florida Bay is dependent on mangroves and seagrasses, and the die-off of seagrasses in the late 1980s was an indication that Florida Bay was seriously threatened by water-management practices in upstream basins (SFWMD, 1992b).

There has been great concern that surface water flows to Florida Bay have been reduced due to increasing competition for available fresh water from agriculture and urban development and from other natural areas. The effects of long-term variations in rainfall patterns and sea-level rise are unknown, but they may be significant (Chapter 6, SFWMD, 1992b). Inputs of both nitrogen and phosphorus are also a concern for Florida Bay (Rudnick et al., 1999). Nutrient sources include the atmosphere, the Gulf of Mexico, and the southern Everglades. The impact of nutrient movement from the Florida Keys and from hydrological changes associated with Everglades restoration are of potential significance to the long-term management of the Florida Bay ecosystem.

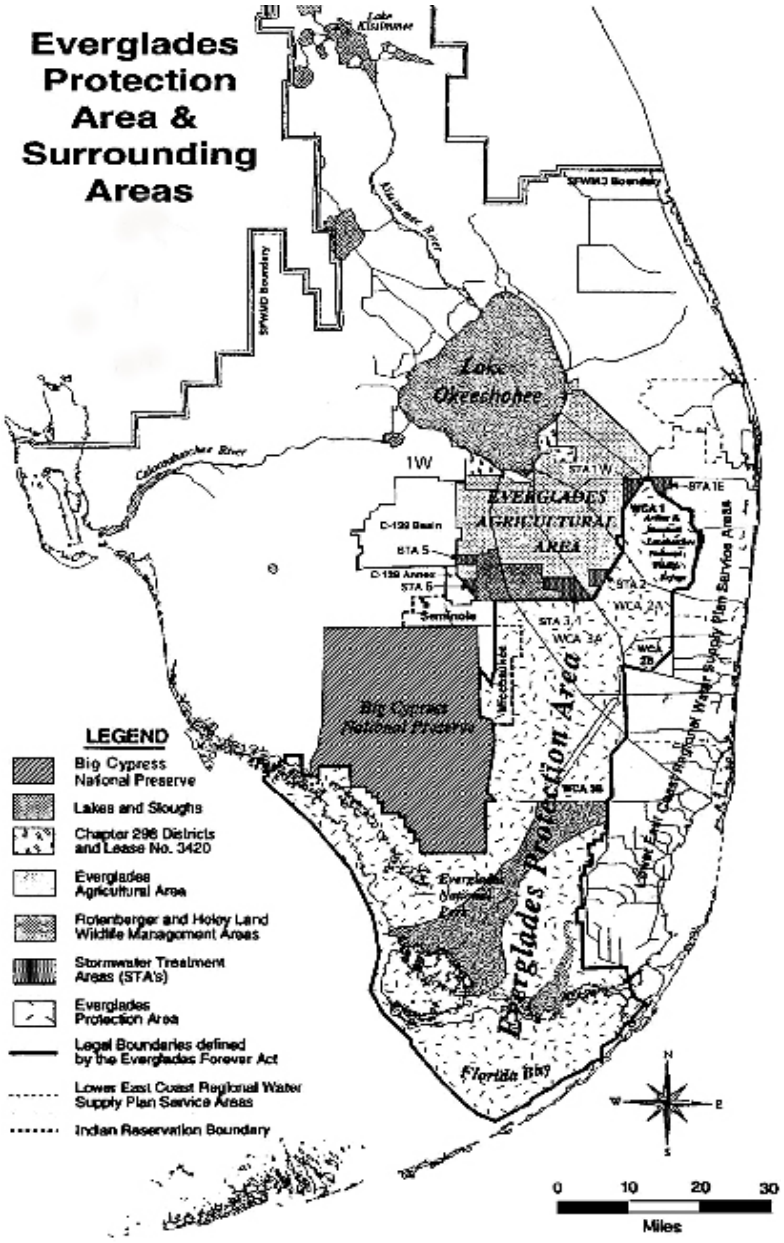

Figure 1-1. Major features of the Everglades Protection Area (EPA) in South Florida.

AREAS SURROUNDING THE EVERGLADES PROTECTION AREA

Several areas adjacent to the modern Everglades are significant because they were part of the historical system. These areas provide significant wildlife corridors and habitat and/or they contribute directly to management problems within the system. These include the Holey Land and Rotenberger Wildlife Management Areas, Everglades Agricultural Area, the C-139 basin, Big Cypress National Preserve, and the Seminole and Miccosukee Indian Reservations (**Figure 1-1**).

Everglades Agricultural Area

The Everglades Agricultural Area (EAA) extends south from Lake Okeechobee to the northern levee of WCA-3A, from its eastern boundary at the L-8 canal to the western boundary along the L-1, L-2, and L-3 levees. It incorporates approximately 2,872 square kilometers (1,122 square miles) of highly productive agricultural land containing rich, organic peat or muck soils. Approximately 77 percent of the EAA, or 2,212 square kilometers (864 square miles), is in agricultural production. Nitrogen-rich, organic peat soils and a warm subtropical climate permit year-round farming. The major crops in the EAA include sugarcane, vegetables, and sod and smaller amounts of rice and citrus. Nutrient-laden water from the EAA is now recognized as a major contributor to enrichment of the Everglades (refer to the subsection below, "The Everglades Restoration Strategy"). As a result, nutrient control is the primary focus of programs under the Everglades Forever Act. Information on the EAA is provided primarily in Chapters 2C and 3 of the *2004 Everglades Consolidated Report*.

Holey Land and Rotenberger Wildlife Management Areas

The Holey Land Wildlife Management Area is a 140 square-kilometer (54 square-mile) tract that is wholly state-owned and managed by the Florida Fish and Wildlife Conservation Commission (FWC). The area is heavily used for hunting of white-tailed deer and hogs. The Rotenberger Wildlife Management Area consists of 96 square kilometers (37 square miles) of state-owned land and is also managed by the FWC for deer and hog hunting. Both of these areas lie within the boundaries of the EAA. In 1983, the South Florida Water Management District (SFWMD or District) and other agencies agreed to restore Everglades values associated with the Holey Land/Rotenberger Tract and to establish water regulation schedules that will simulate the natural hydroperiod. In June 1990, the District and the FWC agreed on improved operational schedules in both the Holey Land and WCA-3A (SFWMD, 1998). In July 2001, treated water from STA-5 began to be discharged into the Rotenberger Tract to restore a more natural hydroperiod. These areas are important for game management, water resource protection, and providing habitat corridors adjacent to the EPA. Both areas will benefit from water treated by the Stormwater Treatment Areas (STAs) to restore a more natural hydropattern (see Chapter 6).

C-139 Basin, Big Cypress National Preserve, and the Seminole and Miccosukee Indian Reservations

Basins located west and northwest of the WCAs discharge into WCA-3A via structures or gaps in the area's western levee. Agriculture is the dominant land use in the C-139, Feeder Canal, and L-28 Interceptor basins. The C-139 basin is the subject of a water quality monitoring program and a regulatory program mandated by the Everglades Forever Act (EFA). These efforts are to ensure that the C-139 basin does not continue its recent high phosphorus loading relative to that

recorded during the 1978–1988 baseline period. Discharges from the C-139 basin are treated in STA-5 up to its hydraulic capacity, with some diversion of untreated water directly to the northern WCA-3A. This untreated portion of the C-139 basin will be captured and treated in STA-6 Section 2, scheduled for completion by December 2006. The remaining land cover in the C-139, Feeder Canal, and L-28 Interceptor basins is predominately wetlands and forested uplands, while the L-28 Gap basin consists almost entirely of wetlands (98 percent) within the Big Cypress National Preserve. Urban land uses occupy 4 percent of the C-139 basin and less than 1 percent of the remaining basins.

The areas immediately west of WCA-3 include reservations of the Seminole Indian Tribe of Florida and the Miccosukee Tribe of Indians of Florida. These areas include extensive private holdings that traditionally have been used for cattle operations on native rangelands or for improved pasture. The basins west of WCA-3A are undergoing rapid agricultural development. Tribal lands within the WCA system should be restored and maintained as natural Everglades habitat for the benefit of the tribes and the Everglades ecosystem.

The 2,280 square-kilometer (891 square-mile) Big Cypress National Preserve was established in 1974 to protect natural and recreational values of the Big Cypress Watershed, while allowing continued hunting, fishing, and oil and gas production. Big Cypress National Preserve also provides an ecological buffer zone and water supply for Everglades National Park. Excessive drainage and the introduction of water of poor quality into Big Cypress National Preserve via the existing canal system are the most significant water management problems. The canals contributing pollutants into the Preserve provide local drainage from lands in the Seminole Indian Reservation and surrounding private lands.

THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT, OTHER GOVERNMENTAL AGENCIES, AND THE EVERGLADES PROGRAM

The Central and Southern Florida Flood Control District was created in 1949 to serve as local sponsor for the Central and Southern Florida Project, a multipurpose water-resources project authorized by Congress. In 1973, the agency was renamed the South Florida Water Management District in response to a broadened mission. The District (or SFWMD) is now responsible for environmental resources management of approximately 17,000 square miles in South Florida, with an agency mission that includes water supply, flood protection, water quality protection, and environmental enhancement.

The District's partner in many of its responsibilities is the Florida Department of Environmental Protection (FDEP). Based on statute, the District operates under the general supervisory authority of the FDEP, and many of the District's programs rely on close cooperation between the agencies. The FDEP issues permits to the District for the operation of water control structures. The District and the FDEP are specifically named as partners in the recently amended Everglades Forever Act, with shared responsibility for various activities in the Everglades Program, including the production of the *2004 Everglades Consolidated Report* (see RAM-8, **Table 1-1**). The FDEP has taken the lead in developing Chapter 2A on water quality and has provided input on many other sections of this report.

The seven elements of the Everglades Program from the 1994 Everglades Forever Act are outlined in **Table 1-1**, along with the Research and Monitoring (RAM) projects that provided

much of the information summarized in this report. Most of these activities are being continued under the auspices of the amended (2003) Everglades Forever Act, which incorporates the Conceptual Plan for Achieving Long-Term Water Quality Goals (known as the Long-Term Plan) as a means of implementing Best Available Phosphorus Reduction Technology (known in the EFA as BAPRT). **Table 1-1** also ties these activities to chapters in the *2004 Everglades Consolidated Report* and provides a brief summary of their status.

Particularly important components of the Everglades Program include the Everglades Construction Project (ECP), discussed in Chapters 4A and 8; agricultural Best Management Practices (BMPs), covered in Chapter 3; and research on Advanced Treatment Technologies (ATTs) for treating stormwater (Chapter 4B). Another major component of the Everglades Program, the Everglades Stormwater Program (ESP) covered in Chapter 8B, includes developing the means to ensure water quality compliance for structures discharging into, from, or within the EPA. The Everglades Stormwater Program moves beyond the Everglades Construction Project to ensure that water quality standards will be met for areas of the EPA not directly involved in the ECP. Information from the results of the various projects of the Everglades Program was applied in the development of the Long-Term Plan (Chapter 8A). The hydrological status of the Everglades is the subject of Chapter 5. Chapter 6 updates information on the effects of altered hydrology in the EPA.

Table 1-1. Seven elements and associated projects of the Everglades Program authorized through the Everglades Forever Act, as amended in 2003. The *2004 Everglades Consolidated Report* originated from the RAM-8 project.

Element Titles (7) Project Abbreviations and Titles (56)		Completion Dates	Chapter Coverage in the *2004 Everglades Consolidated Report* (ECR)
1. Everglades Construction			
Everglades Construction contains 18 projects including 5 Stormwater Treatment Areas (STAs) and 3 hydropattern restorations.		Projects and pre-2006 enhancements by 12/31/2006	Construction is not covered specifically in the 2004 ECR, but the Everglades Construction Project (ECP) and its products are mentioned throughout the report, especially in Chapters 4A, 4B, and 8A.
2. Hydropattern Restoration			
Of the 7 projects in this element, four are completed as of 12/31/98.		Most projects by 12/31/1999, all by 10/01/2003	Chapters 5 and 6 mention hydropattern issues; also discussed in Chapters 7 and 8A.
3. Research and Monitoring (RAM)			
RAM-1	Describe Water Quality in the Everglades Protection Area (EPA) and Tributary Waters	01/31/1996	Chapter 2A covers EPA water quality in detail; Chapter 8A includes issues in tributary basins.
RAM-2	Evaluate Best Management Practices (BMPs) Effectiveness	12/31/2001; ongoing under Conceptual Plan	Chapter 3 is devoted to the EAA BMP implementation. BMPs for tributaries are considered in Chapter 8B.
RAM-3	Evaluate Existing Water Quality Standards for the EPA	12/31/2001	Chapter 2A covers annual evaluation of water quality in detail.
RAM-4	Evaluate Water Quality Standards and Classifications of Everglades Agricultural Area (EAA) Canals	12/31/2001	Chapters 1 and 2A; canal evaluations are not completed to date.
RAM-5	Optimize STA Operation	Ongoing under Conceptual Plan	Chapter 4A discusses this work and STA performance to date.
RAM-6	Interpret Class III Phosphorus Criterion Research	12/31/2002	Continuing Everglades research is covered in Chapter 6.
RAM-7	Peer-Reviewed Interim Report	01/01/1999	Product of RAM-7 is the *1999 Everglades Interim Report.*
RAM-8	Peer-Reviewed Annual Report, Everglades Consolidated Reports	01/01/2000 and yearly to 2006	RAM-8 provides updates; to date, 2000–2004 Everglades Consolidated Reports are published.
RAM-9	Monitor C-139 Basin Water Quality	05/01/1995, ongoing	Covered in Chapter 3.
RAM-10	Hydrological Needs of the Ecosystem	12/31/2001	Detailed in Chapters 5 and 6; also mentioned in Chapters 4A and 7.
RAM-11	Mercury Monitoring and Research	12/31/2001; aspects ongoing	Covered in detail in Chapter 2B; also included in Chapter 4A for STAs.
RAM-12	Identify Advanced Treatment Technologies	Most completed; ongoing under Conceptual Plan	Covered in detail in Chapter 4B; also discussed in Chapter 8A.
RAM-13	BMP Strategies for Other Water Quality Parameters	12/31/2006	Not covered directly in the 2004 ECR; relevant information is presented in Chapters 2A, 3, 4A, 4B, and 8A.

Table 1-1. Continued.

Element Titles (7) Project Abbreviations and Titles (56)	Completion Dates	Chapter Coverage in the *2004 Everglades Consolidated Report* (ECR)
4. Regulation Projects		
This element includes 10 projects; three are now completed.	All projects by 12/31/2006	Projects are mentioned in Chapters 1, 3, and 8C.
5. Exotic Species Control	Ongoing	Covered in Chapter 8E; also mentioned in Chapter 6 and others.
6. Funding Projects	Ongoing	Covered in Chapter 8D.
7. Everglades Annual Reports	Ongoing	The 2004 ECR encompasses annual reporting requirements; the Executive Summary provides all information required in the Annual Report.

ENVIRONMENTAL ALTERATION AND RESTORATION OF THE EVERGLADES PROTECTION AREA

ENVIRONMENTAL PROBLEMS FACING THE EVERGLADES

Landscape development is changing ecosystems dramatically around the world. Hydrological alterations are recognized as a major threat to public lands and other ecosystems (Pringle, 2000; Rosenberg et al., 2000). Dams and other changes to flowing waters associated with development have resulted in huge modifications to the hydrology and chemistry of large aquatic ecosystems, including the oceans (Dynesius and Nilsson, 1994; Chao, 1995; Justic et al., 1995; Humborg et al., 2000). Unfortunately, the Everglades is no exception to these trends. This ecosystem has been altered fundamentally by changes in spatial extent, hydrology, and water quality.

The Everglades Protection Area (EPA) includes the Water Conservation Areas, the Arthur R. Marshall Loxahatchee National Wildlife Refuge, and the Everglades National Park, encompassing most of what remains of a once-larger Everglades ecosystem. This larger system once extended from the south shore of Lake Okeechobee to the mangrove estuaries of Florida Bay and covered more than 10,000 square kilometers. Urban development and agricultural development during the 20th century have reduced the present-day Everglades to 50 percent of its original size (Mitsch and Gosselink, 2000). Of this remaining area, 3,400 square kilometers have been impounded within the WCAs (SFWMD, 1992a & b; Light and Dineen, 1994). The remaining wetland contains a variety of habitats that support unique biotic communities and is still widely recognized as an ecosystem of immense regional and international importance (SFWMD, 1992a; Lodge, 1994; Maltby and Dugan, 1994).

The loss of spatial extent has been accompanied by altered flow regimes and water quality. As a result, overall biotic integrity of the remaining Everglades is endangered. This position is based, in part, on undesirable changes observed in water quality, flora, and fauna in portions of the EPA during the past several decades (Davis and Ogden, 1994). These changes include establishment of pronounced nutrient gradients in the WCAs downstream of major discharge structures; replacement, with cattail, of large areas once dominated by open-water sloughs, sawgrass, and periphyton; decline in wading bird populations; and species changes in periphyton and macroinvertebrate communities (Davis and Ogden, 1994; SFWMD, 1992a & b). These environmental impacts have been attributed to urban and agricultural development, a disruption of the system's natural hydroperiod, and an introduction of nutrient-rich runoff to the EPA from the 2,800 square-kilometer Everglades Agricultural Area (EAA) (SFWMD 1992a, b, c; Chapters 2 and 3 in 2000 and 2001 Everglades Consolidated Reports). Such impacts from agricultural drainage are not unique to South Florida and are often severe (Lemly et al., 2000). Exotic plant species also pose a serious problem in the EPA (covered in Chapter 8E). In addition, mercury in the Everglades remains a concern, although recent regulatory actions have been effective in reducing emissions to the atmosphere (covered in Chapter 2B).

Phosphorus (P) has been identified as the nutrient most responsible for changes in periphyton and plant communities within the EPA (Koch and Reddy, 1992; McCormick and O'Dell, 1996; McCormick et al., 1998). Reducing phosphorus loading to the EPA is central to the state of Florida's strategy for restoring and preserving the Everglades, as described in the following section of this chapter. The undesirable changes in the biotic communities of the Everglades are also associated with alterations in the hydropatterns of the ecosystem. Research on the hydrological needs of the EPA and data and findings on current hydrological status are

summarized in Chapter 6. In addition, mercury, a heavy metal, is a potential challenge to Everglades restoration. A long-term, multiagency program has contributed greatly to our understanding of this toxic metal in South Florida, and findings from research and monitoring on mercury are detailed in Chapter 2B and its appendices.

THE EVERGLADES RESTORATION STRATEGY

Restoration of the Everglades ecosystem is a national, even international, imperative. The Florida Legislature stated the mandate succinctly in the Everglades Forever Act:

> ...the Everglades ecological system not only contributes to South Florida's water supply, flood control and recreation, but serves as the habitat for diverse species of wildlife and plant life. The system is unique in the world and one of Florida's great treasures. The Everglades ecological system is endangered as a result of adverse changes... and, therefore, must be restored and protected. (Section 373.4592, Florida Statutes [F.S.])

The international importance of the restoration activities in the Everglades was made clear in the IV Inter-American Dialogue on Water Management (Iguazu Falls, Brazil, September 2-6, 2001). A special session was held during the conference on the Everglades-Pantanal Initiative, and the final report from that session concluded:

> The South Florida Water Management District and the U.S. Army Corps of Engineers are implementing a comprehensive restoration program in the Everglades region -- the largest undertaking of this nature ever attempted. The experience gained in this endeavor will overtime provide areas such as the Pantanal not only a wealth of data on water quality parameters, management of exotic species, and public involvement processes, but will also assist those with wetlands management responsibilities to avoid problems encountered in this process over the long-term. (IV Inter-American Dialogue on Water Management, Final Draft Report, Inter-American Water Resources Network, Washington, D.C., September 2001)

Although this massive undertaking is unique in scale and complexity, it follows a philosophy of environmental management that addresses the manifestations of excess nutrient inputs (Carpenter et al., 1998; Smith et al., 1999). The restoration strategies described below – and throughout this report – are guided by prior successes in reversing problems associated with nutrient enrichment in aquatic ecosystems around the world. Classic restoration case histories include Lago Maggiore, Italy (de Bernardi et al., 1996), Lake Washington, U.S.A. (Edmondson, 1991), the Chesapeake Bay, U.S.A. (Malone et al., 1996), and the Thames River and Estuary, England (Gameson and Wheeler, 1977). While these cases provide evidence that large-scale restorations are feasible, the spatial extent and unique ecology of the Everglades pose a suite of challenges, which are being met by the strategies and programs described below. Everglades restoration will require an unparalleled effort to improve both the flow regime to the ecosystem and the overall quality of tributary waters.

Florida's Everglades Forever Act establishes both interim and long-term water quality goals to ultimately achieve restoration and protection of the Everglades Protection Area. The interim program encompasses those activities currently underway to reduce phosphorus (P) concentrations to a long-term average of 50 parts per billion (ppb) from the northern tributaries. The program also includes the Everglades Agricultural Area's Best Management Practices (BMPs) (Chapter 3) and the Everglades Construction Project (ECP) (Chapters 4A and 4B). The long-term goal is to combine point-source, basin-level, and regional solutions in a systemwide approach to ensure that all waters discharged to the EPA are achieving water quality goals

(Chapter 8A). With respect to nutrients, the long-term goal is to reduce nutrient discharges to levels that do not cause an imbalance in natural populations of aquatic flora or fauna. If the interim programs are not capable of achieving water quality standards in all discharges to the EPA by December 2003, the EFA has mandated the District to prepare a plan to do so. Achieving the long-term water quality goal will require integration of numerous research, planning, regulatory, and construction activities, as outlined in Chapter 8A of this report and as detailed in the Long-Term Plan.

Best Management Practices

Best Management Practices (BMPs) have been implemented in the Everglades Agricultural Area (EAA) and have proven successful at reducing P loading from those basins. The source reduction of P discharged from farms, towns, and other land uses within the Everglades Agricultural Area has been approached through BMPs. An EAA-wide target of 25-percent load reduction, compared to the May 1979 through April 1988 pre-BMP period, was established by District rulemaking (Chapter 3). Over the last several years, these BMPs have reduced P loads by approximately 50 percent, with an associated reduction of more 1,200 metric tons of P that would have otherwise entered the Everglades. The P concentrations have also been reduced significantly from the pre-BMP period. The agricultural industry, with support from state and federal agencies, is continually investigating additional measures to enhance the existing BMP programs. If proven cost-effective, additional BMPs could be implemented to reduce the overall costs and scale of the long-term water quality solutions. Additional details on the BMP programs are provided in Chapter 3 of this report.

Stormwater Treatment Areas

While BMPs have proven effective, additional P reduction is necessary to achieve the interim goal of 50 parts per billion (ppb) required by the Everglades Forever Act (EFA). Large constructed wetlands are the primary regional treatment component in the phosphorus control program for the Everglades, codified in the 1994 EFA and the federal Everglades Settlement Agreement. These constructed wetlands, referred to as Stormwater Treatment Areas (STAs), sequester P in the soils and biomass through naturally occurring biological phenomena and are designed to reduce the P concentration and load entering the EPA. The basis of design for the STAs is provided in conceptual design documents by Burns and McDonnell (1992), Kadlec and Newman (1992), and Walker (1995). The EFA established the funding mechanisms and construction timetable for the STAs as part of the Everglades Construction Project (ECP), as well as other restoration projects. **Figure 1-1** shows the locations of STAs. To date, four of the six STAs, totaling about 20,000 acres, are operational; three of those are performing better than expected. The fourth has received higher than anticipated P loads, and upstream source controls as well as internal management practices are being implemented. To date, the STAs have removed 340 tons of P that would otherwise have entered the Everglades. The remaining two STAs, totaling about 22,000 acres, should begin operations within the next year. Additional details on STA performance and STA optimization research are provided in Chapters 4A and 4B.

Advanced Treatment Technologies Research

The EFA also required the District to conduct research and monitoring programs designed to, among other things, optimize or supplement the P removal performance of the STAs to achieve optimum water quality for the benefit of the Everglades. These programs, described in

Chapter 4B of this report, are providing the District with the information necessary to achieve this mandate.

Phosphorus Research and Rulemaking

The FDEP has taken the lead in summarizing available information on nutrient effects in Chapter 5 of the *2003 Everglades Consolidated Report* and in earlier Everglades Consolidated Reports. The FDEP also conducts QA/QC reviews of the data and peer reviews of the research effort to ensure that regulatory decisions are based on a strong scientific foundation. This phosphorus research was used as the foundation for rulemaking to establish a numeric P criterion for the Everglades, which was a requirement of the EFA.

On July 18, 2003, the Environmental Regulation Commission adopted a 10 part per billion (ppb), numeric water quality criterion for phosphorus in the Everglades Protection Area (to be codified as 62-302.530-540, Florida Administrative Code, F.A.C.). The rule also includes a compliance methodology. In accordance with the EFA, that compliance method for the Arthur R. Marshall Loxahatchee National Wildlife Refuge and the Everglades National Park is the same as that included in the settlement agreement entered in the case, United States versus South Florida Water Management District, et al., case number 88-1886-civ- Hoeveler (S.D. Fla.). The rule also contains moderating provisions, which set forth the parameters for issuing permits to structures that discharge into the Everglades. The rule is currently under review pursuant to Chapter 120, F.A.C.

Comprehensive Everglades Restoration Plan (CERP)

The objectives of the Comprehensive Everglades Restoration Plan (CERP) are stated in the Water Resources Development Act 2000, Title VI, Sec. 601, (h),(1):

> IN GENERAL – The overarching objective of the Plan is the restoration, preservation, and protection of the South Florida Ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, the improvement of the environment of the South Florida Ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized.

CERP will restore the ecological integrity of the South Florida ecosystem, while continuing to provide flood protection, agricultural and urban water supply, and other project purposes. Interim and final results from CERP will be integrated into long-term implementation activities subject to funding and timing constraints. More information on the Restoration Coordination and Verification (RECOVER) monitoring and assessment activities for the Comprehensive Everglades Restoration Plan (CERP) is provided in Chapter 7 of the *2004 Everglades Consolidated Report*. The status of projects being implemented through CERP is beyond the scope of this report.

- Many other restoration and water management projects are being conducted through federal-state partnerships not included directly in CERP. Many examples, such as the Kissimmee River Restoration Project, multiple land acquisitions for water management projects, and ENP/Modified Water Deliveries, are described on the District's Website for major projects at http://www.sfwmd.gov.

Everglades Stormwater Program

The Everglades Construction Project covers 7 of the 15 major basins that discharge into the Everglades Protection Area. The water quality strategies for the remaining 8 basins and the interior waters of the Everglades were identified in the permit issued in April 1998, which is referred to as the "non-ECP" permit. These schedules and strategies are being implemented through the District's Everglades Stormwater Program (ESP). This program includes a combination of regulatory analyses, water quality evaluations, and water quality improvement measures. The Everglades Stormwater Program is described more fully in Chapter 8B.

The Conceptual Plan for Achieving Long-Term Water Quality Goals

Previous versions of the ECR documented the state's efforts to implement the interim requirements of the EFA. Included in each of the previous reports, however, was a discussion of the challenges the state must overcome to achieve its restoration goals (e.g., lack of funding). These challenges must be resolved before December 31, 2003, which is the District's deadline for submitting its long-term plan to achieve water standards by December 2006. For the past several years the District and other parties have been researching ways to reduce phosphorus inflows to the Everglades. Based on extensive basin-specific feasibility studies (see Chapter 8 of the *2003 Everglades Consolidated Report*), a long-term plan was developed for all discharges to achieve water quality standards by December 2006.

The recommended strategy combines controlling P at the source, enhancing the performance of the STAs, and integration with CERP projects to avoid unnecessary and duplicative costs. That strategy is documented in the Everglades Protection Area Tributary Basins Conceptual Plan for Achieving Long-Term Water Quality Goals Final Report (known as the Long-Term Plan). The plan identifies specific enhancements to the existing STAs and requires them to be implemented by December 2006. Examples of these enhancements include additional levees and water control structures to improve hydraulics, modified vegetation communities in the STAs to increase phosphorus uptake, and refined operations. In addition to STA optimization, the Long-Term Plan also recommends that additional source control measures be implemented in all the tributary basins to minimize phosphorus-laden runoff. Examples of such measures include stormwater retention ponds, agricultural best management practices to prevent over-application of fertilizers, and diversion structures and impoundments to prevent water from flowing into the Everglades. The Long-Term Plan also includes activities designed to accelerate the recovery of areas within the EPA that are already impacted. Complete details about the Long-Term Plan are provided in Chapter 8B

Long-term simulations of the pre-2006 STA enhancements for the ECP basins predict future discharge concentrations in the range of 10 to 14 ppb (geometric mean). It is estimated that discharges from the ECP basins will account for approximately 88 percent of waters flowing into the Everglades based on present schedules. Pre-2006 source control and diversion measures will reduce inflows from the remaining basins from an average of above 50 ppb to approximately 42 ppb (flow-weighted mean). Significantly, under the Long-Term Plan, phosphorus removal will also be coordinated with the $8 billion, federal-state Comprehensive Everglades Restoration Plan (CERP). For example, cost savings of well over $100 million are possible by integrating the C-11 West basin CERP impoundment and diversion projects with other water quality improvement measure mandated under the EFA. Thus, when CERP projects are completed in the non-ECP basins, inflows are predicted to decrease to below 15 ppb (flow-weighted mean).

The Long-Term Plan, which is estimated to cost approximately $451 million to implement, also includes additional research to find new ways to further reduce phosphorus inflows to achieve the phosphorus criterion in the EPA. The plan then requires additional capital improvements to implement the newly discovered measures, if the pre-2006 measures do not achieve the criterion in the EPA.

CONTENT OF THE 2004 EVERGLADES CONSOLIDATED REPORT

REPORT OBJECTIVES

The first and foremost objective of the *2004 Everglades Consolidated Report* is to update and summarize available data and findings relating to the Everglades restoration effort. Information in this report will be used by the District and the Florida Department of Environmental Protection (FDEP) for making decisions affecting implementation of the Everglades Construction Project (ECP) and other restoration and management activities described in the Conceptual Plan. This year's edition of the report builds on and updates information in earlier versions, without repeating detailed technical information. This report is part of an ongoing process to provide information for decisions and updates on important programs. In addition, this report satisfies, or partially satisfies, the reporting requirements and specifications of multiple permits, including the U.S. Army Corps of Engineers (USACE) Section 404 permit for the ECP; FDEP permits for the ECP; and the Non-ECP permit issued by the FDEP. In the various chapters and appendices, District authors also provide information needed for resource management, even if a specific requirement for reporting is not required.

This *2004 Everglades Consolidated Report* has been produced pursuant to section 373.4592(4)(d) 6, F.S., which requires the District to submit an annual peer-reviewed report to state officials. This requirement is RAM-8 of the Everglades Program (**Table 1-1**). The scientific workshops and public hearing are part of the peer review process and were held September 23 through 25, 2003. Through that review process, numerous other agencies or organizations contributed information and focus to this report. However, peer review is not required to include a public hearing with public access to the review panel. The District and the FDEP elect to hold a public hearing and to conduct an open panel review for this report, because the issues being communicated are very important to local resource agencies and to the public. Furthermore, the issues deserve open deliberation before a panel of objective experts. This review process is described later in this chapter.

The contents of the *2004 Everglades Consolidated Report* are the same as those of earlier Everglades Consolidated Reports and are set forth in the EFA (Section 373.4592(4)(d)5, F.S.) as follows:

> The interim report shall summarize all data and findings available as of July 1, 1998 on the effectiveness of STAs and BMPs in improving water quality. The interim report shall also include a summary of the then-available data and findings related to the following: the Lower East Coast Water Supply Plan of the district, the United States Environmental Protection Agency Everglades Mercury Study, the United States Army Corps of Engineers South Florida Ecosystem Restoration Study, the results of research and monitoring of water quality and quantity in the Everglades region, the degree of phosphorus discharge reductions achieved by BMPs and agricultural operations in the

region, the current information on the ecological and hydrological needs of the Everglades, and the costs and benefits of phosphorus reduction alternatives.

For purposes of this report, "available data and findings" and "then-available data and findings" are interpreted as data that were subjected to quality control and complete technical interpretation by about July 1, 2003. In most cases, by this date, authors had access to all data from Water Year 2003 (WY2003), the period from May 1, 2002 through April 30, 2003. Most data summaries in this report use the WY2003 period. This period is especially appropriate for addressing environmental issues in South Florida, because it generally follows the overall wet/dry cycles of South Florida's subtropical environment, and it is consistent with calculations done in the Everglades Regulatory Program described in Chapter 3.

LEGAL AND REPORTING REQUIREMENTS

The District's Everglades restoration efforts entail numerous reporting mandates. These legal requirements include the following:

- An Everglades Forever Act Annual Report, required by Section 373.4592(13), F.S., submitted to the Florida Department of Environmental Protection (FDEP), the Florida governor's office, and the leaders of the Florida legislature. That report must include a summary of the water conditions in the Everglades Protection Area, the status of the impacted areas, the status of the construction of the STAs, the implementation of the BMPs, and actions taken to monitor and control exotic species.
- An annual peer-reviewed report, required by Section 373.4592(4)(d)6, F.S., also submitted to the FDEP, the Florida governor, and legislative leaders regarding the research and monitoring program that summarizes all data and findings as an update on topics included in the 1999 *Everglades Interim Report*, required by Section 373.4592(4)(d)5, F.S.
- A Joint Legislative Committee on Everglades Oversight (JLCEO) Report, required by Section 11.80(4), F. S., submitted to the legislative committee and addressing changes to the Everglades Construction Project, and analyzing costs and revenues.
- A Non-Everglades Construction Project permit annual report, required by Section 373.4592(9)(k) and (l), F.S., and by FDEP Permit No. 06, 502590709, to be submitted to the FDEP and to address water quality at structures associated with the Everglades Protection Area that are not included in the Everglades Construction Project. This report also addresses schedules and strategies to improve that water quality.
- A 404 permit report(s), required by Permit No. 199404532, submitted to the U.S. Army Corps of Engineers (USACE) and addressing the District's strategy for achieving water quality standards and updating USACE on the activities authorized or otherwise regulated by the permit.
- A series of reports on the Stormwater Treatment Areas from National Pollutant Discharge Elimination System permits and Everglades Forever Act permits and to be submitted to the FDEP and the U.S. Environmental Protection Agency. These permits require information on the quality of water discharged from the

treatment systems as well as on the progress of the treatment systems at improving water quality.

This *2004 Consolidated Everglades Report* is submitted in compliance with these reporting requirements. By consolidating all the requirements into a single document, the District ensures that its evaluation of annual data on the Everglades is both comprehensive and cost-effective. Furthermore, the Everglades Consolidated Report is intended to ease the review process for other agencies, organizations, and interested persons and to provide a single source of information on the Everglades for use in decision making.

REPORT DEVELOPMENT AND FORMAT

The *2004 Everglades Consolidated Report* is written with varying levels of technical detail and synthesis, including an Executive Summary with major findings and the technical report, organized in a framework of eight chapters. The Executive Summary of the *2004 Everglades Consolidated Report* is written for a diverse readership and provides an abstract of the report's key facts and supporting information. It has been developed to highlight findings of relevance to environmental decision makers, particularly with regard to decisions on the ECP and associated projects. The Executive Summary fulfills all the information needs formerly addressed through the Everglades Annual Report.

The technical document conveys data and findings in each topic area and is the main product of this reporting effort. It is supported and enhanced by an extensive volume of appended documentation, referenced throughout the main body of the report. These appendices provide data summaries and detailed analyses for the special-interest reader. Many of the appendices include data tables required for compliance with various permits.

Several important factors are essential to understanding all Everglades Consolidated Reports. First, for the most part authors do not repeat technical discussions that have been published in the peer-reviewed literature; they are expected to provide readers with appropriate citations to the primary information source. Second, authors can only report data that are readily available and quality assured as of about July 1, 2003 for WY2003, which ends April 30, 2003. Third, publications used for this report must be complete and interpretable by standard scientific norms. Finally, the reader should recognize that the report is not a formal part of any legal or administrative process. Interpretation of wording in this report must be done from a technical, not a legal, perspective.

CHAPTER ORGANIZATION AND CONTENT

The *2004 Everglades Consolidated Report* is comprised of the technical report in a framework of eight chapters with related appendices and an Executive Summary. The *2004 Everglades Consolidated Report* contains the same topical coverage as earlier versions with the same basic chapter organization. This introductory chapter provides background for the report and a basic outline of the projects and programs described throughout the document. The subsequent chapters (Chapters 2A through 8F) each contain a summary, background on topics, technical discussion of data, findings, strategies for obtaining additional information, and references cited in the chapter. The Executive Summary summarizes information about important issues and guides the reader to sources of additional information in this report. It is written as an abstract of critical information and conclusions for decision makers.

The topics covered in each chapter are highlighted here. Water quality status and trends for standard Class III parameters in the Everglades Protection Area (EPA) are the subjects of Chapter 2A, 2B, and 2C. Chapter 2B specifically covers issues concerning mercury in the EPA and includes an update on mercury research and monitoring in support of risk analysis for mercury contamination associated with the Everglades Construction Project. A history and summary of actions taken under the Everglades Regulatory Program, a BMP program in the Everglades Agricultural Area, are provided in Chapter 3. Chapters 4A and 4B provide a detailed account of information gathered on the performance of the STAs and STA optimization research. The hydrological status of the Everglades Protection Area is summarized in Chapter 5. This chapter has been modified in content from previous Everglades Consolidated Reports, because the phosphorus rulemaking process is now complete. The effects of altered hydrology on Everglades ecology is the subject of Chapter 6. Chapter 7 summarizes the ongoing activities under the RECOVER program of the Comprehensive Everglades Restoration Plan. Chapter 8 is comprised of six sections, all concerning other important Everglades programs. Specifically, Chapters 8A and 8B describes the strategy for achieving water quality goals through the Conceptual Plan for Achieving Long-Term Water Quality Goals in the Everglades Protection Area. Chapters 8C, 8D, 8E, and 8F give status reports on land acquisition, fiscal resources, control of exotic species, and water supply plans for Florida's Lower East Coast.

PEER REVIEW OF THE EVERGLADES CONSOLIDATED REPORT

The *2004 Everglades Consolidated Report* was developed through a two-step review and revision process described previously. Following internal review and revision during July and August 2003, an updated and revised draft of this report was distributed for external public review on the District's Website at http://www.sfwmd.gov. A scientific review panel also received this report during September 2003 (see below). The requirement for peer review is specified by narrative from the EFA (373.4592(4)(d) 6):

> Beginning January 1, 2000, the District and the Department [FDEP] shall annually issue a peer-reviewed report regarding the research and monitoring program that summarizes all data and findings.

The District organized the external review of this report in accordance with (1) typical scientific review practices, (2) the independent panel review process required by Florida Statute for evaluating Minimum Flows and Levels (Section 373.042 [4], F.S.), and (3) "government in the sunshine" provisions of Florida statutes. In the context of this review process, "independent" means the panelists should have no substantial personal or professional relationship with the District or any other organization involved in environmental management in South Florida. Maintaining such independence provides reasonable assurance that reviewers will be objective in evaluating materials presented in this report, as such objectivity is the cornerstone of a bonafide review process. The panel reviewed this report independently, and then interacted with each other and the public over a WebBoard and through public hearings conducted **September 23–25, 2003**. The panel collaborated in providing recommendations, a draft report, and a final report to the District. The breadth of this report and the need for interaction with reviewers require that the Everglades Consolidated Report be reviewed by such a group of experts, as described below.

A general Statement of Work was developed for the review process and was modified to fit the specific role of each panelist. Panelists were given a Purchase Order and Statement of Work by the District to provide the following review services on the Everglades Consolidated Report:

- **Read selected chapters of earlier Everglades Consolidated Reports**. Each panelist was asked to focus attention on assigned chapters closest to their areas of expertise. Broad reading of the *2003 Everglades Consolidated Report* was encouraged as general background for the *2004 Everglades Consolidated Report* and associated public hearings. Earlier Everglades Consolidated Reports were available through the District's Website at http://www.sfwmd.gov and should be read, as needed, on specific issues during the review.
- **Read assigned chapters of the *2004 Everglades Consolidated Report***. Prior to the public hearing, panelists reviewed assigned chapters of the *2004 Everglades Consolidated Report* and prepared a preliminary written review, including questions to be addressed by District staff. All communications between the panelists were done "in the sunshine" through the WebBoard linked to the District's Website at http://www.sfwmd.gov.
- **Participate in the public hearings as a panelist from September 23 through 25, 2003 in West Palm Beach**. The panel participated in public workshops, noticed as public meetings in accordance with "government in the sunshine" statutes. One day was devoted to water quality, STAs and ATTs. The second workshop day concentrated on the long-term strategy to control phosphorus entering the Everglades Protection Area and on the status of RECOVER and other Everglades programs.
- **Develop a draft Panel Report with conclusions and recommendations**. During a working session on **September 25, 2003**, following the public workshops, the panel developed their draft conclusions and recommendations on the *2004 Everglades Consolidated Report*.
- **Collaborate with the other panelists in writing the final report**. The panel's final report summarized conclusions and recommendations and included a narrative with details to the extent the panel deemed appropriate for each chapter. Public comments contributed before and during the hearings were considered by the panel. The final report was delivered to the District on **October 13, 2003** and is provided in Appendix 1-1 of this report.
- **Panel Chairperson, additional responsibilities**. Additional duties of the Chairperson included: communicating with the panelists as needed to ensure consistent interpretation of the Statement of Work; assisting panelists as necessary in the use of the Website for posting reviews and ensuring that panelists used this site for all communication; while in West Palm Beach, conducting organizational meetings as needed to keep the review process well focused; chairing the workshops and working session, September 23 through 25, 2003; organizing the panel's preparation of draft and final reports to the District; and ensuring that the final report was well edited and delivered to the District on schedule.

This intensive public and panel review resulted in extensive written comments and suggestions to the report's authors. Comments from the peer-review panel, as posted on the *2004 Everglades Consolidated Report* WebBoard, appear in Appendix 1-1. Public comments posted to this WebBoard appear in Appendix 1-2, and the authors' responses to all comments are found in Appendix 1-3. Appendix 1-4 contains the final report of the peer-review panel, reproduced verbatim. Each of the authors of the *2004 Everglades Consolidated Report* benefited from the thorough and incisive suggestions of the expert panel. Advice from the panel and from other reviewers guided the authors through a major revision of this report during October and November 2003.

PANELISTS REVIEWING THE 2004 REPORT

Selecting panelists for the *2004 Everglades Consolidated Report* review was based on the success of previous reviews. Authors and interested parties felt strongly that having panelists serve more than once improves their review comments by allowing more time for deliberation of relevant technical matters and less time in "getting up to speed" on the details of Everglades issues. The District and the FDEP received many favorable comments on the panel's performance in 2002 in grappling with difficult Everglades issues and in providing thoughtful and constructive comments to both agencies in their review. As a result of these considerations, the panelists from last year's review process reviewed the *2004 Everglades Consolidated Report*.

In accordance with earlier reviews of the Everglades Consolidated Reports and with routine practice in scientific peer review, professional expertise and experience in the major subject areas covered by this report were the primary criteria used for selecting these panelists for the 2004 process. Knowledge of environmental management and decision making was also important for these well-qualified panelists, and they continued to be free of any professional connection to interests or organizations in South Florida, ensuring their independence. Biographical sketches for the panelists are provided below, along with chapter assignments and specific strengths they brought to the *2004 Everglades Consolidated Report* review process.

Expert 1: Chairperson: Dr. Jeffrey L. Jordan, Professor, Department of Agricultural and Applied Economics, University of Georgia, Griffin, Georgia

Through extensive postdoctoral experience in agricultural economics and water resource policy, Dr. Jeffery Jordan is recognized for his work in modeling water demand and allocation, conservation planning, survey design, and other aspects of water resource analysis. This diverse experience in water-related economic and policy analyses is demonstrated in more than 35 peer-reviewed articles, 45 miscellaneous publications, one book, and several book chapters authored during his productive career with the University of Georgia. Dr. Jordan is well acquainted with general environmental and water quality issues being faced in South Florida. For the past several years, he fulfilled all contract requirements very effectively as panel chairperson for the peer review of the 2000, 2001, and 2002 Everglades Consolidated Reports. Earlier, he served on the peer-review panel for the Lake Okeechobee Minimum Flows and Levels, the Spalding County Water Authority, and the Georgia Water Wise Council. Together, these qualities made him ideally suited as the chairperson of the peer-review panel for the *2004 Everglades Consolidated Report*. He also specifically reviewed chapters on other Everglades programs (Chapter 8), the RECOVER program in the Comprehensive Everglades Restoration Plan (CERP) (Chapter 7), and hydrological aspects of the Everglades (Chapter 5), and the Introduction (Chapter 1).

Expert 2: Dr. Richard A. Meganck, Rector, United Nations University for Water Science and Education, Delft, the Netherlands

Dr. Richard Meganck is highly experienced in planning for development and natural resource management internationally. Since receiving a doctorate in Natural Resource Management in 1975, he has authored dozens of refereed articles and papers in conference proceedings on park planning, international development, ecological restoration, and sustainable development. Dr. Meganck is very experienced in dealing with diverse audiences and interests through his work with the Organization of American States, the United Nations Environment Program, and as a private consultant in environmental management. Recently, he assumed the position of Rector of

the United Nations University for Water Science and Education in Delft, The Netherlands. His resource-planning experience is exceptionally diversified and unique. He participated in peer review of the 2000, 2001, 2002, and 2003 Everglades Consolidated Reports and proved to be very thoughtful and innovative in his review comments. His expertise was well matched to the needs of the *2004 Everglades Consolidated Report* review panel for issues dealing with an overview of environmental restoration (Chapter 1), other Everglades programs (Chapter 8), and the RECOVER program of the CERP (Chapter 7).

Expert 3: Dr. Robert C. Ward, Professor and Director, Colorado Water Resources Research Institute, Colorado State University, Fort Collins, Colorado

Dr. Robert Ward is highly experienced in the science of water quality assessment, including the design of information systems and water quality monitoring networks, application of data to decision making and communication with the public, and wastewater treatment. Since receiving a doctorate in Agricultural Engineering in 1970, he has authored dozens of refereed articles and papers in conference proceedings. Dr. Ward is well acquainted with peer review, having served on many panels and review committees. He is also familiar with South Florida's technical issues and science through his participation in panels that reviewed the phosphorus control program in the Lake Okeechobee watershed and Everglades Consolidated Reports since 1999. His quantitative experience with water quality monitoring data is extensive, and his knowledge of monitoring program design is exceptional. Dr. Ward was well matched to the needs of the *2004 Everglades Consolidated Report* review panel, particularly for issues dealing with water quality and interpretation of monitoring data for regulatory purposes. His participation is particularly valuable for aspects related to water quality monitoring and compliance, contained primarily in chapters concerning water quality (Chapter 2A), agricultural BMPs (Chapter 3), Everglades hydrology (Chapter 5), and the RECOVER section of the CERP (Chapter 7).

Expert 4: Dr. Yuch Ping Hsieh, Wetland Ecology Program, Florida A & M University, Tallahassee, Florida

After receiving a doctorate from Rutgers University in 1976, Dr. Hsieh has held a series of academic positions as a wetland chemist and soil scientist. From 1986 to the present time, he has been a Professor and Program Leader in the Wetland Ecology Program of Florida A & M University. Dr. Hsieh has been responsible for more than 40 scientific publications concerning carbon and sulfur cycling, nitrogen and phosphorus dynamics, and management practices for sustainable soils. He has served on many advisory and review teams and has attracted more than $2.7 million in external support to Florida A & M University. Dr. Hsieh has been involved in water quality issues throughout his career and is extremely well versed in state-of-the-science methods in environmental chemistry, particularly involving isotope techniques and advanced chemical analyses of environmental samples. His input on the *2004 Everglades Consolidated Report* has been particularly important for chapters on water quality (Chapter 2A), constructed wetlands (Chapters 4A and 4B), and hydrological needs of the Everglades Protection Area (Chapter 5). Dr. Hsieh's unique knowledge of sulfur cycling is particularly valuable to aspects of the report dealing with mercury dynamics in the Everglades (Chapter 2B).

Expert 5: Dr. Joanna Burger, Professor, Division of Life Sciences, Rutgers University, Piscataway, New Jersey

Dr. Joanna Burger has a distinguished research and teaching career that spans three decades. She has contributed greatly to our understanding of water-bird ecology and behavior and the effects of metals and other toxic substances on animals. Her research and scholarly activities have been extremely diverse and numerous and have recently included aspects of ecological risk assessment, a subject of emerging importance in South Florida. She is a highly productive research scientist, authoring more than 70 books and book chapters and about 400 refereed publications. The unusual depth and breadth of her experience as a biologist, ecologist, and toxicologist has allowed her to contribute greatly to the review of the Everglades Consolidated Reports during the last three years; her unique understanding of wading-bird ecology has been a valuable asset to these reviews. Dr. Burger acted as the lead reviewer on mercury in the Everglades (Chapter 2B). She also commented on wetland science and hydrology (Chapters 4A, 4B, and 6).

Expert 6: Dr. E. Joseph Middlebrooks, Environmental Engineering Consultant, Lafayette, Colorado

Dr. Joseph Middlebrooks has a track record in science and engineering since 1966, involving a wide range of activities and responsibilities. He has extensive administrative experience at the University of Tulsa, Tennessee Technological University, and Utah State University, demonstrating an excellent grasp of research and policy directions and needs in environmental engineering. He has been involved in a variety of consulting activities on water quality, wastewater treatment, and industrial waste management. Dr. Middlebrooks has been very active in professional societies and has a substantial list of accomplishments and honors as a Professor of Engineering. With 11 books, more than 50 sole-authored papers, and more than 200 jointly authored papers and reports, he has an outstanding record of contribution to the wastewater and environmental engineering disciplines. He served on the review panels for the 2000, 2001, 2002, and 2003 Everglades Consolidated Reports and consistently provided useful, constructive criticism. His breadth of experience and accomplishments place Dr. Middlebrooks in a unique position to contribute greatly to the review of the *2004 Everglades Consolidated Report*. His input was sought on agricultural BMPs (Chapter 3), Stormwater Treatment Areas (Chapters 4A and 4B), Everglades hydrology (Chapter 5), and watershed management (Chapters 8A and 8B).

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