Everglades Interim Report

Major Findings and Preliminary Implications

Garth Redfield, Gary Goforth and Keith Rizzardi

In complying with the requirements of Section 373.4592(4)(d)5, F.S., this **Everglades Interim Report** summarizes all data and findings available as of July 1, 1998, from Everglades research and monitoring. The Report "shall be used by the Florida Department of Environmental Protection (DEP) and the District in making any decisions regarding the implementation of the Everglades Construction Project (ECP) subsequent to the completion of the interim report." Also in accordance with the direction in the Act, "the construction of STAs 3/4 shall not be commenced until 90 days after the interim report has been submitted to the Governor and the Legislature".

The 1994 **Everglades Forever Act** establishes both interim and long-term water quality goals to ultimately achieve restoration and protection of the Everglades Protection Area. While the Act does not specifically designate two distinct implementation phases, it recognizes that additional measures may or may not be required to achieve compliance with long-term water quality standards. For purposes of this document the District has designated the program designed to achieve the interim goal as "**Phase 1**" and has designated the long-term program as "**Phase 2**." Phase 1 encompasses those activities currently underway to reduce phosphorus concentrations to approximately 50 parts per billion (ppb), and includes the Everglades Construction Project and Everglades Agricultural Area Best Management Practices. The goal of Phase 2 is to combine point-source, basin-level and regional solutions in a system-wide approach to ensure that all waters discharged to the Everglades Protection Area meet water quality standards by December 31, 2006. With respect to nutrients, the Phase 2 goal is to reduce nutrient discharges to levels that do not cause an imbalance in natural populations of aquatic flora or fauna.

Major findings derived from information provided in this Interim Report are summarized below. Immediately following each set of findings are **preliminary implications** for subsequent implementation decisions, including those affecting the ECP. Most of these major findings are supported by information in more than one chapter of this Report. Chapter-specific findings are listed in the individual chapters under a separate heading.

I. Major Findings on Water Quality in the Everglades Protection Area

A. **Reducing phosphorus remains a critical restoration goal.** Phosphorus levels entering the Everglades Protection Area remain a critical concern. Peer-reviewed research indicates significant changes in native Everglades flora and fauna within Water Conservation Area 2A begin to occur at average water column phosphorus concentrations between 10 and 20 parts per billion (Ch. 3). The Environmental Regulatory Commission is ultimately responsible for determining if these changes constitute an imbalance.

B. **Current efforts are reducing phosphorus.** Implementation of Best Management Practices, the Everglades Nutrient Removal Project and the Everglades Construction Project have reduced phosphorus in waters entering the Everglades Protection Area from the Everglades Agricultural Area, although not to the levels anticipated for Phase 2 (Chs. 3, 4, 5 & 6).

   Preliminary Implication 1. Further phosphorus reductions are needed. By focusing on phosphorus reduction strategies, the Everglades Construction Project is addressing the most critical water quality parameter for restoring the Everglades ecosystem. In accordance with the Everglades Forever Act and in conjunction with agricultural best management practices, the Stormwater Treatment Areas (STAs) are being designed and constructed to achieve the interim target of 50 ppb. STAs and supplemental technologies are also being evaluated for their potential application to inflows from other Everglades Protection Area tributaries, such as the Western Basins and the lower East Coast.

   Preliminary Implication 2. STA-3/4 is critical to achieve long-term phosphorus reduction goals. As the largest treatment area of the Everglades Construction Project, STA-3/4 is critical and necessary to achieve both the interim phosphorus target of 50 ppb and the long-term restoration goals of the Everglades Forever Act. The design of STA-3/4 is scheduled to begin in January 1999, and the District intends to begin construction as soon as possible upon completion of design in 2001.

   Preliminary Implication 3. The phosphorus water quality standard will influence Phase 2 decisions. DEP's numerical interpretation of the State's narrative standard for phosphorus will provide the basis for determining whether Phase 1 achieves compliance with water quality standards. If Phase 1 is insufficient, the revised water quality standard will influence the final design targets for Phase 2.

C. **Everglades water quality generally meets standards.** With a limited number of exceptions, water quality in the Everglades Protection Area is in

compliance with existing State water quality standards and numeric criteria (Ch. 4).

D. **Excursions from some water quality standards do occur.** For dissolved oxygen and specific conductance, numerous excursions of State water quality criteria have occurred in the Everglades Protection Area. Infrequent excursions have occurred for a limited number of other parameters (Ch. 4). Existing numeric water quality criteria for dissolved oxygen, pH and alkalinity are not always appropriate for all waters of the Everglades Protection Area (Ch. 4).

   Preliminary Implication 4. Revised Water Quality Standards may be needed for parameters in addition to phosphorus. The DEP should consider revising the State Class III water quality criterion for dissolved oxygen to recognize cyclical fluctuations in concentrations and naturally occurring lower concentrations in marshes, such as the unimpacted Everglades. Other appropriate changes should be considered for the pH and alkalinity water quality criteria.

E. **Mercury is a critical Everglades water quality concern.** Although the State Class III numeric water quality criterion for mercury has not been exceeded, mercury levels in fish from the Everglades Protection Area have impaired the use of the resource as a sport fishery and represent a potential threat to fish-eating wildlife (Ch. 7).

   Preliminary Implication 5. Revised Water Quality Criterion is needed for mercury. The DEP should consider revising the State Class III numeric water quality criterion for mercury. The current criterion has not ensured the protection of all present and future uses of the resource or the propagation of healthy, well-balanced populations of fish and wildlife.

F. **Stormwater is a relatively small source of mercury.** Atmospheric deposition represents more than 95% of new mercury delivered to the Everglades Protection Area each year. Stormwater runoff from the Everglades Agricultural Area is not a significant source of new mercury to the Everglades as a whole, but may make a significant contribution to areas immediately downstream of District structures (Ch. 7).

   Preliminary Implication 6. More information on mercury is needed. Mercury monitoring and research programs should continue among Federal, State and local agencies and other organizations to further identify atmospheric sources, better understand processes influencing bioaccumulation in fish and track the response of the ecosystem to any

reductions in local air emissions. Resolving the mercury problem in the Everglades will require an evaluation of local and background sources of mercury in atmospheric deposition, and an examination of the potential to control factors affecting mercury accumulation in the food web.

Preliminary Implication 7. The Everglades Construction Project is unlikely to increase mercury risks. Based on three years of Everglades Nutrient Removal Project data, the STAs are anticipated to reduce mercury loads in treated stormwater by 50 to 75%. This reduction should benefit areas immediately downstream of District structures in the northern Everglades. In addition, based upon an ecological risk analysis, the STA's are unlikely to cause or contribute to a new mercury problem by changing downstream water quality or quantity.

II. Major Findings on the Ecological Needs of the Everglades Protection Area

A. **Phosphorus has major impacts on Everglades flora and fauna.** Excess phosphorus runoff, altered hydrology and reduction in the original size of Everglades marshes have adversely affected the ecology of the Everglades Protection Area. Phosphorus has been shown to be the primary nutrient limiting productivity in the Everglades and is a major determinant of the ecological structure and function of the system (Ch. 3). Stormwater runoff has increased phosphorus availability in soil and water, leading to altered habitats and associated changes in wildlife abundance. Effects of excess phosphorus have been documented on a wide range of biological communities, including periphyton (attached algae) and emergent aquatic plants (Chs. 2 & 3). Since plant communities form the basis of Everglades food webs and habitat structure, phosphorus impacts to vegetation will have major consequences for ecosystem functions and values (Chs. 2 & 3).

B. **Phosphorus research provides foundation for rulemaking.** State, federal and other research activities are underway to provide the information needed to establish a numeric criterion for phosphorus in the waters of the Everglades Protection Area (Chs. 2 & 3). Phosphorus threshold studies in Water Conservation Area 2A indicate shifts in algal species begin to occur at about 10 ppb and other ecological changes are evident between 10 and 20 ppb. Cattails can out-compete other natural vegetation over time under enriched phosphorus conditions. Sufficient data to establish a numeric interpretation of the phosphorus criterion for Water Conservation Areas 1 and 2A, and Everglades National Park should be available by Act deadlines. Establishment of a numeric phosphorus standard for Water Conservation Area 3A may require using data from other areas of the Everglades Protection Area unless site-specific information becomes available. Chapter 12 summarizes the sequence of steps needed to achieve compliance with water

quality standards by 2006, including the numeric interpretation of the phosphorus criterion.

C. **Models predict impacts of phosphorus discharges on the Everglades.** At this time, numeric relationships between the phosphorus in waters discharged to the Everglades Protection Area and the resulting phosphorus levels in the Everglades Protection Area have not been established by the DEP, as required by the Act. However, the Everglades Water Quality Model, which predicts the impact of phosphorus discharges on Everglades water quality, has been developed by the District to assist DEP in this effort (Ch. 3).

   Preliminary Implication 1. Establishing discharge limits is vital to Phase 2 decisions. The relationship between phosphorus discharges to the Everglades Protection Area and resulting phosphorus levels in the Everglades needs to be defined prior to determining the optimal mix of solutions for Phase 2. Final plans for implementing Phase 2 solutions must be completed by December 31, 2003, and this relationship should be established as soon as possible to allow sufficient time for planning, design and construction.

   Preliminary Implication 2. Phosphorus compliance methodology will influence Phase 2 decisions. The method of measuring compliance with the numeric phosphorus criterion remains to be determined. Evaluating compliance requires not only the establishment of a numeric criterion, but also an understanding of relationships between water discharged to the Everglades Protection Area and the resulting water quality. Concurrent with finalizing the compliance methodology, basin-specific discharge limits for phosphorus can be developed. Until this compliance methodology is developed, the District will continue to use 10 ppb as the "end-of-the-pipe" discharge concentration in the Phase 2 planning documents that will be developed no later than December 31, 2003. If the final discharge limits are significantly different from 10 ppb, the optimal Phase 2 solutions may be altered, with significant cost and other differences.

D. **Everglades recovery will not be immediate**. Modeling results suggest that cattail in Water Conservation Area 2A may continue to expand for some time after implementation of the Everglades Construction Project because of phosphorus stored in soils. However, phosphorus reductions through the Everglades Construction Project will ultimately facilitate long-term restoration of impacted areas (Chs. 2 & 3).

   Preliminary Implication 3. Active management of cattail could accelerate recovery. Research should be conducted to determine the time

necessary for the Everglades Protection Area to recover and management options to accelerate that recovery should be explored. Research is required to identify management practices that can reduce cattail expansion by reducing vegetation (e.g., controlled burning, herbicides, etc.), by creating hydrologic patterns that favor desirable vegetation and by reducing phosphorus availability in contaminated sediments.

Preliminary Implication 4. Post-project tracking is needed. After implementing Phase 1 and 2 of the Everglades Program, long-term monitoring of water quality and ecosystem status in the Everglades Protection Area must be conducted to document the effects of phosphorus reductions.

III. Major Findings on the Hydrological Needs of the Everglades Protection Area

A. **Improving Everglades hydrology remains a critical restoration goal.** The hydrology of the Everglades Protection Area has been altered fundamentally in quantity, timing, depth and duration (Ch. 2).

B. **Increased water volumes and revised distribution of inflows are needed to reestablish natural patterns.** Performance measures for system hydrology have been established in the C&SF Restudy using the Natural Systems Model (Chs. 2 & 10). The alternative presently recommended by the Restudy shows a 19% increase in the volume of water directed to the Everglades compared to the 1979 to 1988 base period.

C. **The present design of Everglades Construction Project will help to reestablish natural patterns in the Everglades.** The Everglades Construction Project has been designed to restore more natural quantity, timing, depth and duration for water in the Everglades Protection Area (Chs. 2 & 10).

Preliminary Implication 1. The Everglades Forever Act hydropattern restoration concept is appropriate. Based on current information, the present design for hydropattern restoration in the Everglades Protection Area appears to be appropriate. Information from the C&SF Restudy and Lower East Coast Water Supply Plan can be used to refine the discharge locations and volumes from STA-3/4. In addition, adaptive management (monitoring and refinement) should be used when re-wetting Everglades soils that have been excessively dried out.

Preliminary Implication 2. The Act hydropattern goals will be re-evaluated. In concert with the Restudy, Phase 2 of Everglades Construction Project implementation should be designed to achieve the

hydrologic performance targets of the Everglades Protection Area; accordingly, the target of 28% increase in flows to the Everglades mentioned in the Act may need to be refined.

IV. Major Findings on Everglades Agricultural Area, Best Management Practices

A. **Best Management Practices have reduced phosphorus loads**. Implementation of Best Management Practices within the Everglades Agricultural Area has resulted in phosphorus load reductions that have surpassed the load reduction targets in the Act. The cumulative load of total phosphorus discharged from the Everglades Agricultural Area over the last three years was 55 % lower than the load that would have occurred without BMPs (based on calculations considering hydrologic variability) (Ch. 5).

B. **Existing BMPs may produce further phosphorus reductions.** Through continuing research, monitoring and refinement of Best Management Practices, further sustainable reductions in phosphorus load and concentration from the Everglades Agricultural Area are probable (Ch. 5). Information gained from the Best Management Practices Program in the Everglades Agricultural Area is being considered for application to other tributaries that discharge into the Everglades Protection Area (Chs.11 & 12).

Preliminary Implication 1. Refined BMPs may play a more important role in the final mix of STAs, supplemental technologies and BMPs used to achieve compliance with water quality standards than was apparent when the Act was developed in 1994. If proven cost-effective, additional BMPs could be implemented to reduce the overall costs and scale of Phase 2 of the Everglades Construction Project.

V. Major Findings on the Performance of Stormwater Treatment Areas

A. **The Everglades Nutrient Removal Project has been highly effective at removing phosphorus.** The Everglades Nutrient Removal Project is exceeding its performance objectives in terms of phosphorus concentration and load reduction. During the first four years of operation, the Project outflow concentrations have averaged 22 ppb and load reductions have exceeded 82 % (Chs. 4 & 6). Also, all weekly phosphorus measurements, with one exception, at the outflow of STA-6 were below the required 50 ppb interim project goal during the first seven months of operation (Ch. 6). These reductions in phosphorus loading have occurred during the early stages of Stormwater Treatment Area operation, and they may not be representative of future long-term performance.

Preliminary Implication 1. The Everglades Nutrient Removal Project performance supports Everglades Construction Project assumptions. Evidence to date supports the basic assumptions and design parameters used in planning the STAs and they are expected to achieve the goals of the Act. The design and construction of STA-3/4 and STA 1 East should continue to utilize the basic assumptions and design parameters for phosphorus removal as contemplated in the 1994 Act.

VI. Major Findings on Supplemental Technology Research

A. **Supplemental technology research continues.** Eight projects are underway to identify supplemental technologies that can be used in combination with STAs and BMPs to reduce stormwater phosphorus concentrations to comply with State water quality standards. Candidate technologies include chemical and wetland treatment systems. The research projects on supplemental technologies will be completed by June 2001, at a cost of approximately 10 million dollars (Ch. 8).

B. **Supplemental technologies may have local and regional applications**. Some of the supplemental technologies that are being examined for use in conjunction with Stormwater Treatment Areas may have potential for treatment of on-farm hot-spots, as well as other regional applications (Ch. 8).

Preliminary Implication 1. Completion of supplemental technology research is needed for Phase 2 decisions. The ultimate Phase 2 solution will be a combination of STAs augmented by enhanced Best Management Practices, supplemental technologies as needed and/or additional regulatory programs to achieve and maintain compliance with long-term water quality standards. Completion of supplemental technology research is in the critical path for determining and implementing Phase 2 solutions by December 31, 2006. Completion of this research before the December 31, 2001, deadline may be difficult because biological research inherently requires one or more growing seasons to evaluate performance. The District may be required to make recommendations on Phase 2 based on incomplete science and engineering information, which carries associated environmental and economic risks (see Ch. 12).

Preliminary Implication 2. Supplemental technology may not be available for incorporation into STA-3/4. Since STA-3/4 must be completed by October 1, 2003, final design is anticipated to begin in January 1999, and construction is scheduled to begin in 2001. Since the results from supplemental technologies, BMPs and STA research will likely not be available until the end of 2001, and no funding has been

appropriated, it appears unlikely that Phase 2 technologies will be included in the initial design of STA-3/4.

C. **Initial estimates of supplemental technology costs may have been underestimated.** The preliminary cost estimates for supplemental technologies from a 1996 report appear to be unrealistically low. These initial cost estimates were based on a literature search and not on tests with the actual waters to be treated. Current research with chemical treatment of local agricultural stormwater suggests that actual costs may be upwards of 150 % higher than initial estimates. Revised costs for all of the supplemental technologies under investigation will be available upon completion of each of the supplemental technology demonstration projects (Ch. 8).

VII. Major Findings on the Lower East Coast Water Supply Plan

A. **The interim LEC Water Supply Plan identifies critical projects**. The Interim LEC Plan (March, 1997 draft) identifies a program of improvements that can proceed in a short time frame and without Federal cost-sharing. Most note-worthy for the Everglades Protection Area are establishment of minimum flows and levels, and the development of rainfall-driven operation schedules for the Water Conservation Areas (Ch. 9).

B. **The final LEC Water Supply Plan will be influenced by the Restudy.** The LEC Plan is deemed an *interim* plan and will be coordinated with the C&SF Restudy's recommended program as approved at the State and federal level. A final LEC Plan will be completed by April 2000 (Ch. 9).

Preliminary Implication 1. The LEC Water Supply Plan could impact Phase 2 decisions. Information available at this time supports continuation of the current design of the Everglades Construction Project. District staff will continue to synchronize the LEC Water Supply Plan with Phase 2 implementation, as appropriate.

VIII. Major Findings on the C&SF Restudy

A. The Restudy is a significantly larger project than the Everglades Construction Project. The Restudy is an interagency effort with a significantly larger geographic scale than the Everglades Construction Project (18,000 sq. mi.). The Restudy also uses a different planning timeframe (2050) than the Everglades Construction Project (2006) (Chs. 10 & 12). The current planning level cost estimate for implementing the Restudy is approximately $7.8 billion (Ch. 10).

B. **Continued implementation of the Restudy depends upon the federal government authorization**. A recommended plan for the Restudy which includes a component for a sustainable Everglades ecosystem is scheduled to be delivered to Congress in July 1999 (Ch. 10).

Preliminary Implication 1. Restudy implementation will remain synchronized with the LEC Water Supply Plan and the Everglades Construction Project. Information available at this time supports continuation of the current design of the ECP. Restudy staff will continue to synchronize the Restudy with the LEC Water Supply Plan and the Everglades Construction Project.

Preliminary Implication 2. Restudy results are not available in time to be incorporated into Phase 1 of the Everglades Construction Project. Interim and final results from the Restudy may be integrated into STA-3/4 design and Phase 2 implementation activities subject to funding and timing constraints. However, if STA-3/4 is to be completed in accordance with existing schedules, design and construction cannot be delayed until after the State and Federal approval and appropriation process is completed for the Restudy.

IX. Major Findings on the Everglades Stormwater Program

A. **The Everglades Stormwater Program identified schedules and strategies for complying with water quality standards to the maximum extent practicable.** In April 1998 DEP issued a permit (called the Non-ECP permit) to the District authorizing continued operation of the structures that a) were within the District's control, b) discharged waters into, within or from the Everglades Protection Area, and c) were not included in the Everglades Construction Project. This Non-ECP Permit requires the District to adhere to schedules and strategies for achieving and maintaining water quality standards to the maximum extent practicable (Ch. 11). The permit, which was upheld by Florida's Third District Court of Appeals, is being administered by the District's Everglades Stormwater Program.

B. **The Everglades Stormwater Program monitors and improves water quality in regions not affected by the Everglades Construction Project.** The District's Everglades Stormwater Program (Ch. 11) includes a comprehensive monitoring program that will measure the progress of the programs contained in the permit towards achieving water quality standards. Monitoring results will be included in the annual Regulatory Action Report as required in Specific Condition #8 of the Non-ECP permit.

C. **The Non-ECP permit also authorizes a Regulatory Action Strategy.** This strategy will apply to all basins discharging into the Everglades Protection Area that are not addressed by the Everglades Construction Project. The Regulatory Action Strategy consists of a ten step approach to: a) determine areas of water quality concerns within each contributing drainage basin; b) identify potential sources of those concerns; and c) propose corrective actions where needed. (Ch. 11).

Preliminary Implication 1. The success of the Everglades Stormwater Program is linked to ongoing research efforts. The District's ongoing research programs, including supplemental technology and BMP research, may assist the Everglades Stormwater Program efforts to achieve compliance with water quality standards by December 31, 2006 for all structures discharging into the Everglades.

X. Major Findings on the Integrated Plan to Achieve Water Quality Goals by December 2006

A. **The long-term water quality goal of the Everglades restoration is compliance with all water quality standards by December 31, 2006.** The long-term water quality goal of the Everglades restoration program is to combine point-source, basin-level and regional solutions in a system-wide approach to ensure that all waters discharged to the Everglades Protection Area meet water quality goals by December 31, 2006 (Ch. 12). Concurrent with the implementation of Phase 1, the District and other groups are conducting research related to water quality (Chs. 2 – 8) ecosystem-wide planning (Chs. 9 & 10), and regulatory programs (Chs. 5 & 11) to ensure a sound foundation for science-based decision-making for Phase 2 (Ch. 12).

B. **Long-term solutions require the synthesis of many activities.** A tremendous amount of research, data analyses, rulemaking, planning and basin-specific evaluations must be completed and integrated in a relatively short time to enable the design, land acquisition, permitting and construction of Phase 2 solutions by December 31, 2006. At least eighteen (18) activities, some in parallel, some in sequence, must be completed in a timely manner in order to determine, fund and implement the optimal combination of enhanced BMPs, STAs, supplemental technologies and/or additional regulatory programs by December 31, 2006 (Chs. 11 & 12).

C. **The Everglades Forever Act establishes interim steps to achieve long-term restoration goals.** The Act requires implementation of additional measures to achieve and maintain compliance with water quality standards by December 31, 2006. The Act also requires submittal of a plan by December 31, 2003 of proposed changes to the Everglades Construction Project designed to achieve

Phase 2 solutions (Ch. 12). In contrast with the Act requirements, the Corps of Engineers construction permit for the Everglades Construction Project requires submittal by January 1, 1999, of a preliminary draft strategy for achieving compliance with State water quality standards by December 31, 2006. A draft and final strategy is due by January 1, 2000, and January 1, 2001, respectively. Finally, the Corps permit for the Everglades Construction Project requires that best efforts be made in implementing additional water quality measures for STA-2 within four years of first discharge. This date is more than 3 years before deadline in the Act (Ch. 12).

Preliminary Implication 1. Restoration timelines are aggressive and ambitious. Considering the number and complexities of research, regulatory and potential construction activities required to achieve the long-term water quality goals, the December 31, 2006, time frame established by the Everglades Forever Act is very ambitious. Delays in the timely completion of these activities, many of which are outside the control of the District, may result in unintended delays of the long-term water quality objectives of the Everglades, despite the best efforts of the District. The District may be required to make recommendations on Phase 2 based on incomplete science and engineering information, which carries associated environmental and economic risks.

Preliminary Implication 2. The Long Term Compliance Permit(s) must provide more detail on efforts needed to comply with water quality standards. The Non-ECP permit and the Everglades Construction Project permits will be modified in 2003, when the District must submit detailed plans to achieve compliance with all water quality standards in the Everglades Protection Area by December 31, 2006.

Preliminary Implication 3. No funding is available for Phase 2. To date, no funding for Phase 2 design, acquisition, construction or operation has been identified. Funding must be identified by December 31, 2003, as part of the long-term compliance permit requirements.

Preliminary Implication 4. Corps' 404 permit conditions are more ambitious than the EFA. The District is making best effort to comply with the Corps permit condition that accelerates timeframes in the Everglades Forever Act. Potential obstacles include insufficient information on: water quality criteria, STA optimization, BMP enhancements, supplemental technologies, and hydrologic needs of the Everglades; lack of funding; and insufficient time for design, acquisition, permitting, construction and operation of additional measures.