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Sustainable South Florida

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GOVERNOR'S COMMISSION FOR A SUSTAINABLE SOUTH FLORIDA

A CONCEPTUAL PLAN FOR THE C&SF PROJECT RESTUDY

AUGUST 28, 1996



The Governor's Commission for a

Sustainable South Florida

September 12, 1996

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The Honorable Lawton Chiles
Governor, State of Florida
The Capitol, Room 1501
Tallahassee, FL 32399-0001

Dear Governor Chiles:

After eleven months of arduous effort since issuing our Initial Report, I am extremely proud and pleased, on behalf of your Commission, to present its Conceptual Plan for the C&SF Project Restudy addressing Everglades ecosystem restoration. Adopted by unanimous vote, this Plan implements Recommendation 12 of the Commission's Initial Report and its related action steps.

The Plan was developed in context of, and consistent with, the Commission's comprehensive recommendations in its Initial Report that sought to incorporate the needs of society, the economy and the environment. That report was designed to move South Florida from its present unsustainable course to a sustainable future. Restoration of the priceless natural systems, and assuring urban and agricultural water supply within the region, are major features of this Plan.

The region's private stakeholders and related governmental units were effectively represented on the Commission as were state and national interests concerned with restoring the remnant Everglades and protecting and enhancing the South Florida ecosystem. Encompassed in this Conceptual Plan are components that specifically address protection of the coastal estuaries and the reef systems of the Florida Keys.

The Plan sets forth forty additional restoration components grouped into thirteen thematic concepts, building on previously authorized and ongoing projects. It also contains seven important recommendations to accelerate the overall effort. These recommendations are designed to assure that a strong federal-state partnership is forged to carry out the Plan and that the lengthy federal approval process is changed to expedite the Restudy and its full implementation.

The Honorable Lawton Chiles
September 12, 1996
Page Two

The Commission requests your approval of the Plan and its transmittal to the South Florida Ecosystem Restoration Task Force and the U. S. Army Corps of Engineers for appropriate inclusion in the Restudy. We have further recommended that the Plan be authorized by Congress, subject to the completion of the feasibility phase of the Restudy, in order to avoid the unnecessary and destructive delays that may otherwise impede its implementation.

I want to again commend the Florida Conflict Resolution Consortium for its invaluable assistance in developing the Commission's unanimous support for the Plan. Further, various of your agencies have loaned excellent staff representatives to the Commission to assist in the development of the Plan and they have contributed valuable technical and analytical support to this intensive effort. Federal and private sector technical representatives have also participated in the effort and the public has been constantly consulted during our deliberations. The Commission's staff, led by its most capable Executive Director, Dr. Bonnie Kranzer and its dynamic Deputy Director, Brenda Chalifour, Esq., have also performed outstandingly throughout this effort. Most importantly, I want to thank you for the opportunity to work with such a talented and dedicated Commission.

It is the hope of the Commission that this consensus Plan will become the agreed framework and vision for Everglades and natural system restoration in the South Florida region that will unite local, regional, state and national support. We have an historic opportunity to utilize this consensus to advance this great endeavor. Only through such unity can we succeed.

Sincerely,


Richard A. Pettigrew
Chairman

cc: Lt. Governor MacKay
Governing Board, South Florida Water Management District
Commission Members
Estus Whitfield, Executive Office of the Governor
Sam Poole, Executive Director, South Florida Water Management District

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This report would not be possible without the perseverance and dedication of the members of the Governor's Commission for a Sustainable South Florida identified below.

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August 1996

The Conceptual Plan is also the result of an incredible commitment made by numerous individuals and organizations. Several individuals have, however, far exceeded any expectations placed on them in preparing this report. We would like to recognize their contribution and thank them for their unending and unselfish commitment to this effort.

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EXECUTIVE SUMMARY

The Governor's Commission for a Sustainable South Florida completed its first deliberations in September, 1995, and on October 1, 1995, published its *Initial Report*. The report details the Commission's conclusions regarding the present state of South Florida and offers 110 recommendations for the future of the region. Numerous recommendations in the Commission's *Initial Report* address the water resources of South Florida, which are recognized by the Commission as the lifeblood of the region's economy, quality of life, and health of the human and natural systems.

This second report is the Commission's next step in addressing the region's long-term water resource needs. This Conceptual Plan for the Central and Southern Florida (C&SF) Project Comprehensive Review Study (Restudy) with recommendations is provided to the Governor as proposed input to the U.S. Army Corps of Engineers (Corps) and the South Florida Water Management District (SFWMD) to improve and expedite the Restudy process. The C&SF Project is the predominant feature affecting water resources in South Florida. Modifications to the existing C&SF Project are crucial to restore South Florida's natural systems and to achieve sustainability. Sustainability for South Florida requires adequate water quality, flood protection, and water supply for agriculture and urban areas as well as the natural system. The Commission defines an ecosystem as a community of organisms, including humans, interacting with one another and the environment in which they live. As water resources are the lifeblood of the South Florida ecosystem, the Everglades are the heart of the region. Without the Everglades, the face of South Florida would be dramatically different from the landscape known today. Yet this landscape shows increasing signs of distress. The present manner by which South Floridians manage and make use of the resources of the system is not sustainable. The Restudy, authorized by Congress in 1992, offers a timely opportunity for recommending modifications to the C&SF Project.

Acting on one of its initial recommendations to provide specific recommendations describing its preferred alternatives to the Corps and the SFWMD as these and other agencies pursue the Restudy, the Commission developed planning objectives, selected a list of 40 preferred options to be evaluated, and incorporated these options into this Conceptual Plan for the Restudy. The Commission believes this Conceptual Plan provides a vision and framework for the Restudy. Recommendations are provided for improving and expediting the Restudy process and for implementing modifications to the C&SF Project. An overview of the Conceptual Plan and recommendations follows.

A. CONCEPTUAL PLAN DEVELOPMENT

The Commission endorses and commends the natural system restoration efforts currently underway. These efforts, however, are just that -- a beginning. Further efforts are needed to achieve a healthy ecosystem that has the capability to provide the vital water resources necessary for a viable economy and quality of life that will allow for a sustainable South Florida. The Commission's Conceptual Plan for the Restudy includes ongoing water resource projects grouped into 13 thematic concepts with additional elements, which collectively will help achieve a sustainable South Florida. The Commission recognizes this Conceptual Plan is only a start. More detailed planning and design by the Corps, the SFWMD, and other agencies is needed prior to implementing projects. The Conceptual Plan provides a focus or a context for the Restudy effort. The following thematic concepts are supported by the Commission. A detailed explanation of what is included in each of these concepts is found in Chapter II. It is important to recognize that although these concepts are listed individually, each concept is linked to the others and must be viewed holistically.

- Concept 1: Regional Storage Within the Everglades Headwaters and Adjacent Areas
- Concept 2: Lake Okeechobee Operational Plan
- Concept 3: Everglades Agricultural Area Storage
- Concept 4: Water Preserve Areas
- Concept 5: Natural Areas Continuity
- Concept 6: Water Supply and Flood Protection for Urban and Agricultural Areas
- Concept 7: Adequate Water Quality for Natural System Functioning
- Concept 8: Increased Spatial Extent and Quality of Wetlands Beyond the Everglades
- Concept 9: Invasive Plant Control
- Concept 10: Aquifer Storage and Recovery
- Concept 11: Protection and Restoration of Coastal, Estuarine, and Marine Ecosystems
- Concept 12: Conservation of Soil
- Concept 13: Operation, Management, and Implementation of the C&SF Project Modifications and Related Lands

B. RECOMMENDATIONS

Just as it is critical to have a plan to guide the direction the Restudy should take, so is it critical to have a means to implement such efforts. The endeavors being undertaken in South Florida constitute the largest natural system restoration effort ever undertaken. The sheer magnitude and complexity of the venture guarantees that an unprecedented level of cooperation is required of the

many governments, agencies, and private entities that have a stake in the future of South Florida. The Commission is concerned that the existing process for implementing modifications to the C&SF Project is too linear and time consuming given the critical needs of South Florida. Instead, an improved partnership must be utilized that accelerates implementation without compromising good planning, existing laws, or opportunities for public input. In recognition of the difficult, yet essential tasks that must be accomplished to achieve natural system restoration and sustainability, and realizing that South Florida is at a pivotal moment in history, the Commission offers the following recommendations.

Recommendation 1: Authorized purposes of the C&SF Project should include protection and improvement of water quality for natural system protection and restoration and water supply for environmental and economic needs.

Recommendation 2: Modifications to the C&SF Project developed as part of the Restudy should be cost-shared on a 50/50 basis between the Federal government and the State.

Recommendation 3: The feasibility phase of the Restudy, including the Comprehensive C&SF Project Plan, should be expeditiously completed and other preparatory steps necessary to implement the Plan should be taken.

Recommendation 4: State implementation activities for Everglades restoration should be expedited.

Recommendation 5: Adaptive management strategies should be used to implement C&SF Project modifications.

Recommendation 6: Adequate agency resources must be provided for implementation of the Plan.

Recommendation 7: Congress should remove impediments to more effective public/private involvement in ecosystem management and natural system restoration.

The activities entailed in each of the above recommendations are found in Chapter III of this report. Chapter I contains relevant background information and a more thorough explanation of the Commission's role in the C&SF Project Comprehensive Review Study. Chapter II presents the Conceptual Plan for the Restudy.

CHAPTER I

BACKGROUND AND UNDERSTANDING

The Governor's Commission for a Sustainable South Florida was created by Governor Lawton Chiles on March 3, 1994, through Executive Order 94-54. The Commission is charged with making recommendations that will move South Florida toward a healthy ecosystem that can coexist with, and be mutually supportive of, a sustainable economy. The Commission issued its *Initial Report* containing 110 recommendations on October 1, 1995. The Governor's Commission for a Sustainable South Florida is a nontechnical body representative of the populace of Florida providing an informed consensus of the wishes of Florida citizens in regard to the Restudy. This document is not a substitute for further sound scientific and technical review by the various public agencies involved in the Restudy. This chapter provides an overview of the Commission's recommendations to achieve a sustainable South Florida through development of a Conceptual Plan for the Comprehensive Review Study (Restudy) of the Central and Southern Florida (C&SF) Project.

A. INTRODUCTION

The Governor's Commission for a Sustainable South Florida consists of 47 members representing federal, state, Native American tribal, regional, and local governments; and business, agricultural, public, and environmental interests. Central to the Executive Order that created the Commission is the recognition that the South Florida ecosystem is a nationally and internationally unique area. It provides essential habitat for a significant number of endangered and threatened wildlife species, and contains the only living coral reef system in the continental United States. Due to its subtropical climate, South Florida is a mecca for business, tourists, retirees, and outdoor enthusiasts. It is also a primary producer of citrus, sugar cane, winter-grown vegetables, a variety of tropical fruits, many ornamental plants, and commercially harvested food fish. The Commission's charge is broad-based and far-reaching. It requires the Commission to examine all aspects of the South Florida ecosystem and make recommendations to further a sustainable economy and maintain a quality of life for South Florida's residents that is compatible with a healthy natural system.

The Commission defines an ecosystem as a community of organisms, including humans, interacting with one another and the environment in which they live. The South Florida ecosystem stretches from the Kissimmee River Basin -- Lake Okeechobee region to the coral reefs in the Atlantic Ocean and from the Caloosahatchee to the St. Lucie estuaries. This water-dominated system encompasses a myriad of interconnected freshwater rivers, lakes, marshes, prairies, forests, and estuaries, and includes the natural systems of the Kissimmee

River Basin, Lake Okeechobee, the Everglades, Big Cypress Swamp, Florida Bay, Biscayne Bay, the Florida Keys reef tract, Charlotte Harbor, and Indian River Lagoon. The area also includes all or part of 16 counties, comprised of over 5 million human inhabitants and the tourist meccas surrounding Orlando, such as Disney World; the Everglades Agricultural Area (EAA) south of Lake Okeechobee; small rural towns such as Pahokee, La Belle, and Belle Glade; and urban centers such as Fort Myers on the west coast and the cities on the southeast coast stretching from Fort Pierce to Key West.

To assist its deliberations, the Commission appointed a Technical Advisory Committee and a Science Research Advisory Committee. These two committees provided the Commission with analytical information on many subjects and issues. Assisting the Commission in the development of this Conceptual Plan for the Restudy were a Support Group, whose membership is made up from the two advisory committees and a Restudy team consisting of representatives from the Corps, SFWMD, U.S. Department of Agriculture, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, National Park Service, Florida Game and Fresh Water Fish Commission, Florida Department of Environmental Protection, Florida Department of Agriculture and Consumer Services, and Native American tribal governments.

A-1. COMMISSION'S INITIAL REPORT

To address the many issues of sustainability, the Commission met extensively throughout its initial 17 months. These meetings, using a consensus building approach, culminated in the unanimous adoption of the Commission's October 1, 1995 *Initial Report*. The report contains 110 recommendations with a central theme of sustainability -- meeting the needs of the present without endangering the ability of future generations to meet their needs -- revolving around the management of water.

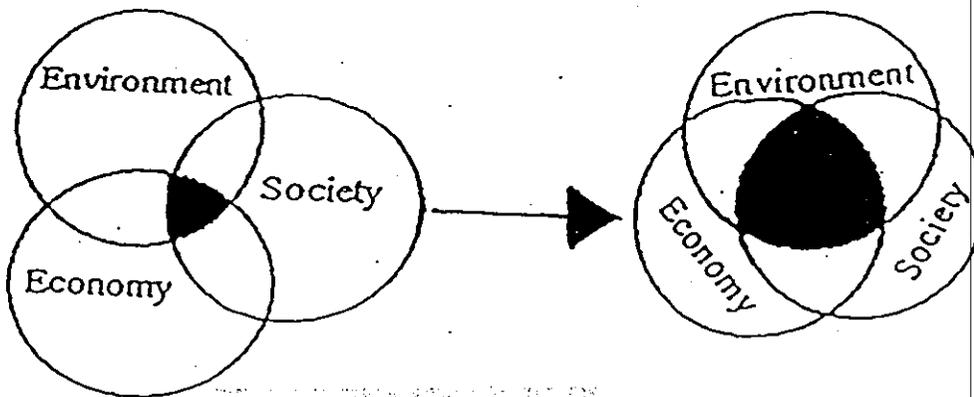
Water resources have always been a defining factor in South Florida. Historically, the natural system was self-perpetuating, but not well suited to human habitation. Beginning in the 1800s, a number of private, state, and federal efforts drained large parts of the Everglades and allowed for the development of South Florida. The C&SF Project, one of the largest drainage and flood control systems in the world, was begun in the 1950s to accommodate urban and agricultural development. The Project is the predominant feature affecting water resources in South Florida. The construction of the Project has allowed urban, suburban, and agricultural development.

The desirability of South Florida's climate, geographic location, cultural and social setting, and thriving economic opportunities have contributed to a

population explosion that is predicted to triple in the region by the year 2050. Nearly 45% of the state's population lives within the boundaries of the C&SF Project. The by-products of such growth, which include sprawling development patterns, incremental loss in spatial extent of natural systems, water management activities required to support human needs, pollution, and conversion of natural and agricultural land to urban and suburban uses, have increasingly cumulative negative impacts on the South Florida ecosystem.

There is an unavoidable link between the human community and the surrounding natural system. The human community is dependent on the natural system for public health, safety, and welfare; continued economic viability; and enhanced quality of life. A self-sustaining natural environment depends upon the wisdom and actions of its human inhabitants. The Commission is confident that building consensus among divergent interests can reverse negative environmental, economic, and social trends and can create and sustain safe, prosperous, and beautiful communities. By increasing the areas of common interest shared by the environment, urban and rural communities, and business groups until they are integrated into a sustainable ecosystem, the needs of the human community and the natural system can be balanced and met.

The Commission's *Initial Report* identified three broad components -- society, the economy, and the environment -- that must be fully integrated and balanced to achieve sustainability in South Florida. These components encompass a variety of human and natural system issues that are closely intertwined and require a holistic approach.



The societal component of a sustainable ecosystem, particularly its human element, necessitates that the basic underlying quality of life be maintained and assured over time. Fundamental needs such as education, employment, food, health care, affordable housing, safety, transportation, and recreation must be ensured for all citizens, present and future. A societal issue to be addressed in the Commission's *Initial Report* includes enhancing the quality of the urban areas and integrating them more fully with the natural system. This involves changing the

often unthinking nature of humans in their day to day activities that result in environmental degradation. Another issue centers around the restoration and enhancement of urban areas to slow the suburban sprawl that adversely impacts existing natural areas. The Commission's recommendations entail the formulation and identification of an eastern central urban corridor and the planning of its redevelopment. Through a public/private partnership, the Eastward Ho! initiative aims to spur redevelopment of an urban corridor spanning Dade, Broward, and Palm Beach Counties. The goal is to create affordable housing, promote mixed use, increase employment, provide schools, and increase cultural and recreational opportunities in this corridor, thereby reducing urban sprawl and promoting public transportation. Although Eastward Ho! focuses on the highly urbanized lower east coast, these factors affecting the quality of life must be improved throughout the entire region.

Economic stability and growth are also critical components of a community's quality of life. Before a community can become sustainable, the standard of living must also reflect the opportunity to earn a reasonably high wage with access to potential economic improvement. Building a prosperous future also means recognizing the interdependence of the economy and the environment and the importance of balancing the needs of each.

The Commission recognizes the critical nature and importance of all industries in the region. Health care, financial services, transportation, recreation, utilities, commercial marine endeavors, construction, mining, agriculture and other businesses and commercial enterprises make significant contributions to the South Florida economy. Tourism and international trade substantially impact the economy in terms of total jobs, gross and taxable sales, airport activity, port tonnage, and collection of sales and use taxes. Agriculture is responsible for up to 30% of the earnings in some of the interior South Florida counties and in addition, affords important land stewardship opportunities critical to the region's long-term sustainability. The economic component of the Commission's *Initial Report* includes expanding the availability and accessibility of education, training and high wage employment, policy changes, public and private partnerships, business and industry leadership, and coordinated planning among economic development and tourism entities. This must be done through holistic approaches to community development and natural and human resource protection.

This Commission recognizes that both the cost and benefits of its recommendations will impact present and future taxpayers. Our definition of "sustainability" requires that competing methods for accomplishing our recommendations must be subjected to rigorous and appropriate cost-benefit analysis, using principles of full cost accounting (as defined in the Glossary), to assure its attainment in the most cost-effective manner.

The environmental component, born out of the consensus that the health of the Everglades ecosystem must be restored in perpetuity, is dominated by the issue of water management. To obtain a higher level of stewardship, the Commission examined how to save, store, and reuse water more efficiently for human and natural systems. More efficient management could result in less discharge of stormwaters to tide, improved water quality, reduced flooding, and enhanced natural systems. This highly complex ecosystem, with its interrelated social, political, and environmental needs was addressed through numerous recommendations for improved water resources management.

A-2. NATURAL SYSTEM RESTORATION AND ECOSYSTEM SUSTAINABILITY DIRECTIVE

"Our quality of life is inextricably linked to the health and viability of natural systems; that a healthy Everglades system is vital to natural plant, animal and human populations alike." (Initial Report, 1995)

The ability to restore the health of the natural system and achieve sustainability of the South Florida ecosystem that includes sustaining the region's economy and quality of life depend, to a great extent, on the success of the efforts to protect and manage the region's water resources. It is evident that the present course in South Florida is not sustainable. The inextricable link between the human community and the natural system is obvious. A healthy natural system is the foundation from which South Floridians' quality of life stems.

The interdependence of the Everglades and the whole South Florida ecosystem and economy cannot be ignored. The Kissimmee River, Lake Okeechobee, the Everglades, Florida Bay, the Florida Keys, the estuaries and the barrier coral reefs are strongly interconnected natural systems, but have been viewed and managed as isolated components. A new and broader perspective is needed to integrate the entire ecosystem.

The changes that have taken place in South Florida's natural areas, escalated by the C&SF Project and other water management activities, have had broad and far-reaching effects. Direct impacts on the tourist industry and on local and regional economies are being felt. In certain areas, water and air-borne pollutants are threatening public health, safety, and welfare. The Commission believes that the protection of South Florida's water resources is an issue requiring immediate attention.

A-3. THE COMPREHENSIVE REVIEW STUDY

The C&SF Project consists of a regional network of canals, levees, storage areas, and water control structures designed to provide reliable water supply and flood protection for existing and future development. The region's hydrology is now largely governed by manmade systems superimposed on natural ones. Unintentionally, water management activities have resulted in extensive damage to South Florida's environmental systems: the channelization of the Kissimmee River in the 1960s and '70s; the deterioration of water quality and aquatic life in Lake Okeechobee; the excessive drainage caused by the Golden Gate and Faka Union canal systems within Collier County; and the environmental degradation of the Everglades, Florida Bay, the coral reefs, and many estuarine areas. South Florida's systems continue to suffer additional casualties, including severe degradation of estuaries and aquatic life and loss of valuable uplands. With over half of the Everglades' wetlands destroyed, and with population projected to triple by the year 2050, South Florida must reassess and redirect its priorities. Positive steps must be made to alter its present unsustainable course.

The C&SF Project has performed its intended flood control, water supply, and other purposes effectively; however, it has also contributed to the decline of the South Florida ecosystem. This decline has led to the congressional authorization to reexamine the Project. The Central and Southern Florida Project Comprehensive Review Study (Restudy) was authorized by Section 309(l) of the Water Resources Development Act of 1992 (Public Law 102-580), which states:

"(1) CENTRAL AND SOUTHERN FLORIDA - The Chief of Engineers shall review the report of the Chief of Engineers on Central and Southern Florida, published as House Document 643; 80th Congress, 2nd Session, and other pertinent reports, with a view to determining whether modifications to the existing project are advisable at the present time due to significantly changed physical, biological, demographic, or economic conditions, with particular reference to modifying the project or its operation for improving the quality of the environment, improving protection of the aquifer, and improving the integrity, capability, and conservation of urban water supplies affected by the project or its operation."

This study is also authorized by two resolutions of the Committee on Public Works and Transportation, United States House of Representatives, dated September 24, 1992. The first resolution states:

"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, that the Board of

Engineers for Rivers and Harbors, is requested to review a report of the Chief of Engineers on Central and Southern Florida, published as House Document 643, 80th Congress, 2nd Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of environmental quality, water supply and other purposes."

The second resolution states:

"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, that the Board of Engineers for Rivers and Harbors, is requested to review the report of the Chief of Engineers on Central and Southern Florida, published as House Document 643, 80th Congress, 2nd Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of environmental quality, water supply, and other purposes for Florida Bay, including a comprehensive, coordinated ecosystem study with hydrodynamic modeling of Florida Bay and its connections to the Everglades, the Gulf of Mexico, and the Florida Keys coral reef ecosystem."

The existing C&SF Project is a complex, multipurpose project. The existing authorized purposes of the Project include water control; water supply for Everglades National Park deliveries; flood control; regional water supply for agricultural, urban and natural areas; prevention of saltwater intrusion; conservation of fish and wildlife; recreation; and navigation. The Commission recognizes that the Restudy authorized by Congress provides a timely mechanism for formulating, evaluating, and implementing modifications to the C&SF Project needed to restore the health of the natural system and provide for a sustainable South Florida ecosystem. In order to better evaluate the Project in the context of all these purposes, consistent with Congressional direction for the Restudy, the Corps completed the Reconnaissance Report in November, 1994. Following that effort, the Corps and the SFWMD jointly developed a Project Study Plan for the Restudy, that was approved by SFWMD's Governing Board in July, 1995, to provide guidance for all subsequent phases of the Restudy.

B. THE COMMISSION'S ROLE IN THE COMPREHENSIVE REVIEW STUDY

"...the Commission should provide the SFWMD and the Corps with specific recommendations describing its preferred alternatives in the Restudy." (Initial Report, 1995)

It is the mission of the Commission, representing diverse interests, to develop recommendations and public support for regaining a healthy Everglades ecosystem that can coexist with a sustainable economy and quality communities. The initiation of the Restudy by the Corps and the SFWMD provides the Commission with a timely opportunity to express its vision of South Florida and its desire to expedite the shared federal/state restoration effort.

The charge of the Governor's Commission for a Sustainable South Florida is much broader than the water resource issues that can be addressed by the Restudy. The Commission, however, envisions the Restudy as an important component of sustainability and recognizes it as the vehicle to address many of the regional water resource issues identified in the Commission's *Initial Report*. Several of the recommendations in the *Initial Report* apply directly to the Restudy. For example, the Commission encourages integrating water resources management state-wide. Presently, there is insufficient coordination between the multitude of agencies to ensure that conflicting interests will be fairly addressed. The Commission can bring a broad array of interested parties into the planning process. This grouping would allow those most affected to anticipate problems, offer solutions to problems and ensure that any possible deleterious effects, economic or otherwise, are avoided. Where they cannot be avoided, any such effects should be more equitably shared by all. Other recommendations address the need to integrate all elements of water resource management including water supply, flood protection, water quality, and natural resources restoration, protection and management. The Commission wishes to ensure that these objectives for sustainability and the interests of all South Florida are addressed by the Restudy.

As a means to provide input to the Restudy, the Commission has developed this Conceptual Plan that describes how the Restudy should fit into its broader vision of sustainability. This Conceptual Plan provides specific recommendations describing the Commission's preferred alternatives for consideration in the Restudy and includes concepts the Commission feels are vital to solving the water resource problems of South Florida. While the Commission has had the benefit of numerous presentations of a technical nature that have assisted in developing the 40 preferred options, the Commission itself has not

performed technical evaluations in developing its Conceptual Plan. Therefore, this plan is intended to identify options for modifications to the C&SF Project, grouped by thematic concepts, to guide technical evaluations to be performed during the Restudy by the Corps. It is not intended to serve as a blueprint for construction, nor limit the range of alternatives considered to address the water resource problems of South Florida. Rather, it provides a framework for the formulation and evaluation of alternative plans for the Restudy.

C. THE COMMISSION'S CONCEPTUAL PLAN FOR THE RESTUDY

One of the fundamental recommendations of the Commission's *Initial Report* is to further refine its objectives for reconciling natural system restoration and continued development in South Florida. In recognition of the opportunity to further the Restudy, the Commission developed a number of planning objectives ranging from restoring fish and wildlife, to increasing water supply for urban areas, agriculture and natural areas, to improving marine conditions (see Table 1). The Commission also developed a list of 40 preferred options that, together with on-going efforts, should be further reviewed on a technical basis in the Restudy to determine if the options work toward restoring the natural system while ensuring adequate water supply and flood protection for South Florida in the near and long term (see Table 2). For the purpose of developing a broad-based Conceptual Plan for the Restudy that accounts for the needs of the stakeholders, the options were generalized into thematic concepts. This generalization ensures that the Restudy addresses a broad range of alternatives including variations of the 40 preferred options and other options that might be feasible but have not yet been considered. The details of this process and the subsequent development of the Conceptual Plan for the Restudy can be found in Chapter II of this report.

The Conceptual Plan for the Restudy serves as a means for incorporating the Commission's goals and objectives for a sustainable South Florida with those of the Restudy. It must be recognized that the broad components identified by the Commission -- society, the economy, and the environment -- are intrinsically linked and the health of each is extremely important to a sustainable South Florida. This Conceptual Plan will clarify the Restudy's role within the context of the Commission's broader holistic view of sustainability. The Commission's Conceptual Plan for the Restudy provides the vehicle to specifically address water resource issues and natural system restoration. Nevertheless, these components are inseparable in terms of long-term sustainability of South Florida's human, natural, and economic resources. Integrated actions that address each of these components are essential to regain a healthy Everglades ecosystem with a sustainable economy and quality communities.

**Table 1
GENERAL PLANNING OBJECTIVES FOR THE RESTUDY**

<p>ECOLOGIC</p> <ul style="list-style-type: none"> • Improve habitat quality and heterogeneity. • Improve connectivity and reduce fragmentation of habitats. • Provide the spatial extent of natural areas required to support the mosaic habitat characteristic of the pre-drained Everglades ecosystem. • Improve and protect habitat quality, heterogeneity, and biodiversity in coastal and associated marine ecosystems. • Provide for sustainable populations of native plant and animal species with special attention to threatened, endangered, or species of special concern. • Restore and, where appropriate, improve functional quality of natural systems (including both wetlands and uplands). • Reduce the spatial extent of invasive nonnative species to the extent that they do not affect the natural system. • Halt and/or reverse the conditions causing the spread of native species that are threatening (and perhaps dominating) areas as a result of disturbances such as nutrient enrichment.
<p>HYDROLOGIC</p> <ul style="list-style-type: none"> • Restore more natural hydropatterns, including associated sheetflow. • Provide more natural quality and quantity, timing and distribution of freshwater flow to and through the natural Everglades. • Provide more natural quality and quantity, timing, and distribution of freshwater flow to estuaries and coral reef ecosystems. • Ensure adequate water supply and flood protection for urban, natural, and agricultural needs. • Regain lost storage capacity. • Restore more natural organic and marl soil formation processes and arrest soil subsidence. • Improve water quality, including reduction of toxins, and ensure appropriate water quality consistent with designated uses including restoration and protection of the natural systems. • Control saltwater intrusion into freshwater aquifers. • Integrate the Project with local stormwater, wastewater, and other water management functions.
<p>SOCIO-ECONOMIC</p> <ul style="list-style-type: none"> • Establish levels of provided flood protection in terms of frequency, depth, and duration. • Reduce damages from flooding to public and private property. • Provide water management that supports economic diversity and sustainability derived from the natural and developed systems. • Enhance economic opportunities consistent with sustainable marine ecosystems. • Protect and preserve cultural and archeological resources and values. • Increase recreational opportunities consistent with sustainable natural systems.

Table 2
40 PREFERRED OPTIONS (With Conditions)

Kissimmee River Area including Native American Tribal Lands

- Kissimmee River Pool A Restoration
- Paradise Run Restoration
- Kissimmee Region - Water Treatment Areas - *Project design must address water quality concerns. Holding areas should be multi-purpose.*

Lake Okeechobee Area

- Maximize Lake Storage Without Environmental Harm - *No significant impacts to the littoral zone or water quality should be allowed. Damage to the east and west coast estuaries by the current regulation schedule must be addressed.*
- Restore More Natural Fluctuations of Lake Levels - *No significant impacts to the littoral zone or water quality should be allowed. Other state agencies (e.g., FGFWFC) should be involved.*
- Restoration of Kreamer, Torry, and Ritta Islands
- Lake Okeechobee - Aquifer Storage and Recovery (ASR) - *The maximum additional storage and cost effectiveness should be evaluated. Impacts to the littoral zone should be minimized.*

Everglades Agricultural Area (EAA)

- EAA - Water Storage Areas (Reservoirs) - *Sufficiency of land to accomplish storage should be based on need, science, and appropriate cost-benefit analysis. Up to the entire Talisman property should be considered as a target of opportunity for increased storage with any portions not needed returned to agriculture; additional areas may be considered as necessary. Land acquisitions should be made with willing sellers and in consultation with local landowners. The burden of water storage should be shared across the system.*
- Increase Groundwater Levels to Control Soil Subsidence

Lower West Coast including Caloosahatchee River

- Caloosahatchee - Water Storage Areas (Regional Attenuation/Reservoir Facilities) - *Locations of potential storage areas should be chosen in consultation with local landowners.*
- Caloosahatchee - Water Treatment Areas - *Project design must address water quality concerns. Holding areas should be multi-purpose and located in consultation with local land owners.*
- Restoration of Golden Gate Estates - *Consistent with the SFWMD's restoration plan.*
- Caloosahatchee - ASR - *The maximum additional storage and cost effectiveness should be evaluated. Impacts to the littoral zone should be minimized.*
- Remove Organic Sediment Deposits from Caloosahatchee Estuary - *Any such removal should be evaluated as to cost effectiveness; pollution impacts from removal process; sediment disposal; and how to prevent resiltation.*

Table 2 (continued)
40 PREFERRED OPTIONS (With Conditions)

Western Basin including Native American Tribal Lands

- Water Treatment Area for L-28 (Interceptor)

Upper East Coast Area (UEC)

- UEC - Water Storage Areas (Regional Attenuation Facilities) - *Locations of potential storage areas should be chosen in consultation with local landowners.*
- Stabilize St. Lucie Canal Banks
- Remove Organic Sediment Deposits from St. Lucie Estuary - *Any such removal should be evaluated as to: cost effectiveness; pollution impacts from removal process; sediment disposal; and how prevent resiltation.*

Water Conservation Areas (WCAs) including Holey Land and Rotenberger Wildlife Management Areas

- Modify WCAs to Create Contiguous Natural Area - *Restore the connectivity of the WCAs to the maximum feasible extent consistent with the ability to maintain flood protection and habitat quality, and to replace, through storage in the overall system, any existing urban water supply that may be lost.*
- Modify each WCA to Enhance Wetland Habitat - *Habitat should be enhanced to the maximum extent feasible. Public water supply may be addressed through storage in the overall system, and flood protection should be maintained.*
- Remove Invasive Non-Native Plants

Lower East Coast Area

- Water Preserve Areas
- Seepage Control - *All methods should be considered and evaluated.*
- Saltwater Treatment (Reverse Osmosis, Blending) - *Employ only as a last resort. Cost effectiveness should be evaluated. The technology does not stand alone.*
- LEC - ASR - *Use in conjunction with storage in buffer areas. Cost effectiveness, technical feasibility, and water quality should be addressed.*
- Wastewater Reuse
- Raise Coastal Canal Stages Coupled with Increased Discharge Capacity
- Water Treatment Area for S-9
- Inter-connect Local Water Management Systems - *There should be shared costs and a clear delineation of responsibilities. The responsibility to solve regional concerns should be included.*
- Implement Southern L-8 Basin / Loxahatchee Slough - *There should be no negative environmental impacts. This option is an example of a project that could salvage, clean-up, and reuse water. It would require local governmental consultation and review in concert with the Restudy.*
- Lake Belt/Seepage Barrier - *All methods of seepage control should be considered and evaluated.*
- Remove Invasive Non-Native Plants (LEC)
- 8 ½ Square Mile Area - *The progress of the East Everglades 8 ½ Square Mile Area Study should be monitored. The western 1/3 to ½ should be bought by the public and included in the buffer.*
- Control Structure in C-4 Canal

Table 2 (continued)
40 PREFERRED OPTIONS (With Conditions)

Big Cypress National Preserve

- Modify L-28 and L-28 Tieback Levees to Restore More Natural Flows Through Big Cypress National Preserve - *Increased conveyance through Tamiami Trail from CR 951 to 40 Mile Bend and Loop Road should be included.*

Everglades National Park

- Degrade L-29 Levee and Raise Portions of Tamiami Trail
- Add More Culverts Under Tamiami Trail - *Includes the entire reach of Tamiami Trail.*
- Flamingo Road Improvements to Improve Hydrologic Flow
- Incorporate Water Quality and Supply into C-111 and Modified Water Deliveries Projects

Florida Bay/Biscayne Bay/Florida Keys

- Hydrologic Improvements in the Model lands Basin in Dade County
- Hydrologic Improvements in North, Central, and South Biscayne Bay Basins in Dade County

Meeting the restoration and future water supply needs for the region, while maintaining or improving flood control, are key objectives. As South Florida continues to develop, however, options are being foreclosed as critical lands necessary to achieve restoration and sustainability diminish. Recognizing that time is of the essence, the Commission has included in the Conceptual Plan for the Restudy a process to expedite these efforts.

The current authorization process used by the Corps to implement water resource projects is time-consuming and concentrates decision-making at the Washington level with limited coordination with the State. Under the current process, authorization for modifications to the Project will not occur until the completion of the feasibility study, estimated to take up to five more years to complete. Upon completion, a lengthy review process at the Washington level is conducted before the report would be sent to Congress. Enactment of legislation that would authorize the specific modifications to the C&SF Project, normally in the Water Resources Development Act, is required before construction and land acquisition can proceed. The current process precludes acquisition of lands necessary for project implementation until after Federal authorization. Detailed designs of individual components identified in the Restudy will likely be independently subjected to the lengthy Washington-level review and authorization process unless an overall Comprehensive C&SF Project Plan is developed and an improved collaboration process implemented. Given the complexity and size of the C&SF Project, the existing piecemeal approach would likely fail.

An improved partnership between federal and State government that streamlines the review and authorization of C&SF Project modifications and

existing process requires the coordination, cooperation and input from both private interests as well as local and regional governmental agencies. The improved partnership should be consistent with existing laws and should recognize the statutory authority vested in other government agencies. Chapter III includes the Commission's recommendations for an improved partnership.

CHAPTER II

CONCEPTUAL PLAN FOR THE RESTUDY

The Commission's Conceptual Plan for the Restudy consists of a strategy for coordinating and implementing a number of the water resource projects in South Florida into a cohesive whole, ensuring that they are consistent with the Commission's goals for a sustainable South Florida. This chapter summarizes the process the Commission employed to develop this Plan for the Restudy. Included are the Commission's planning objectives for the Restudy (see Table 1) and the conceptual level water resource projects needed to ensure a sustainable South Florida ecosystem (see Table 2). Various agencies are implementing some water resources projects (termed ongoing projects). However, the Commission finds the need for additional efforts that are fully integrated. Therefore, numerous water resource projects already programmed or underway also are considered and discussed as an integral part of the Conceptual Plan for the Restudy.

The Commission recognizes that the Conceptual Plan for the Restudy is only a start. More detailed planning and design by the Corps, the SFWMD, and other entities are required prior to implementing projects. Nevertheless, the Commission believes that the Conceptual Plan for the Restudy provides a focus and a means to accelerate the efforts that will follow over a number of years. Chapter III provides a set of recommendations for coordinating and implementing the Conceptual Plan for the Restudy.

A. INITIAL REPORT RECOMMENDATIONS

Of the 110 recommendations in the Commission's *Initial Report*, many specifically address goals and objectives for the Restudy and provide specific recommendations describing the Commission's preferred alternatives to the Corps and the SFWMD. In summary:

- The Corps and the SFWMD should *"assure that the Restudy addresses the need to achieve a sustainable South Florida economy by... proposing reliable, cost-effective measures to provide the necessary water supply."* (Recommendation 11)
- The Corps and the SFWMD should: (1) address water supply needs for urban and agricultural users; (2) address natural water level fluctuations within the natural system and restoration of natural water quality, timing, volumes, and distribution to the Everglades; and (3) expedite the Restudy schedule without sacrificing thoroughness or quality of the final product. (Recommendation 13)

- *"The Restudy should integrate all elements of water management (water supply, flood protection, water quality protection, and natural system management). Redesign should provide for sustainability for human and natural system requirements." (Recommendation 15)*
- *"All plans, and especially the Restudy, should assure that new demands do not adversely affect the sustainability of human and natural systems." (Recommendation 16)*
- *"In the Restudy, the SFWMD and the Corps should ensure that the redesign of the system allows for resilience for a healthy natural system." (Recommendation 17)*
- The agencies and interested parties should *"redesign and develop new operations for the South Florida water management system at all levels to conserve and sustain natural systems, to maximize the capture of stormwater, and to conserve water for the benefit of all users."* (Recommendation 23)
- The Corps and the SFWMD *"should reduce the extent of damage from flooding to human and natural systems."* (Recommendation 27)

B. PLANNING OBJECTIVES

In addition to the recommendations in the *Initial Report*, the Commission developed a list of planning objectives for the Restudy (see Table 1). These objectives guided efforts to prepare this document, serving as the starting point to develop options for consideration in the Restudy.

The Commission's objectives fall into three general categories: ecologic, hydrologic, and socio-economic. The Commission believes that if these objectives can be achieved, the goals of restoring the ecological health of the natural areas (including adjacent watersheds and tributaries) and enhancing the region's economy and quality of life can be achieved. The 23 planning objectives are listed in Table 1.

The ecologic planning objectives focus on restoring environmental quality to a system that has experienced a massive loss of natural resources. They aim to expand habitat through reclamation and improve habitat quality and heterogeneity consistent with the characteristic mosaic habitat of the pre-drained Everglades and the coastal and associated marine ecosystems.

The hydrologic objectives focus on ensuring adequate water quality; water supply; timing of flows; flood control for urban, natural, and agricultural needs;

restoring more natural hydro patterns, including sheetflow; regaining lost storage capacity; reducing per capita consumption; and encouraging water reuse to achieve the ecologic objectives stated earlier.

Finally, the economic and social objectives provide for water management that supports economic diversity and sustainability for natural, agricultural and developed systems. The Commission believes the need to integrate regional water management systems with local stormwater, wastewater, and other water management functions must be considered when developing alternatives.

C. DEVELOPMENT OF THE CONCEPTUAL PLAN FOR THE RESTUDY

The ability to create a sustainable South Florida depends, to a large degree, on the ability to protect and manage the region's water resources. It requires a change in the region's historic approach to water resources management. This Conceptual Plan for the Restudy consists of a series of projects and programs that together form a comprehensive strategy to bring about positive change. While some projects are in various phases of implementation, these projects, by themselves, do not result in restoration. The Commission has identified the need for additional and integrated efforts. This section summarizes on-going projects and describes additional efforts supported by the Commission that together make up the Conceptual Plan for the Restudy, that -- while immense in scope -- is still a subset of the overall restoration efforts needed for a sustainable South Florida. The term "thematic concepts" is used to describe the components of the Conceptual Plan for the Restudy and is intended to provide specific recommendations describing the Commission's preferred alternatives for consideration in the Restudy as detailed studies get underway.

Since 1948, the C&SF Project has undergone numerous changes including eleven Congressional Acts directing the Corps to make major modifications to the project. Today, there is a concerted effort in South Florida by federal, Native American tribal, state and local governments, business and agricultural interests, land owners, and communities to restore the surviving remnants of the historic Everglades and its associated ecosystems. Numerous programs and projects are underway that will provide immediate benefits while others will require long-term planning for the future. The on-going projects form a foundation from which to develop the Conceptual Plan for the Restudy. Because the entire C&SF Project is hydrologically linked, all water management activities impact one another. Therefore, implementation of the ongoing projects and programs must be closely coordinated by sharing information as they proceed from planning and design through implementation and operation. These on-going efforts, while not intended to be all-inclusive, are included as elements of the thematic concepts. The following section is a detailed description of the process the Commission

underwent to generate the 13 concepts that together form the Conceptual Plan for the Restudy.

C-1. PRELIMINARY OPTIONS

As a first step toward identifying the additional actions needed to develop the Conceptual Plan for the Restudy, the Commission considered 66 options/ideas formulated from a myriad of federal, state, and local agencies; interest groups; and other members of the public. Many of these options had been evaluated to varying degrees during the reconnaissance phase of the Restudy and the Lower East Coast Regional Water Supply Planning effort. The ideas ranged from non-structural options to ones that require major structural modifications or additions to the existing C&SF Project. Five additional options were generated by members of the Commission.

Through a series of three workshops, the Commission considered and grouped the options together to form alternative plans. This process helped the Commission gain an understanding of the interrelationships among the various options and set the framework for determining which options had common support and which ones did not. Facilitated discussion allowed for a systematic review and screening of each option.

The result of this process was a list of 40 preferred options, to be evaluated as modifications to the C&SF Project. The Commission agreed to support these options for technical evaluation in the Restudy, although conditions or limits were placed on certain ones. The conditions were intended to clarify important issues and to provide specific recommendations describing the Commission's alternatives for consideration in the Restudy (see Table 2) in more detailed study of these options. Table 2 includes the list of the 40 preferred options and the conditions (in italics) placed on those options.

Fundamental general concepts pertaining to the 40 preferred options were:

- A. The burden and responsibility for water storage should be shared across the system.
- B. Water quality and treatment should be addressed and optimized throughout the system.
- C. The Commission supports projects in general that salvage, clean up, and reuse water.

C-2. ELEMENTS OF THE CONCEPTUAL PLAN FOR THE RESTUDY

After reaching consensus on the 40 preferred options, the Commission asked for additional analysis and information in order to refine the preferred options for possible inclusion into the Conceptual Plan for the Restudy. As part

of the Restudy, the Commission's preferred options were screened and a process for analyzing them further was developed. Due to the similarities in function, the 40 preferred options were grouped into 13 thematic concepts to form a broad-based Conceptual Plan for the Restudy. These concepts include the spectrum of the preferred options identified by the Commission but are less specific. By generalizing the concepts, the Commission hoped to provide the Restudy with sufficient information to evaluate the broad spectrum of options and the trade-offs among them without restricting development of new options. Together with the potential modifications to the C&SF Project contained in the 40 preferred options, these concepts must be viewed holistically, not individually, since they come together to form an overall vision for the Restudy. In addition, many of the concepts will serve multiple purposes. For example, storage areas can help supplement natural system needs as well as provide water supply for agricultural and urban areas. The Commission recognizes the need for detailed analyses conducted as part of the Restudy to develop specific projects. However, the concepts that comprise the Conceptual Plan for the Restudy provide a basis for the formulation and evaluation of specific plans.

Table 3 identifies the various thematic concepts and illustrates how the 40 preferred options fit within these concepts. Table 3 also identifies ongoing projects and Farm Bill priority projects that fit under these thematic concepts. In addition, the map (found at back of this document) schematically portrays many of the concepts in relative geographic locales. The following sections provide a description of each of the concepts which include these projects currently underway or programmed and additional features the Commission determined important to meet its objectives for the Restudy.



Table 3
THEMATIC CONCEPTS

Includes Projects Underway and 40 Preferred Options (in *Italics*)

<p>Concept 1 - Regional Storage Within the Everglades Headwaters and Adjacent Areas <i>Kissimmee River Restoration Project*</i> <i>Upper Chain of Lakes - Operational Changes*</i> <i>Caloosahatchee - Water Storage Areas</i> <i>Upper East Coast - Water Storage Areas</i></p> <p>Concept 2 - Lake Okeechobee Operational Plan <i>Lake Okeechobee SWIM Plan.*</i> <i>Interim Lake Okeechobee Regulation Schedule Study*</i> <i>Maximize Lake Storage Without Environmental Harm</i> <i>Restore More Natural Fluctuations of Lake Levels</i></p> <p>Concept 3 - Everglades Agricultural Area Storage <i>Everglades Construction Project -STAs*,**</i> <i>Bolles And Cross Canal Project*</i> <i>EAA Water Storage Areas**</i></p> <p>Concept 4 - Water Preserve Areas <i>East Everglades 8 ½ Sq. Mi. Area*</i> <i>Water Preserve Areas**</i> <i>Seepage Control</i> <i>Lake Belt/Seepage Barrier</i> <i>Control Structure in C-4</i></p> <p>Concept 5 -Natural Areas Continuity <i>Experimental Program of Modified Water Deliveries to Everglades National Park (Shark River and Taylor Sloughs)*</i> <i>C-111 Project*</i> <i>Modified Water Deliveries to Everglades National Park*</i> <i>Florida Bay Emergency Interim Plan (Taylor Slough Demonstration Project)*</i> <i>Modify WCAs to Create Contiguous Natural Area</i> <i>Modify each WCA to Enhance Wetland Habitat</i> <i>Modify L-28 and L-28 Tieback Levees to Restore More Natural Flows through Big Cypress National Preserve to Everglades National Park</i></p>	<p><i>Incorporate Water Quality and Supply into C-111 and Modified Water Deliveries Projects</i> <i>Degrade L-29 Levee and Raise Portions of Tamiami Trail</i> <i>Add More Culverts Under Tamiami Trail</i> <i>Seepage Control</i> <i>Flamingo Road Improvements to Improve Hydrologic Flow.</i> <i>Hydrologic Improvements in the Model Lands Basin in South Dade County **</i> <i>8 ½ Square Mile Area**</i> <i>Seminole Water Conservation Project*,**</i> <i>Rotenberger/Holey Lands**</i></p> <p>Concept 6 - Water Supply and Flood Protection for Urban and Agricultural Areas <i>SFWMD Water Supply Planning*</i> <i>Saltwater Treatment (Reverse Osmosis, Blending)</i> <i>Wastewater Reuse</i> <i>Raise Coastal Canal Stages Coupled with Increased Discharge Capacity</i> <i>Interconnect Local Water Management Systems</i> <i>Implement Southern L-8 Basin / Loxahatchee Slough</i></p> <p>Concept 7 - Adequate Water Quality for Ecosystem Functioning <i>Everglades Construction Project -STAs*,**</i> <i>Advanced Water Quality Treatment Technologies -Research*</i> <i>Seminole Water Conservation Project*,**</i> <i>Miccosukee Water Management Area*,**</i> <i>SWIM Plans*</i> <i>Mercury Program*</i> <i>State Water Quality Efforts*</i> <i>Florida Keys National Marine Sanctuary Water Quality Protection Program*</i> <i>Kissimmee Region - Water Treatment Areas</i> <i>Caloosahatchee - Water Treatment Areas</i> <i>Water Treatment Area for L-28 (Interceptor)</i> <i>Water Treatment Area for S-9</i> <i>BMPs for Agriculture **</i> <i>Lower Western Basin STA**</i></p>
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Note: Projects Underway noted by *; Governor's Commission for a Sustainable South Florida's Farm Bill Priority Projects noted by **

**Table 3 (continued)
THEMATIC CONCEPTS**

Includes Projects Underway and 40 Preferred Options (in *Italics*)

<p>Concept 8 - Increase Spatial Extent and Quality of Wetlands Beyond the Everglades <i>Kissimmee River Restoration*</i> <i>Lake Kissimmee Drawdown*</i> <i>Save Our Rivers Program*</i> <i>Kissimmee River Pool A Restoration</i> <i>Paradise Run Restoration</i> <i>Restoration of Kreämer, Torry, and Ritta Islands</i> <i>Restoration of Golden Gate Estates**</i> <i>South Dade Wetlands Addition**</i> <i>Fakahatchee Strand**</i> <i>Belle Meade**</i> <i>South Glades**</i></p> <p>Concept 9 - Invasive Plant Control <i>Remove Invasive Nonnative Plants from WCAs</i> <i>Remove Invasive Nonnative Plants from Urban Areas</i></p> <p>Concept 10 - Aquifer Storage and Recovery <i>Lake Okeechobee - Aquifer Storage and Recovery</i> <i>Caloosahatchee - Aquifer Storage and Recovery</i> <i>LEC - Aquifer Storage and Recovery</i></p>	<p>Concept 11 - Protection and Restoration of Coastal, Estuarine, and Marine Ecosystems SWIM Plans* C-111 Project* Modified Water Deliveries to Everglades National Park* Florida Keys Carrying Capacity Study*,** Florida Bay Emergency Interim Plan (Taylor Slough Demonstration Project)* Florida Bay Hydrodynamic Model* Biscayne Bay Hydrodynamic Model* Florida Keys National Marine Sanctuary Water Quality Protection Program* <i>Remove Organic Sediment Deposits from Caloosahatchee Estuary</i> <i>Stabilize St. Lucie Canal Banks</i> <i>Remove Organic Sediment Deposits from St. Lucie Estuary</i></p> <p>Concept 12 - Conservation of Soil <i>Increase Groundwater Levels in the EAA</i></p> <p>Concept 13 - Operation, Management, and Implementation of the C&SF Project Modifications and Related Lands</p>
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Note: Projects Underway noted by *; Governor's Commission for a Sustainable South Florida's Farm Bill Priority Projects noted by **

Concept 1: Regional Storage Within The Everglades Headwaters And Adjacent Areas

Sufficient water to meet competing demands can only be provided by maximizing storage. Water storage should be provided throughout the entire system and in such a way that no single area is environmentally damaged by excessive storage requirements or bears a disproportionate share of the storage burden. This storage must be achieved in all areas of the South Florida system using every practical option. As part of this concept, regional storage would be evaluated for the northern reaches of the Everglades system (Caloosahatchee, St. Lucie, and Kissimmee River Basins). The additional storage in these basins should increase the water supply capabilities of the system and could ultimately

reduce demands on Lake Okeechobee, thereby providing additional water during the dry season and reducing damaging high water conditions and harmful discharges to the east-west estuaries during the wet season.

Kissimmee River Basin

The Kissimmee Chain of Lakes forms the headwaters of the Everglades system and provides a critical source of water for Lake Okeechobee. The Kissimmee River Restoration Project, as currently planned, includes operational changes of lake levels in lakes Kissimmee, Hatchineha, and Cypress to increase storage capacity necessary for the restoration of the Kissimmee River. Additional efforts that should be considered under this concept include examination of the operational plans for the remainder of the Upper Chain of Lakes to discern if they could provide additional storage capabilities to benefit the health of Lake Okeechobee and potentially reduce the volume of water shortages in the system.

Additional storage within the Kissimmee River Basin could reduce the amount of runoff entering Lake Okeechobee during the wet season when the lake typically approaches high levels. This could shorten the duration of high water levels within the lake that damage its littoral zone and could reduce the frequency of high volume discharges to the east and west coast estuaries. The increase in water levels within the Upper Chain of Lakes could be restricted to avoid natural system impacts of high water levels and the need to maintain flood protection to lakeside residential development throughout the area. In support of the Commission's sociological and economic goals, this concept must be designed to balance the need for storage with the need to maintain flood protection to lakeside developments and should not result in the relocation of communities and agricultural areas.

St. Lucie Canal and Caloosahatchee River Basins

Creating additional storage or enhancing the storage capacity on existing private or public facilities and open areas within the St. Lucie Canal and Caloosahatchee River Basins may reduce water supply demands on Lake Okeechobee by providing a supplemental source of water for irrigation and environmental base flow for the estuaries. The water conserved in Lake Okeechobee could be available for sustaining the health of the lake and downstream natural areas and other uses. Storage facilities could also attenuate local basin runoff that presently upsets the salinity balance in estuaries and adversely impacts seagrasses, invertebrates, and fisheries.

Pumping local basin urban and agricultural runoff into storage areas could attenuate flows during the wet season and provide storage into the dry season. Restoring hydropatterns in large natural areas and storing excess water in wet

pastures could attenuate flows and help restore cleaner and more natural inputs to the estuaries. Restoration of natural areas can also help meet the goal of expanding and enhancing the spatial extent of short hydroperiod wetlands. Dry period releases from these storage areas could be used for agricultural irrigation and for meeting minimum flow requirements of the estuaries. During those periods when supplemental irrigation requirements could not be met by the storage areas, water supply releases from Lake Okeechobee could still be provided. Attenuating stormwater runoff will provide some water quality benefits, although additional treatment may be required depending on the use of the discharged water. Water clarity is very important to aquatic vegetation, particularly grasses. For example, storing stormwater may allow suspended solids to settle out, consequently improving the transparency of the water.

The storage areas and their associated water treatment facilities should be sized and designed to be ecologically consistent with the location. The total storage volume, coupled with the size and depth of the storage areas, need to be optimized as a part of detailed design during the Restudy. The storage areas could require perimeter levees, pump stations, and conveyance canals to move water from the canal system into the storage areas and to control water supply and environmental releases from the storage areas. Ideally, individual upland storage areas would be divided among the various sub-basins and would be interconnected to provide for maximum flexibility of water management options among basins. The siting of these facilities should, to the maximum extent practicable, avoid primary or secondary impacts to existing wetlands and adjacent uplands, both of which contribute to a viable ecosystem and economy. The Indian River Lagoon Feasibility Study is examining the option of on-site retention for large dischargers within the St. Lucie Basin not presently providing such facilities; this concept should be examined for other areas as part of the Restudy effort.

Concept 2: Lake Okeechobee Operational Plan

Lake Okeechobee provides a critical source of water for the Everglades Agricultural Area (EAA), the urbanized areas of the lower east coast, portions of the lower west coast, the remaining portions of the historic Everglades system, and other wetland components of the South Florida ecosystem. Prior to manmade alterations, lake levels rose in response to rainfall and served as a valuable source of freshwater spilling into the Everglades during a relatively small number of high rainfall years. Today a lake regulation schedule triggers different management activities according to different lake levels. The current regulation schedule, known as Run 25, was developed for multiple purposes including water supply, flood control, navigation, and environmental protection. Since some of these goals conflict, achieving all of them under current conditions is impossible. Past efforts to meet all of these conflicting goals have resulted in damage to the lake's littoral zone and to the east and west coast estuaries. The Commission believes a new

operational plan for the lake is needed that maximizes storage opportunities, protects the east and west coast estuaries, restores the ecological health of the lake, and enhances wildlife populations. The ability to accomplish these goals greatly depends on additional storage throughout the system and on other improvements to the overall C&SF Project.

Within the constraints imposed by these conflicts, the operational guidelines for Lake Okeechobee are currently being reviewed to attempt to optimize the natural resources within the lake, water discharges for the purpose of restoring the natural hydropattern of the Everglades, and flows to the estuaries without adversely impacting flood control or urban and agricultural water supply. Avoiding environmental harm to the St. Lucie and Caloosahatchee estuaries caused by massive lake releases is an important goal. Equally important is protection of the lake littoral zone from prolonged high water. Maximizing storage for environmental, agricultural and urban needs while protecting the lake and estuaries will require creative new operational schedules. This interim study of operational guidelines for the lake is being conducted in conjunction with SFWMD's Lower East Coast Regional Water Supply Plan. In addition, the SFWMD's Surface Water Improvement and Management Plan requires specific regulatory and non-regulatory activities to address water quality conditions, including ongoing development and testing of Best Management Practices to reduce pollutants and assure water quality compliance for discharges into the lake. Additional actions may be necessary since current nutrient loads to the lake remain above the established target. Nutrient levels contained in lake water would need to be lowered before it could be discharged into the Everglades. These ongoing efforts should serve to benefit the health of the lake through improved water quality and operational changes which are more desirable for the lake's littoral zone without compromising other project purposes such as flood control and water supply. To fully resolve these conflicting demands on the lake, additional storage areas throughout the system and methods to improve water quality are required.

Until additional storage options are available elsewhere in the system, temporary storage capacity in the lake could help meet projected demands for urban and agricultural water supply and natural system needs. Revisions to the operational plan for Lake Okeechobee may allow additional water to be stored in the lake during wet periods and may help meet the projected demands during dry periods while maintaining ecologically desirable water fluctuations and lake levels. This could be accomplished by allowing periodic lower levels during droughts and higher water levels during wet periods, providing there is no significant adverse impact to the lake's littoral zone, or the east and west coast estuaries. A new operational plan needs to be identified that triggers management activities for high lake levels and "supply-side" management actions for low lake levels. Modified lake operations could increase the storage capacity of the lake,

while reducing impacts to other parts of the regional system. All operational options that seek to increase lake storage capacity, while protecting the littoral zone and the east and west coast estuaries, must be carefully examined.

Lake Okeechobee's littoral zone provides important nursery grounds and habitat for fish and other aquatic organisms. It also supports large populations of wading birds and migratory waterfowl. The current location of the littoral zone is the result of the construction of the existing dike system, and the lowering of the lake level by drainage. Colonization by aquatic plants creates a littoral zone where fluctuating water levels are sufficient to support emergent vegetation. A diverse littoral zone cannot survive under periods of prolonged inundation. Timing of varying water levels and light penetration in the shallows are key factors in maintaining a viable littoral zone. The existing littoral zone was established when lake regulation levels fluctuated between 13.0 and 15.5 feet NVGD. In 1978, the regulation schedule was set at 15.5 to 17.5 feet to increase lake water storage. Assuring the continued health of the existing littoral zone is an important goal. All available information should be used to design a lake regulation schedule that preserves a healthy littoral zone, maximizes lake storage, and allows attenuation of floodwaters to protect the east and west coast estuaries. If it is determined to be feasible, raising the regulation schedule above the current limits may require costly structural changes such as raising existing levees, modifying or adding water control structures, constructing new pump stations, canals, and tie back levees. Also, State Road 78 may need to be raised and additional flood easements acquired. Recent high lake levels and the resulting dike seepage problems indicate levee repairs and improvements may be required even if the current regulation schedule is not raised. In addition, the Seminole Tribe's Brighton Reservation is located on the northwest side of Lake Okeechobee. As federal trust property, this reservation should be considered in any decision regarding modifications to the water levels of the lake. The Restudy must consider all of these aspects when evaluating the role that Lake Okeechobee will play in the future.

Concept 3: Everglades Agricultural Area Storage

Much of the supplemental water supply for the EAA in the dry season is currently met by deliveries from Lake Okeechobee. Additional water storage in the EAA will lessen its dependency on Lake Okeechobee for irrigation water and potentially reduce the ecologically damaging high water conditions in the Water Conservation Areas and backpumping into Lake Okeechobee during the wet season. Regional above-ground impoundments or storage areas within the EAA could capture and store EAA runoff or excess water from Lake Okeechobee during the wet season. During the dry season, reservoir releases could be made to the primary canals for agricultural irrigation and for restoration of the downstream Everglades ecosystem. Lake Okeechobee would then no longer serve

as the only supplemental source for meeting EAA irrigation demands. During the periods when supplemental irrigation requirements could not be met by the storage areas, water supply releases from Lake Okeechobee could still be provided.

The Commission recommends that the determination of sufficient land to accomplish storage in the EAA be based on need, science, and appropriate cost-benefit analyses. The Talisman property is currently being considered for acquisition by the State for use as a water storage area. The Commission supports the acquisition of up to the equivalent of the Talisman property as a target of opportunity for increased storage. Additional areas may be considered. Until the total storage volume, size, and depth of storage areas are designed and optimized during the Restudy, based on analyses of costs, benefits, needs, and impacts, all land acquisition should be made with willing sellers and in consultation with local landowners. Acquired lands could be returned to agricultural use if not needed for restoration activities.

Properly sized and designed storage areas have the potential of improving the quality of water being delivered to the natural system by reducing EAA runoff entering the stormwater treatment areas (STAs), thereby reducing the nutrient loading coming from the EAA and aiding the STAs in meeting target phosphorus levels entering the WCAs. Further, detention of stormwater for attenuation purposes will improve water quality. However, additional water treatment may be required if the water within these storage areas is to be used to meet natural system demands.

Ongoing efforts to improve flood control capacity within the EAA and water quality of downstream flood control discharges, include the Everglades Construction Project and the reevaluation of the Bolles and Cross canals. Presently, the design of the major canals of the EAA is constrained in moving water internally within the EAA or from Lake Okeechobee to the south. By incorporating expanded or modified EAA canals with STAs and new water storage areas, the increased operational flexibility could provide additional flood protection to the EAA while protecting the WCAs and the coastal estuaries from damaging high water levels and untimely discharges. When Lake Okeechobee exceeds its regulation schedule, water that currently impacts the lake's littoral zone or disrupts the east and west coastal estuaries could be moved southward into new storage areas or, water quality permitting, to the Water Conservation Areas.

Concept 4: Water Preserve Areas

The purpose of the Water Preserve Areas (WPAs) concept is to: (1) increase storage and hold more water in the system by controlling seepage from

natural areas; (2) capture and store excess stormwater currently discharged to coastal waters, thus retaining an important water supply source for both urban and natural systems; (3) provide a buffer between the natural and developed areas; (4) preserve and protect wetlands outside the publicly owned Everglades; and (5) provide important transitional land uses between the natural and developed areas. The WPA concept may also enhance flood control in areas to the east of the WPAs. Attempts to meet these various goals should be coordinated and developed in a consistent manner.

Hydrologic modeling of the regional system has demonstrated seepage control is a critical component for achieving restoration targets in the southern Everglades and Florida Bay. Much of the water that seeps out of the Everglades is collected in the secondary canal network and discharged into the regional canal system, resulting in excessive releases to coastal waters. The WPA concept must include a cost-effective implementation of one or all of these alternatives to achieve the multi-purpose functions and operational flexibility needed to meet the Commission's objectives. WPAs should enhance regional capabilities for meeting environmental, urban, and agricultural water demands, while simultaneously providing protection of certain designated wetlands outside the Water Conservation Areas and Everglades National Park. The WPA concept consists of a series of surface water impoundments, interconnected and managed as a system of marshlands, storage areas, and/or aquifer recharge basins. These areas provide the potential to backpump stormwater currently discharged to coastal waters and serve to control urban sprawl into remaining peripheral wetlands. Some examples of seepage control alternatives which should be evaluated for inclusion in the WPAs are creating areas to store excess urban runoff, creating a step down of water levels toward the east, building collection and backpumping facilities, and installing subterranean barriers.

Water quality becomes an important consideration where enhancement of existing wetlands or backpumping into the Water Conservation Areas or wellfield recharge areas is desired. Untreated stormwater should be diverted to a treatment facility or should undergo other treatment options necessary to achieve water quality standards prior to discharge to a wetland area, wellfield recharge area, or surface water supply source areas. In particular, the S-9 pump station must also be considered. The S-9 pump station is the only major C&SF Project facility that currently discharges untreated urban stormwater into the Everglades. Other urban stormwater discharge into the Everglades by local drainage districts must also be addressed. Structures that discharge into WCAs should have appropriate permits to discharge effluent, should be monitored, and should meet all applicable state and federal water quality standards and laws. A water treatment facility could remove phosphorus and other constituents from stormwater prior to discharge into the Water Conservation Areas.

The WPA concept includes the remaining natural areas and open spaces along the eastern boundaries of Everglades National Park and the Water Conservation Areas and extends north into the Upper East Coast area. This concept is considerably more extensive than the existing SFWMD East Coast Buffer Project boundaries, that is a land acquisition initiative that preserves, where possible, design flexibility for future water preserve elements. For example, Palm Beach County has proposed that the WPA concept be extended east and northeast into the Loxahatchee Basin.

In June 1995, the Martin and St. Lucie County Commissions established a WPA Task Force to facilitate selection of suitable sites for WPAs in those counties. In Martin and St. Lucie counties, WPAs could provide for the diversion of surplus runoff from the C-23, C-24, and C-25 drainage basins to storage areas where the water could be used for agricultural purposes or, with treatment, could be discharged into the estuary to enhance needed baseflow. The Task Force has completed a draft report that evaluated a number of potential WPA sites and conducted a design charette for a potential site at Allapattah Ranch. WPAs in these two counties could help alleviate the problems caused by excessive inflows of freshwater to the St. Lucie estuary and Indian River Lagoon.

The area of northwestern Dade County proposed as a future "Lake Belt" by the South Florida Limestone Mining Coalition lies east of WCA-3B and comprises a large portion of land being considered for the WPAs. The Florida Legislature recognized that one of the few remaining high-quality, construction grade limestone deposits suitable for the production of aggregates, cements and road base materials in the state is located in this area. Therefore, the legislature established the Northwest Dade County Freshwater Lake Plan Implementation Committee and further defined the proposed lake plan boundaries. The objective of the legislation is to develop a plan that:

"(a) enhances the water supply for Dade County and the Everglades; (b) maximizes efficient recovery of limestone while promoting the social and economic welfare of the community and protecting the environment; and (c) educates various groups and the general public of the benefits of the plan."

A public/private partnership may offset the cost or reduce the need for acquiring portions of the WPA (including but not limited to land donations, land swaps, and less than fee simple acquisitions). However Lake Belt Plan development is proceeding in advance of the WPA design component of the Restudy. Coordination between these two planning efforts is necessary to avoid difficulties associated with Everglades restoration. It is important that the future lake plan be consistent with economic and environmental sustainability and flexible enough to

ensure compatibility with South Florida natural system restoration and other objectives set forth by the Governor's Commission.

The WPA concept should extend seepage control south of Tamiami Trail to the eastern panhandle of Everglades National Park including the 8 1/2 Square Mile Area and the C-111 Basin. The stretch of the L-31N from Tamiami Trail to the 8 1/2 Square Mile Area is of significant concern because of the extreme rates of seepage along the eastern border of Northeast Shark River Slough. Raising water levels in the L-31N Canal is a critical element in restoring hydropatterns in Everglades National Park. This cannot be achieved without seepage control due to the flooding threat to the 8 1/2 Square Mile Area and areas to the east of the L-31N Canal. One suggestion in support of the WPA concept is to install a divide structure in the C-4 Canal. This would increase the potential volumes of stormwater that could be captured by various backpumping configurations as well as help recharge wellfields and improve flood protection for urban areas.

Because the 8 1/2 Square Mile Area is located adjacent to the Everglades National Park boundary, flood control could affect restoration of natural hydropatterns, flows and water quality within the Park. The currently authorized flood mitigation for the 8 1/2 Square Mile Area does not provide adequate protection for the community. The 8 1/2 Square Mile Area deserves consideration by the Restudy, consistent with the recommendations of the Governor's Committee on the 8 1/2 Square Mile Area.

The exact extent, design, and operation of the WPAs should be evaluated and determined as part of the Restudy. However, time is of the essence as lands in some of the proposed WPAs are rapidly being converted to uses that are incompatible with their potential use as WPAs. Therefore, accelerated acquisition of critical lands is needed to ensure that this concept remains viable.

Concept 5: Natural Areas Continuity

Historic freshwater wetland habitats in South Florida have been reduced spatially, compartmentalized, and hydrologically altered as a result of the C&SF Project. Further, habitats have been unnaturally fragmented. Reestablishing the hydrologic and ecologic continuity of the remaining natural areas is expected to benefit the entire Everglades ecosystem by recovering the pre-drainage functions and habitat values of historic freshwater wetlands, reducing the fragmentation, and restoring more natural hydropatterns including associated sheetflow. These actions may also help restore the ecological processes and relationships, and the diversity and numerical abundance of animals that can only come by reestablishing the central and southern Everglades and Big Cypress into a single, fully integrated ecosystem. This concept proposes to restore ecological continuity

to areas that are currently treated as geographically and hydrologically distinct. These areas include the three Water Conservation Areas, the Rotenberger/Holey Land tracts, the Big Cypress National Preserve, Ten Thousand Islands, Fakahatchee Strand, Mullet Slough, Corkscrew Swamp, Caloosahatchee Slough, Rookery Bay, Everglades National Park, the Model Lands, Florida Bay, the Florida Keys, and associated estuarine and marine waters. This concept involves structural and/or operational changes within the remaining natural areas for the benefit of the entire ecosystem. These structural changes should also include examining the effects and/or proposing changes to U.S. 27, which bisects the Water Conservation Areas, to enhance natural conditions.

Water quantity and water quality are important aspects of this concept, however, features to achieve these goals will generally come from outside the boundaries of the remaining natural areas. This concept assumes that appropriate quantity and quality of water needed to meet ecosystem goals in the natural areas will be available and that the Water Conservation Areas will be managed to the maximum extent feasible for natural values. Existing legislation by the State of Florida, the Everglades Forever Act (EFA), addresses non-point source pollution from agricultural activities in the EAA. Best Management Practices and treatment of runoff from the EAA through STAs are designed to reduce phosphorus levels in water released to the Everglades to 50 parts per billion, an interim goal for the discharges. Additional water quality treatment may be necessary if more stringent water quality standards are applied and additional water for restoration is required. Where possible, the EFA implementation schedule should also be accelerated.

Several efforts are currently underway that will help achieve the goals of restoring the hydrological function and reestablishing ecological connections between natural areas and wildlife communities. These ongoing projects include the Experimental Program of Modified Water Deliveries to Everglades National Park, the C-111 project, and the Florida Bay Emergency Interim Plan (Taylor Slough Demonstration Project). The Commission believes implementation of these projects will help achieve these goals while maintaining and, where possible, improving levels of water supply and flood protection to the adjacent agricultural areas.

The Experimental Program of Modified Deliveries to Everglades National Park was initiated in 1984 to test alternative operational plans and to provide more natural hydrologic conditions in the Everglades during the testing process. Initial tests addressed water deliveries to Shark River Slough and have since incorporated tests of water deliveries to Taylor Slough. The program will continue through the design and construction of the Modified Deliveries to Everglades National Park and the C-111 projects. The Modified Water Deliveries to Everglades National Park project is aimed at restoring the original deep water

portion of Shark Slough and reducing the impacts of large flood releases in western Shark Slough. The C-111 Project will create a buffer area along the eastern boundary of the Park to allow increased water levels in Taylor Slough and gradually lessen water levels from west to east. C-111 Project design modifications should also ensure natural water deliveries to the panhandle area of Everglades National Park and the Model Lands area east of U.S. 1. In addition, the Florida Bay Emergency Interim Plan, required by the Everglades Forever Act, should increase the amount of freshwater reaching Florida Bay by acquiring the Frog Pond and raising canal stages to promote more freshwater to flow through Taylor Slough into Florida Bay. Flood protection will be maintained and, where possible, improved for adjacent, existing urban and agricultural lands as these projects are implemented. Results should be monitored to evaluate effectiveness or identify needed modifications. The goal is to replicate flows, more natural hydropatterns, and flows in natural areas to maintain and restore native wetland, upland plant communities, and wildlife communities.

In the development of this Conceptual Plan for the Restudy, the Commission identified additional efforts needed in the region to fully meet its objectives for hydrologically and ecologically reconnecting natural areas. These are described as follows:

Water Conservation Areas

Historically, the three Water Conservation Areas (WCAs) were an expansive mosaic of habitats including uplands, hammocks, sawgrass plains, wet prairies, sloughs, lakes, and marl-forming marshes that constituted the central and northeastern portions of the historic Everglades. Construction of the three WCAs has resulted in the management of each of the areas according to a regulation schedule based on inflow and outflow of water through water control structures and system demands.

As part of this concept, structural modifications to the levees and structures currently compartmentalizing the WCAs and changes in operational plans will be investigated for the purpose of restoring more natural hydrologic and ecologic continuity within all of the WCAs. Preliminary hydrologic modeling conducted during the reconnaissance phase of the Restudy indicated some levees and structures may still be necessary to create desirable hydrologic and ecologic conditions throughout the area. Further, the current WCA regulation schedules need to be modified to schedules based on more natural conditions. The goal is to replicate more natural hydropatterns within the WCAs and to maintain and restore native wetland and upland plant communities. It is important to note that the movement of water through these areas has been altered by soil subsidence. Current flow patterns are much different than historic flow patterns. For these and other reasons, more detailed hydrologic modeling is necessary to determine

changes in hydrologic patterns that result from modifications to the amount, timing, and distribution of water flowing into and through the WCAs. As part of the Restudy, restoring the connectivity of the WCAs with the other portions of the Everglades should be consistent with the ability to maintain flood protection and existing water supply for agricultural and urban areas.

Big Cypress National Preserve

The Big Cypress National Preserve area is a mosaic of evolving habitat types resulting from both natural and manmade forces. Historically, long hydroperiods limited the invasion of shrubs and pines into cypress forests and frequent fires prevented hardwoods from dominating cypress and pine forests. Infrequent hot fires burned holes into peat soils that created new pools. The result of these conditions was a balance of shifting successional communities. Construction of the L-28 levee, Tamiami Trail, and Loop Road altered flows and changed the habitat cycles of floods and fires.

As part of this concept, hydrological and ecological conditions will be improved by providing more historic-like flows along the eastern border of Big Cypress National Preserve. This will provide for more natural inter-annual and seasonal variations of flow that will, in turn, result in a more natural cycle of floods and fires in the area. As more natural patterns of fires and floods are restored, overall habitat heterogeneity will increase and a more natural interspersion of uplands and wetlands will return. Additional benefits of this concept may include improvements in water table elevations in the coastal mangrove forests in the Ten Thousand Islands area of Everglades National Park. Impacts to threatened and endangered species such as the Cape Sable Seaside Sparrow and the West Indian manatee will need to be considered and addressed.

The L-28 levee presently separates WCA-3A and the Big Cypress National Preserve. To restore hydropatterns within Big Cypress National Preserve, this levee, Tamiami Trail, and Loop Road may need to be modified. Further upstream, the L-28 Interceptor Canal (L-28I) collects water from the Seminole Reservation and upstream basins and discharges it into WCA-3A. Allowing this canal to discharge further upstream in the northeast corner of Big Cypress National Preserve could rehydrate Mullet Slough and the headwaters of Big Cypress National Preserve, while still providing flood protection to the Seminole and Miccosukee Reservations. Facilities for water treatment will be necessary to improve water quality entering natural areas from the C-139 and the L-28I canals that presently flow directly into WCA-3A. The Seminole Tribe's Water Conservation Plan provides a greater opportunity to restore more natural hydropatterns in the Big Cypress National Preserve by creating flows further north and west. Bypass structures will be placed under the West Feeder Canal on

the Big Cypress Reservation that will sheetflow clean water south along the length of the Feeder Canal into the Preserve Addition.

Everglades National Park

Tamiami Trail (U.S. 41) and L-29 form an ecological and hydrological barrier between WCA-3 and Everglades National Park. Two on-going projects have identified ways to improve hydrologic and ecologic conditions within Everglades National Park; the Modified Water Deliveries and C-111 Projects. These projects will help improve conveyance into Everglades National Park and provide some seepage control south of Tamiami Trail. While these projects will improve conditions in Everglades National Park in the interim, additional measures may be needed to further control seepage and restore conveyance to historical levels. These issues need to be addressed through the Restudy and evaluated collectively. Structural modifications to the L-29 levee and improving conveyance through Tamiami Trail (bridge structure) from CR 951 to 40 Mile Bend and Loop Road need to be evaluated by the Restudy from the perspective of restoring the hydrologic and ecologic continuity of WCA-3, Everglades National Park, Big Cypress, and Ten Thousand Islands.

Groundwater seepage loss is the main impediment to any kind of restoration within Everglades National Park. Its impact is far reaching, affecting every water management decision along Tamiami Trail. To address this problem, the WPA concept has been extended south of Tamiami Trail to control the extreme seepage losses that occur on the east side of the Park. At a minimum, the areas of concern include the 8 ½ Square Mile Area, Bird Drive Basin, and the Pennsucco Wetlands.

Flamingo Road, which is the main road through Everglades National Park, is the only road providing access to the Flamingo visitor center. This roadway acts as a levee during high flow conditions and impedes sheetflow through portions of Everglades National Park. This concept addresses improving conveyance through this road. Adding culverts, bridges, or other improvements to Flamingo Road will remove a hydrological barrier and restore more natural flows within the area, resulting in improved hydrologic and ecologic continuity.

Biscayne National Park

Large public works projects in South Dade County (e.g. U.S. 1, the C&SF Project, etc.) have interrupted natural freshwater flows into Biscayne Bay. The pending transfer of Homestead Air Force Base to Dade County, and the public acquisition of the Model Lands provide important opportunities to improve these hydropatterns. The Commission supports the sustainable conversion of the air base and redevelopment of appropriate areas in southeast Dade County as

critical economic development projects. Water management changes that result from these activities must be made in ways that protect Biscayne National Park and other vital environmental resources in southeast Dade County, reconnect drained wetlands east and west of U.S. 1, and reinforce the sustainable agricultural goals of this Commission. The reconnection of Biscayne Bay to more natural freshwater flows from the mainland will complete the "natural area continuity" at the southeastern end of the natural system.

Concept 6: Water Supply and Flood Protection for Urban and Agricultural Areas

The flood protection and water supply provided by the C&SF Project have facilitated the development of urban and agricultural areas in South Florida. Population growth and the intense development in South Florida are expected to continue resulting in significant increases in the demand for water and pressure to maintain and enhance flood protection. The Commission recognizes that flood protection and water supply for all users are critical components of sustainability of the region. The Commission also recognizes the continued importance of the C&SF Project to meet these needs. It is the goal of the Commission to maintain existing levels of water supply and flood protection and, where consistent with restoration goals, to balance future flood protection and water supply.

C&SF Project facilities allow the WCAs and Lake Okeechobee to serve as a critical source of water for meeting urban needs during periods of low rainfall. This includes providing recharge to the surficial aquifer along the lower east coast and maintaining surface water supplies to the Caloosahatchee Basin and the West Palm Beach Water Catchment Area. In addition, the lake serves as a direct source of water for lakeside communities.

The SFWMD is currently developing four water supply plans that, together, cover the entire boundaries of the SFWMD. Each regional plan analyzes the available water supply and makes projections of future demand through the year 2010. Working with public advisory committees, the SFWMD is determining the likelihood of future water supply problems, and is developing potential solutions to these problems. The majority of the C&SF Project facilities fall within the boundaries of the Lower East Coast Regional Water Supply Plan that is scheduled to be completed in 1996. The Lower West Coast Water Supply Plan was completed in 1994. The Upper East Coast Water Supply Plan is scheduled for completion in 1996 and the Kissimmee Water Supply Plan in 1997. The plans will make recommendations to address immediate water supply issues and will also make long term recommendations to the Restudy.

One important option under consideration in both the Lower East Coast Regional Water Supply Plan and the Restudy is the WPA concept, which will

benefit regional water supply. Capturing and storing excess stormwater runoff in the WPAs could serve as additional storage areas for urban water supply and enhance recharge of the Biscayne Aquifer. Other regional concepts, such as modification of the regional and secondary canal systems to improve water management and recharge capability are possible methods of increasing recharge to the surficial aquifer. Options that have been identified for this purpose include raising coastal canal stages (with appropriate means to maintain flood control) and interconnecting local surface water management systems and the southern L-8 project in northern Palm Beach County.

Other alternatives, while less regional in nature, include new inland wellfields, public water supply aquifer storage and recovery (ASR), wastewater reuse, the reduction of per capita water usage, and the use of brackish or saltwater sources of water. Utility or local government programs for plumbing retrofit and landscape water conservation programs may also be useful in slowing the increase in urban demands. It is anticipated that the implementation of a combination of alternatives will be necessary, depending on the type of user and the circumstances that the user encounters. It is critical that the Restudy effort work closely with local water utility departments to further develop these alternatives. The Commission believes the Restudy must take a regional view toward water supply. Further, the Commission recognizes that regional water supply deliveries from the C&SF Project are critical to achieving sustainability. The Restudy must develop plans to mitigate and replace any water supply lost through system modifications for environmental restoration.

The C&SF Project has provided regional flood protection throughout the entire system. Flood protection provided to existing agriculture and development should be maintained. In a number of areas, some features of the Project have never been constructed and development and agriculture have occurred in areas not previously anticipated to be converted. Of particular concern is the South Dade area where projects such as the Modified Water Deliveries and the C-111 Project are underway. These South Dade projects must incorporate appropriate flood protection into their design. The Commission has identified a number of water storage options throughout the C&SF Project system that will provide increased flood protection. These options including the WPAs and storage areas should also include flood protection as their purpose.

Concept 7: Adequate Water Quality for Natural System Functioning

A fundamental requirement for maintenance and restoration of the Everglades ecosystem, Florida Bay and the coastal estuaries is the delivery of adequate amounts of clean water. Just as restoration of water quantity in proper volumes and timing to the Everglades is the cornerstone of Everglades restoration, the Commission believes that the natural system can only be restored

through the supply of clean rainwater and surface water from upstream marshes, rivers, sloughs, and Lake Okeechobee.

Drainage from the extensive agricultural development in the EAA delivered to the Everglades marsh via the C&SF Project structures resulted in the degradation of Everglades marsh surface waters. Stormwater runoff from extensive urban development on both coasts has degraded water quality in the coastal estuaries and certain portions of the Everglades where urban stormwater/drainage water is backpumped (i.e., the C-11 basin) via the C&SF Project structures. Since the natural Everglades ecosystem is oligotrophic, with high plant biomass and very low nutrient concentrations in marsh surface waters, it is acutely vulnerable to eutrophication by elevated nutrient levels. The estuaries, notably Florida Bay, Biscayne Bay, and the St. Lucie estuary, have been damaged by degraded water quality or unnaturally high volumes of water facilitated by the C&SF Project canals.

Large scale Everglades restoration planning and implementation must include the delivery of clean water to the Everglades marsh. Ecological restoration cannot be accomplished if water flowing to the Everglades contains high nutrients and ecologically damaging levels of pesticides, heavy metals, and other constituents. If, in the future, the Everglades marsh consists of large expanses of cattail monoculture, the ecologic integrity of the Everglades will not be equivalent to restoration of a diverse, heterogeneous system of sawgrass marsh intermingled with spikerush flats, deep water sloughs, tree islands and upland hardwood hammocks.

A number of activities are currently underway or programmed by various agencies to address the issue of water quality entering Lake Okeechobee, the Everglades, Florida Bay and the region's estuaries. These activities serve to improve the quality of water currently being discharged into lake, wetland, and estuarine ecosystems from existing water management infrastructure and are a critical and integral component of the Commission's Conceptual Plan for the Restudy. Evaluations of these water quality improvement activities must occur to insure their adequacy in meeting the goal of restoration.

The Florida Department of Environmental Protection's (DEP) water quality standards program develops designated uses and classifications of State waters. Narrative and numeric water criteria are set for various water quality parameters to protect the designated use of the water body. The Everglades Forever Act mandates that DEP, in conjunction with the SFWMD, develop numeric water quality criteria for phosphorus in the Everglades Protection Area by the year 2001. The development of numeric water quality criteria, particularly for phosphorus in the Everglades marsh, is a critical step in developing ecosystem-wide water quality and ecological restoration strategies. The Seminole

and Miccosukee Tribes have also been delegated the authority to set water quality standards. These standards will address protection of wetlands with cypress and sawgrass communities.

Because enforcement of state narrative and numerical water quality standards is critical to protecting the ecological health of the Everglades ecosystem, the Commission recommends that structures discharging into the Everglades Protection Area be appropriately permitted, as provided by law, and that discharge effluents be monitored to ensure all applicable state and federal water quality standards and laws are met.

Nonpoint source pollution associated with urban or agricultural land uses adversely impacts both groundwater and surface water resources and must be controlled in basins draining to both the Everglades Protection Area and the coastal estuaries. Specifically, nonpoint source pollution associated with the backpumping of untreated water into WCA 3-A at pump structure S-9, in the C-11 drainage basin in western Broward County, must be adequately addressed and controlled by local, state and federal water pollution control agencies.

In addition, high levels of methyl mercury have been found in fish and wildlife in Everglades marshes and canals. In Florida, the highest concentrations of mercury in fish have been found in WCA-3A. Human consumption advisories have been issued by the State banning consumption of several fish species in WCAs-2A, 3A and the Park, and limiting consumption in Loxahatchee National Wildlife Refuge (WCA-1). Possible sources of mercury include atmospheric deposition, effects of drainage, soil disturbance, hydroperiod alteration and historic storage of mercury in the Everglades. An extensive interagency state-federal mercury research program is underway to identify and quantify mercury sources and transport systems to the Everglades. The Environmental Protection Agency (EPA), DEP and the United States Geological Society (USGS) are developing models to evaluate the effect of various mercury source control and water management strategies on the Everglades mercury problem. The SFWMD and the Florida Game and Fresh Water Fish Commission (FGFWFC) are also working as part of the multi-agency effort to better understand this ecological problem and develop appropriate responses.

DEP and the SFWMD are also involved with numerous water quality improvement efforts throughout South Florida aimed at establishing appropriate criteria for discharges and streamlining the permitting process. These efforts are consistent with the Commission's objectives for sustainability in that they support integration of human activities with the needs of South Florida's natural resources and allow for an ecosystem management perspective.

About 700 million gallons of wastewater are treated and discharged in South Florida daily, much of it to tide. Some urban areas in South Florida have experienced problems with sewage overflow and lack of capacity. The tripling of population anticipated in South Florida in the next few decades may result in three times as much wastewater. There must be adequate capacity to treat this wastewater to a quality that does not adversely impact groundwater or receiving surface waters such as canals, estuarine areas or near-coastal waters. In addition, if properly treated, reuse of this wastewater for appropriate purposes would help meet regional water supply needs.

In addition to areas that generate large quantities of wastewater, there are also numerous communities in South Florida that utilize on-site sewage disposal systems, such as septic tanks and cess pits, for wastewater treatment. Throughout the region, concentrations of such systems pose significant water quality problems. Replacement of these systems with centralized wastewater disposal systems or other technologies which significantly reduce nutrient impacts may be expensive, but necessary, and is often beyond the means of many of the region's small communities, particularly around Lake Okeechobee and the Florida Keys.

The Seminole Tribe's Water Conservation System Conceptual Project provides for sustainable development of their Big Cypress Reservation and balances the needs of the environment with the Tribe's needs for economic sustainability on its homeland. It provides for a network of surface water management structures and the implementation of a comprehensive system of BMPs. This effort helps the Tribe meet the numerical standard for phosphorus concentration in waters discharged from the Reservation, thereby supporting sustainable agriculture while contributing to restoration of the western Everglades ecosystem. The Seminole Tribe is also contributing to the improvement of water quality in the Western Basins through the Landowners Agreements and an Agreement with the SFWMD. The Everglades Forever Act only covers flows from the C-139 Basin and the C-139 Annex. These waters currently flow through the L-28 into WCA-3A. Water from these basins will be diverted and treated through STA 5 and STA 6 of the Everglades Construction Project. In order to address high phosphorus inflows to the Reservation, the Seminole Tribe has entered into these agreements and will be embarking on an enhanced water quality monitoring program.

Of the 23 planning objectives developed by the Commission for the Restudy, 12 are either directly or indirectly dependent on attainment of adequate water quality conditions (see Table 1). Many of the concepts considered for inclusion into the Restudy require further water quality evaluation and could have either a positive or a negative influence on the Everglades. As the Restudy progresses, the water quality aspects of individual alternatives must be assessed. In particular, certain concepts give rise to opportunities to address water quality

issues including: the EAA water storage concept, WPAs, and the regional storage within the Everglades headwaters concept. The Commission also proposes specific water quality improvement projects to be considered under this concept including water treatment facilities for the Kissimmee River, Caloosahatchee River, S-9 , C-111, and L-28 Interceptor.

Concept 8: Increased Spatial Extent and Quality of Wetlands Beyond the Everglades

Roughly 50% of the Everglades have been destroyed by land conversion to agricultural, urban, and industrial development. They continue to be lost through wetland permitting programs. Wetland loss has reduced landscape heterogeneity, eliminated habitat of wetland dependent species, and threatened the long-term viability of vertebrate species that require extensive territory (e.g., wading birds and panthers). The protection and restoration of wetlands outside the publicly owned lands, not just the Everglades, could substantially increase success in reestablishing many native communities. This concept focuses on the protection and restoration of existing wetlands including smaller, isolated wetlands not contained in the remnant Everglades. It includes ongoing restoration efforts, such as the wetland conservation strategies and multi-species recovery planning, as well as additional efforts that address the Commission's objective for increasing the spatial extent and quality of wetlands. A regulatory permitting strategy coupled with a land acquisition program for the remaining wetlands is needed immediately to ensure their values are protected and restoration opportunities are not precluded.

The State of Florida's Conservation and Recreation Lands and Save Our Rivers Programs use bond proceeds, supported by the general revenue portion of the State's Documentary Stamp Tax, to acquire lands for the purposes of water management, water supply, and the conservation and protection of the State's water resources. Manageability, surface and groundwater systems, and the formation of corridors for the critical interaction of wildlife populations are major considerations in this land acquisition process. Prime requisites in managing these public lands continue to ensure water resources, fish and wildlife populations, and native plant communities are maintained in an environmentally acceptable manner, and that they are made available for appropriate outdoor recreational activities consistent with their environmental sensitivity.

The Kissimmee River, once a meandering river with associated marshlands that provided water storage for the Everglades system and habitat for birds, fish, and wildlife, was channelized into a 56-mile ditch (the C-38 Canal) as part of the C&SF Project. Channelization drained approximately 20,000 acres of wetlands. The Corps and the SFWMD are currently restoring portions of the Kissimmee River's floodplain.

Two areas of the Kissimmee River not presently under consideration for restoration, but supported by the Commission, are Pool A and Paradise Run. Pool A is situated south of Lake Kissimmee. The existing C-38 flood control channel there will remain in place to ensure flood protection in the Upper Chain of Lakes. Flow-through marshes, encompassing approximately 3,000 acres, could be created to improve the quality of water delivered southward and to restore additional high quality floodplain wetland habitat. Paradise Run, 8.5 miles in length, lies immediately north of Lake Okeechobee and west of the old Kissimmee River channel. It now consists of 1,200 acres of wetlands. The restoration of Paradise Run would result in more natural hydrologic conditions and improved habitat for fish and wildlife resources, and would add an additional 2,200 acres of high quality floodplain wetlands.

The Herbert Hoover Dike was built around portions of Lake Okeechobee in the 1930s, largely as a consequence of the 1926 and 1928 hurricanes. The C&SF Project completed the impoundment of the lake in the 1950s and 1960s. This impoundment separated large natural areas located adjacent to the northern, western, and, to a more limited extent, the southern portion of the lake from their connection to the lake. These areas, once upper elevation marshlands, are drier than they were historically and no longer function as they once did. Wetland enhancement to areas that once formed the littoral system would contribute to the quality of fish and wildlife habitat. Any activities related to this restoration need to consider impacts to the Seminole Tribe's Brighton Reservation on the northwest side of Lake Okeechobee.

Kreamer, Torry, and Ritta Islands, located in the southern end of Lake Okeechobee, were formerly used for agricultural purposes. The restoration of these islands would involve degrading selected levees to allow more natural water levels and transplanting native vegetation. These actions would not affect existing private properties. They could result in additional habitat for water birds, fish, and other wildlife. Contaminant studies need to be completed prior to restoration design.

The Big Cypress Basin provides freshwater to the coastal marsh and mangrove communities of the southwestern Everglades. Construction activities associated with the defunct Golden Gate Estates development has altered the basin's natural drainage patterns through over-drainage and has affected biologic habitat and natural hydro patterns. Restoration of the southern portion of the Estates (between I-75 and Tamiami Trail) would restore sheetflow over an area of 113 square miles. This, in turn, would improve habitat quality and heterogeneity, notably for the endangered Florida panther, reduce the incidence of destructive wildfires, and improve the quality and timing of freshwater discharges to Faka Union Bay, Pumpkin Bay, Rookery Bay, Ten Thousand Islands, and Naples Bay.

The areas along the east coast are generally included in the WPA concept and should be carefully examined to ensure remaining areas are preserved or restored, where feasible. The Model Lands Basin that is located in southern Dade County is one such area. It is predominately east of U.S. 1 and encompasses approximately 79,000 acres. U.S. 1 and Card Sound Road have impeded the flow of water to the basin, impacting wetland habitat and necessitating discharges to downstream bays. Restoring hydrologic connections and functions to the Model Lands, including improving the hydrologic connections under U.S. 1, would not only improve the functional quality of these wetlands, but would also help restore Barnes Sound, Card Sound, and Biscayne Bay. Additionally, it would complete a contiguous wildlife corridor stretching from the basin southward to the Florida Keys National Marine Sanctuary. Similarly, the Pennsocco wetlands, west of the Dade-Broward levee in northwestern Dade County, are peripheral wetlands used by foraging wading birds, including endangered species. Management of the Pennsocco wetlands, the final footprint of which is being considered by the Northwest Dade County Freshwater Lake Implementation Committee, should include maintaining and enhancing the habitat and foraging benefits of this area for wildlife.

The South Florida Ecosystem Restoration Working Group, the Chair of the Commission, and the Dade County Commissioners have supported the need to protect open spaces and wetlands that serve vital hydrologic functions for Biscayne Bay. This refers to lands between Biscayne National Park and Dade County's present Urban Development Boundary. These lands are all that remain of once vast coastal uplands, prairies, and wetlands in the Biscayne Bay Basin that filtered, conditioned, and dispersed freshwater flowing east into Biscayne Bay. These lands have been drastically reduced in area and in hydrologic integrity. The protection and hydrologic improvement of these areas is needed to sustain agriculture and the marine systems of the park.

Concept 9: Invasive Plant Control

Non-native ("exotic") plant species, such as melaleuca, Australian pine, Brazilian pepper, torpedo grass, and hydrilla have invaded large portions of the South Florida ecosystem. This occupation resulted in the displacement of native species and/or the degradation of habitat essential to native plants and animals. Melaleuca is especially damaging because of its high rate of evapotranspiration compared to native grasses that may contribute to lowering water levels in the Everglades and Lake Okeechobee. Aerial and other types of surveys reveal the proliferation of exotic plants has resulted in the formation of melaleuca monocultures in some areas of the WCAs. Surveys also show their occurrence throughout most areas east of the WCAs, particularly those that may be included as WPAs. Even when these plants do not occur in natural areas, they act as seed sources and pose a threat to natural areas. Control or eradication of invasive

exotic plants is necessary to improve and protect habitat quality and heterogeneity.

This concept includes the development and evaluation of methods to control invasive (exotic) plants throughout South Florida, the application of these methods to control exotics within the C&SF Project area, and the establishment of success criteria combined with appropriate biological monitoring. Successful control of exotic pest plants depends on the formation of cooperative intergovernmental and public/private partnerships.

Existing methods to remove invasive exotics are being used throughout South Florida. These methods include mechanical harvesting, application of herbicides, and use of biological agents. Because extensive use of herbicides is contrary to water quality improvement, alternative methods, such as biological controls, need further investigation or testing on a trial basis.

While past and present invasive exotic eradication activities have been limited, it appears that future activities may be further reduced because of federal budgeting priorities. The Commission believes that a comprehensive invasive exotic plant control program that includes monitoring activities designed to map the distribution and abundance of exotics throughout South Florida must be developed and implemented to control and eventually remove invasive exotics from natural habitats. Additionally, melaleuca should be added to the Corps' list of invasive aquatic plants so that funds can be allocated for its control. The use of volunteers, analogous to the UF/IFAS Lake Watch program, should also be considered as part of a sustained eradication strategy.

The Science Subgroup of the South Florida Ecosystem Restoration Working Group, in their November 15, 1993, report, recommended that short hydroperiod wetlands should be reestablished. The Restudy process should investigate the role of short hydroperiod wetlands in South Florida natural system restoration and, if additional short hydroperiod wetlands are determined to be necessary, their location and spatial extent must be determined.

Concept 10: Aquifer Storage and Recovery

This concept addresses the potential use of Aquifer Storage and Recovery (ASR) technology as a means of storing water in aquifers for future use. Water is injected into an aquifer during periods of surplus for later recovery during dry periods. Storing water in an aquifer, such as the upper Floridan, using ASR technology may provide greater storage efficiency when compared to the land requirements and high seepage and evapotranspiration rates associated with above ground reservoir storage. Areas that could potentially benefit from ASR include the EAA, the Caloosahatchee Basin, St. Lucie Basin, Lake Okeechobee and the

urbanized lower east coast. ASR technology should be investigated to determine its feasibility at a regional scale, as well as its environmental impacts.

Water quality concerns, particularly regarding untreated surface water, currently limit the ability to use ASR. ASR should be tested to evaluate technical uncertainties with high capacity applications (GCSSF Technical Advisory Committee ASR Report, May 23, 1996). In planning a pilot study for large-scale ASR, several issues need to be addressed. These include environmental and health concerns regarding water quality, current regulatory constraints, costs of the project, and potential benefits of having additional clean water at the chosen site.

Potential locations for ASR pilot projects include sites on the fringe of Lake Okeechobee, to store excess lake water that would either be lost through discharge to tide or create harmful, prolonged high water conditions in the lake's 100,000 acre marsh. Since the higher lake regulation schedule was fully implemented in 1979, discharges to the estuaries have exceeded 400,000 acre feet in 10 of the following 17 years. During six of those years, discharges exceeded 1,000,000 acre feet; during two years discharges exceeded 2,000,000 acre feet; and during one year discharges exceeded 3,000,000 acre feet. Damaging prolonged high water levels also covered the lake's marsh for a number of those years. When the rain comes, we cannot refuse to accept it. When the lake rises to damaging or dangerous levels, our current choices are limited to accepting damage to lake's marsh, or the estuaries, or both. If the goals of protecting the estuaries and the lake's marsh, while improving the quality, heterogeneity, and expanding the spatial extent of Everglades system natural habitats are to be achieved, development of alternative water storage methods for the massive amounts of water entering Lake Okeechobee is vital.

Current water supply demands are projected to increase to meet environmental goals and expanding water supply needs. There is also a need to both protect the lake's marsh and to establish minimum levels for natural waterbodies. Storage of excess water during years of surplus for use during drought years will become increasingly important. Acquiring sufficient lands to hold all of an average year's estuarine discharge is cost prohibitive. Using ASR in combination with EAA storage has the potential to store large amounts of water at its source and close to the demand while protecting the ecological health of the estuaries and the lake. A proposed ASR project utilizing Lake Okeechobee water is currently under review by the EPA and DEP. The Commission supports this pilot project.

The possibility of conducting pilot projects at other sites, using other aquifers, should also be considered. Sites within the lower east coast which could store, in the upper Floridan aquifer, water taken from the Water Preserve Areas should also be considered. If large-scale ASR is shown to be feasible, more

extensive regional scale facilities utilizing untreated surface water runoff and Lake Okeechobee discharges could be beneficial in meeting additional demands within the region. Detention facilities or canals that intercept and hold excess water for injection into the aquifer may be required at some sites. The quality of untreated stormwater runoff may preclude its injection for ASR purposes under current regulations

Regional scale ASR facilities could be beneficial in meeting demands in the Caloosahatchee River and St. Lucie River basins, or other basins. Water quality concerns would also be present in these areas. Regional scale ASR in association with the WPAs has also been proposed for western Dade, Broward, and Palm Beach counties. The source of water would be surface water backpumped into the WPAs or canal flow. Utilization of ASR in these areas may increase the storage capability of the WPAs and provide more urban water supply benefits for these areas. The feasibility of ASR in association with the WPAs may be limited due to many of the same water quality concerns that face projects using untreated surface water in other areas. The Commission recognizes that water injected into the aquifer may not meet appropriate water quality standards. Water recovered from the ASR system may not have the appropriate quality for its intended use. A final consideration is that ASR facilities are most useful at the site of water treatment plants, where clean treated water can be injected, plant operation economies can be realized, and conveyance losses can be eliminated.

Concept 11: Protection and Restoration of Coastal, Estuarine, and Marine Ecosystems

Florida's estuaries and bays have been harmed by human alterations to the ecosystem within the last 50 years. Without drainage canals to divert storm and surface waters, development in low-lying coastal areas would never have been possible. Unfortunately, too much water is diverted too efficiently. Untreated stormwater is rapidly funneled out to sea through the estuaries instead of being stored in wetlands. What remains of the inland marshes seldom receive their full share of water. Estuaries suffer from a glut of freshwater following heavy storms and a lack of freshwater when not enough water is stored in the system to make it through Florida's dry winters and periodic droughts.

These alterations have radically changed the volume, timing, and quality of freshwater flow to South Florida's estuaries. From the Indian River and St. Lucie estuaries to the Biscayne and Florida bays, the Ten Thousand Islands to the Caloosahatchee tidal river estuary, the quality of estuarine habitat for fish and other marine resources has been affected by freshwater flow changes associated with the C&SF Project and other water control efforts (e.g., the Golden Gate Estate canal system). In general, channelization decreases the time lag between rainfall and runoff. This increases the rate of flow to certain downstream estuaries

during the wet season and decreases the flow during the dry season. Estuarine life is negatively impacted both by the wet season excesses and the extended dry season deficiencies. Surface water also permeates the soil and becomes groundwater, whose quantity, quality, and distribution is equally important to coastal systems, such as Biscayne and Florida bays. An extreme example of this problem is in the upper Ten Thousand Islands, where 200 square miles of the Big Cypress wetlands is channelized into Faka Union Bay. Freshwater flow has been diverted away from Florida Bay and the mangrove estuaries of the lower southwest coast (e.g., Whitewater Bay), possibly resulting in both wet season and dry season deficits. In the St. Lucie and Caloosahatchee estuaries, regulatory releases from Lake Okeechobee have exacerbated the problems of excess flows.

Water quality in the Keys and on the reef tract is declining due to macro-scale regional development in South Florida, the diversion of water away from Florida Bay, and detrimental water quality activities locally and regionally. Over the years, the cumulative effect of these changes is catastrophic. Murky water and algal blooms have replaced the clear waters of Florida Bay. Similar degradation is occurring in northern Biscayne Bay. The highly productive seagrass beds and fisheries of the St. Lucie and Caloosahatchee estuaries, as well as Florida Bay, are now in decline as a result of dramatic fluctuations of freshwater input into estuarine and marine waters. Diseases and eutrophication threaten the coral reef systems of the Florida Keys. The Commission places a high priority on protecting and restoring South Florida's coastal and marine ecosystems, not only for their intrinsic value, but for protecting the fisheries, the fishing and tourist industries, and the characteristic South Florida lifestyles that depend on nature's bounty. Understanding the linkage between the lower watersheds, the Ten Thousand Islands, and Florida Bay is critical to developing solutions that provide for sustainability of the Keys.

The Florida Keys, including Florida Bay and the offshore coral reefs and sea grasses, are a threatened resource of international significance. In response to the Governor's Executive Order directing public agencies to take action to improve environmental conditions in the Keys, a carrying capacity study of the Florida Keys has been initiated by the Corps with funding provided by the Florida Department of Community Affairs. The study will result in an information base upon which informed development and infrastructure investment decisions can be made to achieve a balance between the economic and environmental needs of the area. Research activities in Florida Bay are being coordinated by the Florida Bay Program Management Committee (PMC). The PMC has developed the Florida Bay Research Plan and is utilizing adaptive management in the implementation of that plan. Although numerous research and monitoring activities are currently underway in Florida Bay by a variety of governmental agencies and private organizations, a process to collectively evaluate the information and develop a comprehensive plan of action is not currently planned or programmed. A program

is needed to ensure effective coordination of all efforts in Florida Bay, identify all the problems and their sources, and develop a plan of action and implementation process. A comprehensive literature search and data analysis will serve to ensure that all activities influencing the bay are identified and that adequate monitoring activities are implemented. The program should also include analyses that give sufficient consideration to any improvements of current state and federal water quality standards that may be needed to achieve the Commission's goal of sustainability.

The programmed and proposed projects that form previously described concepts of the Commission's Conceptual Plan for the Restudy involve restoring appropriate freshwater flows to bays and estuaries to protect natural salinity gradients, restore water clarity and quality, and improve water supply through management changes within the South Florida Region. The Florida Bay Emergency Interim Plan (Taylor Slough Demonstration Project), the C-111 project, Modified Water Deliveries to Everglades National Park, the Lake Okeechobee Operational Plan, and the creation of water storage areas in the WPAs, Caloosahatchee basin, and the Upper East Coast area will help protect the region's coastal estuaries from the detrimental effects of excessive stormwater runoff and will improve essential baseflow of freshwater during dry seasons. Projects identified as part of the regional SWIM plans will serve to improve the quality of water delivered to the coastal areas through development and implementation of BMPs for agricultural and development activities, retrofitting of existing stormwater management facilities to reduce pollutant loads, and elimination of sewage effluent discharges and septic tank impacts. The various SWIM plans need to be integrated and coordinated with other adjacent local restoration efforts such as those for the Miami River and the New River.

Other critical projects underway to achieve the Commission's goals for sustainability include the development of hydrodynamic circulation models for Biscayne Bay and Florida Bay. A hydrodynamic model of Florida Bay is under development for use in simulating water movement patterns in the Bay. Among other things, the model will enable salinity predictions from varying temporal and spatial freshwater inflows. The Florida Bay model will accept output from the hydrologic models used to predict overland flows to determine the impacts that the modifications and operational changes to the C&SF Project will have on Florida Bay. (Often, the hydrologic models can predict the volume and location of flows across the mangrove zone.) The model will be multi-dimensional, allowing two dimensional vertically averaged calculations at a minimum, and perhaps some three dimensional calculations where stratification is evident. The hydrodynamic model will be linked with a water quality model. Development of a mathematical computer simulation model system for Biscayne Bay is currently underway as a first step to investigate the effects of the C&SF Project on water circulation and salinity patterns. This effort must be further developed to assess

impacts to biological communities and water quality in the Bay. The SFWMD developed a one-dimensional hydrodynamic model that predicts salinity throughout the St. Lucie estuary under various inflow conditions from the watershed. This model was used to identify a salinity range that is favorable to the development and maintenance of a healthy estuarine ecosystem. This effort must be further developed and expanded to assess the C&SF Project freshwater discharge impacts on the Indian River Lagoon. These model efforts are essential to the identification of existing conditions and the evaluation of the effects of any proposed modifications to the C&SF Project on these important coastal resources.

Sediment Removal and Control in Estuaries

Accumulated organic sediments have been deposited in the Caloosahatchee and St. Lucie estuaries. Organic sediments settle out in the estuaries as a result of sediment runoff and the interaction between fresh and estuarine water. These organic sediments deplete the dissolved oxygen and degrade water quality through resuspension during periods of physical disturbance. Removal of these sediments could improve water quality and possibly expose coarse-grained substrate suitable for aquatic plant growth along the littoral shelf of the estuaries. Small scale pilot projects should be implemented to determine the feasibility and environmental effects of muck removal or stabilization from the St. Lucie estuary.

A report on a potential muck removal demonstration project for the St. Lucie estuary was previously completed. The report recommended that further studies be conducted prior to proceeding with a demonstration project. The report concluded that large scale sediment removal may improve water quality by reducing re-suspension of fine sediments and would reduce oxygen demands in the water column, assuming upstream sediment sources were eliminated.

The St. Lucie Canal was constructed in the 1920s by the Everglades Drainage District. The canal banks are unstable in a number of areas along the length of the canal and material from the banks that sloughs off is transported and deposited as shoals in the St. Lucie estuary. Stabilizing the canal banks with rip-rap, or reshaping and restoring vegetation on the canal banks could reduce the sediment loading to the estuary. The Restudy should include an analysis of the bank erosion and its impacts to the estuary. It may be possible to acquire additional rights-of-way and reshape the canal banks to create a functional littoral zone. Such projects could reduce erosion and produce other benefits such as water quality and habitat improvements. Additional study will be necessary to evaluate and quantify the benefits to the estuary from environmentally sensitive bank stabilization measures.

Concept 12: Conservation of Soil

Conservation of soils in the agricultural areas bordering the Everglades increases the opportunity for long-term sustainability of agriculture and natural areas. In particular, organic soil subsidence, caused by man's drainage facilities including the C&SF Project, is adversely impacting natural areas and agriculture in South Florida. Subsidence is created by a number of factors, including the oxidation of organic soils resulting from lowered water tables for extended periods of time, fires, wind erosion, and peat shrinkage.

In the EAA, soil loss has diminished the higher ground elevations that maintain the hydraulic head which drives water south. In some areas more than eight feet of organic soil was lost by 1984. Soils continue to oxidize; however, Best Management Practices should slow down the rate of oxidation. Some areas in the southern EAA, where shallow soils overlie bedrock, already have less than two feet of soil remaining. As soils subside, the movement of stormwater out of the area requires increased pumping. Soil conservation is also important in southern Dade County, where agriculture still forms a vital part of the local economy as well as a buffer between urban development and the natural system. In this area, soil conservation and sustainable agriculture programs will enhance the long-term viability of the ecosystem.

Research has shown that if soil moisture content of the organic soils is maintained for longer periods of time throughout the year, soil subsidence can be significantly reduced. Limited research is now underway to develop sugar cane varieties that can tolerate higher water levels, yet maintain an acceptable yield. These types of crops, some conversion to traditional wet-pasture beef cattle production, aquaculture, rice production, BMPs, and improved water management may significantly increase the long-term sustainability of agricultural activities in the EAA.

Increasing groundwater levels in the EAA will reduce the overdrainage that has caused the oxidation of organic soils. Under this concept, rainfall during the wet season will reduce the need for water from Lake Okeechobee to be used in maintaining these higher water tables. This should result in benefits to the natural system, including increased water storage in the EAA, decreased vulnerability to floods, and decreased necessity to send large pulses through the east coast and west coast estuaries. Further, water quality should be improved by reducing phosphorus inputs from oxidation and erosion of the soil through application of BMPs and maintenance of higher water tables.

Soil subsidence has also impacted portions of the natural system. Restriction and diversion of natural sheet flow has overdrained portions of the Water Conservation Areas, the Holey Land and Rotenberger tracts resulting in

areas of major subsidence. Overdrainage has also caused additional soil loss as a result of severe muck fires. In addition, tree islands have been destroyed through such soil loss. As soil elevations are altered, water levels change and the associated biological community is altered. Restoration of more natural flows and hydro patterns in the Everglades, Holey Land and Rotenberger tracts and other natural areas should control the subsidence and potentially reverse the trend by creating conditions favorable to the accretion of peat soils.

The goal of current public and private research efforts is for modified water management to provide conditions enabling soil accretion rather than soil oxidation. This soil conservation activity, in both natural and agricultural areas, can serve as a measure of both the environmental and economic sustainability of restoration efforts. Opportunities exist to expand on these research efforts through public/private partnerships.

Concept 13: Operation, Management, and Implementation of the C&SF Project Modifications and Related Lands

The South Florida ecosystem is a water-driven system encompassing a massive, unique, and fragile natural system that is also home to five million human inhabitants. The C&SF Project provides a physical and operational framework around the South Florida ecosystem that offers options for managing the natural functions of the Everglades and other natural areas. The C&SF Project also provides other benefits, including flood control and water supply for the human population of South Florida. The interconnection of the C&SF Project, both within and without its boundaries, cannot be ignored for its contributions and complexity. This Project is a multi-purpose public works system that has inherent conflicts among the competing priorities of water management.

The Commission seeks to maximize the benefits of the C&SF Project while reducing the problems it has caused. In addition to the structural changes to the C&SF Project as expressed in the 40 options, and the other 13 thematic concepts, new operational and management measures for the system will be required. How the system is managed hydrologically affects virtually every aspect of the South Florida ecosystem. This suggests that the operational changes throughout the system are critical and thus require specific attention during the Restudy. The Restudy must incorporate the best available research and modeling to ensure the multi-purpose objectives are balanced and maximized. Effective monitoring programs must be developed that allow for the implementation of adaptive management strategies to ensure that the Commission's objectives are met.

Where Project operations are expected to affect lands (and their associated communities) being protected and restored as natural wetlands, operational

planning needs to be consistent with sound biological science. Adequate provision is needed for monitoring biological impacts, especially where these operational changes may affect recovery efforts for endangered species and the protection of sensitive habitats.

As a first attempt to restore hydrology in Everglades National Park, a rainfall-based plan for water deliveries has been developed and implemented. A rainfall-based plan is a delivery formula that delivers water to natural areas based on antecedent climatic conditions. The Restudy should investigate the potential use of rainfall-based delivery formulas to determine if natural areas, including the WCAs, and estuaries, can benefit from such operational changes to water deliveries.

Further, the Restudy and other efforts to provide for the sustainability of the South Florida ecosystem will ultimately determine both the extent of lands needed for the Project and the management of these lands. Rapid development of some areas of South Florida is limiting the ability to fully implement these modifications to the C&SF Project, which are needed for sustainability. As a result, the Commission has recognized the need to expedite certain land acquisitions prior to final planning and design of the modifications to the C&SF Project. Because lands are such a critical component to all restoration efforts in South Florida, recent federal funding was provided to expedite implementation of potential Project features. This has required the Commission and other decision makers to prejudge certain land acquisition projects without having all the scientific and engineering analyses completed. Acquisition of these identified priority lands should be limited to voluntary/willing sellers. Careful consideration must be given to determine the potential uses of the lands and, to the extent possible, the justification for acquisition of these lands should be based on available science.

Once acquired, these lands must be managed to meet the environmental and economic needs of the region. Meeting these needs will require the inclusion of advanced planning and land management strategies as part of the acquisition process. Such planning will ensure that the lands are properly utilized and managed consistent with the intended objectives. For example, one mechanism to help promote economic sustainability of the region would be to return agricultural lands back to agriculture, so long as such use does not conflict with long-term land use/management objectives, until a final project design utilizing these lands is completed. Therefore, these lands could be secured at an overall lower cost with less disruption to the South Florida economy.

D. ASSESSING THE CONCEPTUAL PLAN FOR THE RESTUDY

The Commission, in developing this Conceptual Plan for the Restudy, has attempted to bring together balanced objectives for the entire region, incorporating all relevant issues and identifying impediments to natural system restoration while establishing the means to best accomplish the task. Table 3 illustrates the components that collectively form the Commission's Conceptual Plan for the Restudy. While not all inclusive, this list of ongoing efforts, together with additional projects form a plan for which a course of action can be developed. Readers need to keep in mind, however, that this document is intended to provide direction for the Restudy. The effort to achieve sustainability in South Florida is of even larger scope. The Restudy, however, is a major first step in helping to ensure sustainability.

As studies continue on the elements of the Conceptual Plan for the Restudy and plans become more detailed, extensive hydrologic, ecologic, water quality, economic, and water supply models and evaluation tools will be developed as part of the Restudy as well as other efforts. All evaluations, whether conceptual or detailed, must include a system-wide focus that acknowledges the needs of all existing water users, links hydrologic restoration to ecologic restoration, and relates all the projects back to the objectives and goals.

D-1 RELATING THE CONCEPTUAL PLAN FOR THE RESTUDY TO THE OBJECTIVES

The Commission believes that implementation of this Conceptual Plan for the Restudy will help meet the Commission's 23 objectives for the Restudy. To determine the general effectiveness of the plan, a qualitative analysis was conducted to relate the planning objectives with the thematic concepts. This analysis is displayed in Table 4.

In support of the Commission's broad components of sustainability; the environment, society, and the economy, the Conceptual Plan for the Restudy attempts to create a balance between the variety of human and natural system issues. Conforming to these principles, the Conceptual Plan for the Restudy addresses the issue of sustaining the region's economy and quality of life through the protection and management of the region's water resources.

Environment

The primary premise for South Florida restoration deems hydrologic restoration as the necessary starting point for ecological restoration. Restoration begins with the reinstatement of the natural distribution of water in space and time. The spatial extent of the hydrologically restored area is critical to ecological

Table 4
ACHIEVEMENT OF PLANNING OBJECTIVES

OBJECTIVES	THEMATIC CONCEPTS											Operate Manage Implement	
	Regional Storage - Everglades Headwaters	Lake Okeechobee Operational Plan	EAA Storage	WPAs	Natural Areas Continuity	Urban/Ag. Water Supply & Flood Protection	Water Quality	Increase Area and Quality of Wetlands	Control Invasive Plants	ASR	Restore Coastal to Marine Systems		Conserva- tion of Soil
Habitat Quality and Heterogeneity				✓	✓			✓					✓
Connectivity					✓								✓
Increase Spatial Extent				✓				✓					✓
Coastal and Marine Ecosystems	✓	✓	✓	✓	✓			✓		✓			✓
Sustainable Populations of Plants and Animals					✓			✓					✓
Functional Quality of Natural Systems		✓	✓	✓	✓			✓					✓
Reduce Invasive Species													✓
Reverse Spread of Nuisance Species								✓					✓
Natural Hydropatterns		✓	✓	✓	✓				✓				✓
Quality and Quantity of Flows	✓	✓	✓	✓	✓					✓			✓
Quality and Quantity of flows to Estuaries	✓	✓	✓	✓	✓				✓				✓
Water Supply for all Users	✓	✓	✓	✓	✓				✓				✓
Regain lost Storage Capacity	✓	✓	✓	✓	✓								✓
Restore soil deposition and halt subsidence			✓		✓							✓	✓
Improve Water Quality	✓		✓	✓									✓
Control Saltwater Intrusion													✓
Integrate local Water Management Functions													✓
Establish Levels of Flood Protection*													✓
Reduce Damages From Flooding			✓		✓								✓
Provide Economic Diversity				✓	✓								✓
Economic Opportunities for Marine Systems	✓			✓	✓								✓
Preserve Cultural and Archaeological Resources*													✓
Increase Recreational Opportunities				✓									✓

* Achievement of these objectives depends on project design

restoration. Water quality protection and improvement is also an integral part of all hydrologic restoration.

Restoration can be viewed as the reconstitution of a pre-existing ecological condition, or range of conditions. The conceptual target of restoration of South Florida's wetlands and certain estuaries is the healthy natural function characterized by pre-drainage South Florida, as defined by topography, hydrology, and vegetative cover. The goal is to create a restored Everglades system; one that is sustainable over the long term and that has high values in critical areas, such as abundant wading birds, more plentiful numbers of now endangered species, clean and clear water, and healthy bays. The large spatial scale of the pre-drainage South Florida wetlands was key to the long-term maintenance of the region's ecological functions and components. The irreversible loss of a significant portion of wetland area, expectations of sea level rise, and the almost complete urbanization of the east coast ridge, a major groundwater recharge area, make the restoration target more challenging. What the restoration effort must hope to recapture is the essential hydrologic and landscape characteristics that are critical to a sustained and healthy South Florida ecosystem.

Essential to the task of hydrologic restoration is a return to natural hydroperiods and hydropatterns. These conditions in turn depend on restoring the system's tremendous storage capacity, so that the slow rate of water flow throughout the system allows the wet season rainfall to keep the wetlands flooded, and maintains freshwater flow to the estuaries well into the dry season. These requirements translate into a need for resolution of several water resources issues including the need for additional storage capacity, seepage control along the eastern edge of the Everglades, and other structural, nonstructural, and operational changes that provide greater storage to the system.

The Conceptual Plan for the Restudy includes measures that are expected to reconnect natural areas, restore more natural hydrologic characteristics, improve system storage capacity, and reestablish more natural water quality conditions. Regional reservoir facilities, new operational plans, WPAs, establishment of more natural Water Conservation Areas and features to improve water quality are all concepts included in the Conceptual Plan for the Restudy. These concepts are also expected to better protect the region's coastal estuaries from the detrimental effects of excessive stormwater runoff and improve essential baseflow of freshwater during dry seasons. Also included are a number of options that should increase the spatial extent and quality of wetlands outside the surviving remnants of the historic Everglades.

Society

"Man is recognized as a part of the system to be restored, and what is sought is a partnership between man and nature in developing a healthy economy within a fragile, but highly supportive ecosystem. Sustainable ecosystems integrating economic and ecologic processes is the restoration target for the overall South Florida ecosystem." Science Sub-Group

Society affects the environment through land use, pollution, and competition for resources, while the environment provides a diversity of essential support to society and the quality of human life. The societal issues addressed by the Commission in this Conceptual Plan for the Restudy include sustainable development and integrating society more fully with the natural system.

The WPA concept may serve multiple purposes, one of which is to provide a necessary buffer between the natural system and urban development. This concept complements the Commission's Eastward Ho! initiative, as it may help redirect suburban growth and balance the needs of society with the needs of the natural system.

The competition for water supply among the human, agricultural, and natural components is expected to continue to increase into the future due to a growing population. A combination of overdrainage and increased demand threatens the sustainability of future water to meet all competing uses. Adequate water supply for the urban and agricultural areas of South Florida is needed to sustain a viable economy in the future. The Commission's Conceptual Plan for the Restudy includes a myriad of storage, water supply, and conservation options which would benefit all users. The Conceptual Plan for the Restudy will also enable the urban and agricultural areas to receive indirect benefits, such as wellfield recharge, from the additional regional storage, which increases the overall storage capabilities of the system.

Economy

There is a growing recognition that protection of the water supply and quality in the natural system, while meeting the needs of competing human and agricultural users, is essential to meeting the long term needs of South Florida's economy. Restoration must be done with a sensitivity to its impact on all sectors of our economy. The resources necessary for restoration can only be generated by a healthy economy.

Sustainable Agriculture

Agricultural history includes major efforts at natural resource stewardship. The first Best Management Practices (BMPs) developed by the United States Department of Agriculture Soil Conservation Service (now known as the Natural Resources Conservation Service) in the 1930s focused on techniques to deter damaging runoff. The United States Department of Agriculture -Natural Resources Conservation Service (USDA-NRCS) and the local Soil and Water Conservation Districts (SWCDs) have been leaders providing assistance to the agricultural community in South Florida for 50 years. The USDA-NRCS and SWCDs are the key agencies to assist agriculture in sustaining farming, maintaining visible rural communities, and providing for a healthy natural environment.

The conversion of rural land to urban uses usually increases erosion and the volume of stormwater runoff. Development also causes other problems that affect soil and water. As part of programs installed to alleviate these problems, engineers increasingly must assess the probable effects of urban development, as well as design and implement measures that will minimize those adverse effects. USDA-NRCS and the local SWCD have BMPs that should be used by the urban areas before, during, and after construction to reduce urban pollution, runoff and erosion. The USDA-NRCS and the local SWCD use mobile irrigation labs to test home owner, golf course, apartment complex and condominium irrigation systems to assist water users in conservation and efficiency.

The future of agriculture in South Florida is affected by a number of factors, including restoration measures, urban development, readjustment of water table levels, long term availability of water, domestic and foreign competition, and, in many areas, the oxidation of organic peat soils. While restoration may mean the reclamation of a small part of the extensive former wetlands now used for agriculture, it can also mean the salvation of the soils that may support future crop production. The Conceptual Plan for the Restudy includes improvements to water supply that should support crop production through the dry season and provide flood protection during the wet season.

The Conceptual Plan for the Restudy encourages a sustainable agriculture industry, which can best be accomplished in areas with muck soils by abating soil oxidation. Restoration needs to achieve a balance of natural, urban, and agricultural landscapes. Improvements in the quality of agricultural discharges and research efforts aimed at more water tolerant crops may support integration of sustainable agricultural activities with the needs of the natural system.

CHAPTER III

RECOMMENDATIONS

The preceding two chapters of this document laid out the context of sustainability for the South Florida region and described the opportunity that exists for conveying the perspective and vision of a broad consensus of the stakeholders of South Florida into the Restudy effort. The previous chapters also described, in a broad conceptual manner, the urgent and interrelated themes that comprise the basis for an integrated effort in regard to the Restudy. This effort aims at restoring attributes of the natural system (hydrological, biological, and qualitative), while ensuring the continued performance of the multiple purposes of the Central and Southern Florida (C&SF) Project.

Just as the thematic concepts described in Chapter II ranged from necessary physical "fixes" to overall operation and management of the Project, this Conceptual Plan for the Restudy requires more than just a description of its parts. It requires a springboard for timely and enduring action. The process needs to move faster and it needs to be broadened to involve a greater South Florida voice and participation.

The Conceptual Plan for the Restudy serves as the South Florida vision and framework for an integrated restoration effort. This conceptual vision and framework is intended to be used as an input document in the Restudy effort. This product has been developed through a consensus process. Following its approval by the Commission, it should be presented to the Governor and the Governing Board of the South Florida Water Management District (SFWMD), the local sponsor of the C&SF Project, for their review and consideration. The Governor, after considering the recommendations of the SFWMD, should then present the Conceptual Plan to the South Florida Ecosystem Restoration Task Force (Task Force), on which the Lieutenant Governor serves, for consideration in the Restudy.

As the Commission noted in its *Initial Report*, time is of the essence and urgent strategic action is needed to curtail further degradation of the South Florida ecosystem. The current process for the Restudy, that is in the feasibility phase, is projected to take at least five more years before possible authorization of any projects. These projects then require further years of detailed design and land acquisition culminating in project construction. The Commission is concerned that the existing process for implementing modifications to the C&SF Project is too time consuming given the critical needs of South Florida. Instead, an improved partnership must be utilized that accelerates implementation of portions of the process without compromising good planning, existing laws, or opportunities for public input. In addition, implementation could be accelerated

through such things as early acquisition of lands. An expedited process could both crystallize and focus the decision-making on critical path issues and could provide the forum for a collegial body of integrated decision-making and provide a broader arena for public input.

In addition to expediting the Restudy process, the authorization for the C&SF Project needs to be broadened to ensure that the multi-purpose nature of the Project includes water quality. A sustainable South Florida depends equally on a hydrologic system whose physical, biological, and chemical characteristics are attended to in a comprehensive and thoughtful way. At the same time, the Commission has stressed that the overall goal of the restoration effort is *"to restore a sustainable South Florida ecosystem that preserves the valued properties of South Florida's natural systems and supports productive agriculture, fishery, and tourist-based economies and a high quality of urban life."*

In order to expedite the Restudy process, reinforce and broaden its scope and participants, and infuse the process with the diversity, complexity, and clarity it rightfully deserves, the following recommendations are provided. These recommendations propose an enhanced model of decision-making, governance, and stewardship.

RECOMMENDATION 1: AUTHORIZED PURPOSES OF THE C&SF PROJECT SHOULD INCLUDE PROTECTION AND IMPROVEMENT OF WATER QUALITY FOR NATURAL SYSTEM PROTECTION AND RESTORATION AND WATER SUPPLY FOR ENVIRONMENTAL AND ECONOMIC NEEDS

The existing C&SF Project is a complex, multi-purpose project. Achieving sustainability in South Florida requires that the C&SF Project be modified. In addition, the authorized purposes of the Project should include water supply for environmental and economic purposes and the protection and improvement of water quality for natural system protection and restoration, as well as flood control, water control, prevention of saltwater intrusion, preservation of fish and wildlife habitat, recreation, and navigation. The authorized project purposes for the C&SF Project currently do not explicitly enumerate water quality for natural system protection and restoration and this should be specifically included.

The C&SF Project has resulted in hydrologic modifications that have adversely impacted the chemical and physical properties of the water flowing through wetlands and natural resources. Sustainability depends on the integration of all aspects of water -- quality as well as quantity, timing, and distribution. Water quality improvements to alleviate the adverse impact of hydrologic modifications to natural and developed areas are essential to natural system protection and restoration. Meeting the Commission's water resources goals to

achieve sustainability depends on not only having the right amount of water at the right place at the right time, but also on having water of the right quality.

The Commission recognizes that, in the past, environmental protection has been neglected and there has been a failure to achieve an optimum balance of all authorized purposes of the C&SF Project, permitting degradation of natural areas. An optimum balance of Project purposes should achieve natural system protection and restoration as well as meeting economic needs for water supply and other authorized purposes.

RECOMMENDATION 2: MODIFICATIONS TO THE C&SF PROJECT DEVELOPED AS PART OF THE RESTUDY SHOULD BE COST-SHARED ON A 50/50 BASIS BETWEEN THE FEDERAL GOVERNMENT AND THE STATE

Traditionally, cost sharing for federal water resource projects has been based on the purpose assigned to each project feature with different formulas for each purpose. The Commission recognizes, however, that for the C&SF Project the distinctions between these various purposes are, to a large extent, arbitrary. In South Florida, this categorization does not reflect the presence of important national resources, including tribal trust lands, Everglades National Park, Biscayne National Park, Big Cypress National Preserve, Florida Keys National Marine Sanctuary, and numerous national wildlife refuges. These resources, distributed throughout the ecosystem, but concentrated in its lower reaches, have been adversely impacted by the construction and operation of the C&SF Project.

Proper water resource management in South Florida requires a multi-functional, multi-disciplinary approach. It is essential that the interrelated nature of the various aspects of water management be recognized and addressed simultaneously by all levels of government. Just as any single project or activity may focus on one element of water management, its impacts on other elements must be addressed. For example, while seeking solutions for flood protection problems, opportunities to address water supply or water quality concerns must be evaluated and considered before determining the appropriate strategy to pursue. The 50/50 cost share between the federal and state governments should be based upon the combination of Project modifications and not determined separately for each Project modification standing alone.

In recognition of the national interest to restore the Everglades ecosystem and, in turn, protect and enhance the nation's resources, the Commission recommends that modifications to the C&SF Project developed as part of the Restudy should be cost-shared on a 50/50 basis between the federal government and the State. The costs to acquire real estate for C&SF Project modifications and restoration components of the Conceptual Plan for the Restudy should be included

as part of these costs to be shared. Equally splitting the costs of the modifications to the C&SF Project is a demonstration of the partnership between the federal and state governments and their shared responsibility to protect the ecosystem. The Commission visualizes the Restudy and its implementation as part of the ongoing partnership formed between the State and its agencies and the federal government. This cooperative process will involve extensive and continued iterations to achieve the jointly agreed upon purposes of this partnership.

It is anticipated that a Comprehensive C&SF Project Plan for modifications to the C&SF Project will be composed of a series of major components, or groupings of discrete and separable project elements. This recommendation is not intended to preclude either the State or the federal government from proceeding with a separable project element, such as discrete stormwater treatment areas, in which the cost share is not provided by the other party. However, the final costs for each of these major components must be borne on a 50/50 cost share basis. This recommendation is not intended to affect the funding provisions as specified in the Everglades Forever Act or those cost share agreements for already ongoing construction projects, except for the C-111 Project. In addition, the Commission recommends that the C-111 Project cost share arrangement be changed to a 50/50 cost share basis. It is also not intended to affect legal responsibilities to comply with pollution abatement requirements.

RECOMMENDATION 3: THE FEASIBILITY PHASE OF THE RESTUDY, INCLUDING THE COMPREHENSIVE C&SF PROJECT PLAN, SHOULD BE EXPEDITIOUSLY COMPLETED AND OTHER PREPARATORY STEPS NECESSARY TO IMPLEMENT THE PLAN SHOULD BE TAKEN.

The C&SF Project Comprehensive Review Study (Restudy) provides a timely mechanism to reexamine the C&SF Project to determine the feasibility of modifying the Project to restore the health of the natural system and improve the sustainability of the South Florida ecosystem. The Feasibility Phase of the Restudy should be expedited. As stated in the Project Study Plan:

"The purpose of the C&SF Project Comprehensive Review Study is to reexamine the C&SF Project to determine the feasibility of modifying the Project to improve the sustainability of South Florida. Specifically, as required by the authorizing legislation, the study will investigate making structural or operational modifications to the C&SF Project to improve the quality of the environment, improving protection of the aquifer, improving the integrity, capability, and conservation of urban and agricultural water supplies and improving other water-related purposes." (July, 1995)

The Corps and the SFWMD should expeditiously complete the Comprehensive C&SF Project Plan and other tasks provided in the Project Study Plan. If it is determined, in accordance with existing law and agreements, that significant changes to the Project Study Plan are needed, the Project Study Plan should be amended as provided in the Feasibility Cost Sharing Agreement that provides an opportunity for public review and comment. They should also seek public review of a programmatic draft Environmental Impact Statement (EIS) to fulfill the procedural requirements of the National Environmental Policy Act (NEPA).

This Conceptual Plan for the Restudy, developed by the Governor's Commission for a Sustainable South Florida, describes the Commission's consensus vision and framework for hydrologic restoration of the Everglades ecosystem, while providing other essential water related benefits to the region. This Conceptual Plan was developed through a process that involved input and viewpoints from all interests represented on the Commission, as well as the public. The Commission recommends that the Corps and the SFWMD seriously consider the Commission's Conceptual Plan for the Restudy in the formulation of the Comprehensive C&SF Project Plan. After the completion of the public review required by NEPA, the Corps and the SFWMD should expeditiously complete the Comprehensive C&SF Project Plan.

While the Comprehensive C&SF Project Plan is being developed, the Commission recommends that Congress immediately authorize the modifications to the C&SF Project consistent with the Commission's Conceptual Plan (including the 40 preferred options described in Table 2). The Commission further recommends that, under this authorization, construction should not be initiated until the Comprehensive C&SF Project Plan is completed, the requirements of NEPA are met, and the concurrence of the local sponsor (the SFWMD) is obtained.

The Corps or the local sponsor should have the authority to acquire land consistent with the Commission's Conceptual Plan. The Corps should also have authority to proceed, based on completion of the Corps' current study, with early construction on L-28 and related improvements to the L-28 basin (including portions of Loop Road and Tamiami Trail). Funding may be sought for these projects at any time. To ensure the integrity of the planning process, actual construction of all other components of the Commission's Conceptual Plan would not begin prior to the completion of the Comprehensive C&SF Project Plan. Construction of the Ongoing Projects referenced in Table 3 should proceed on schedules appropriate to each individual project.

RECOMMENDATION 4: STATE IMPLEMENTATION ACTIVITIES FOR EVERGLADES RESTORATION SHOULD BE EXPEDITED

Successful Everglades restoration requires that the State and its agencies undertake a more aggressive approach to resolving the problems confronting the ecosystem. The Florida Department of Environmental Protection (DEP) and the SFWMD should give high priority to research and development of alternate technologies in order to achieve final water quality standards. To the extent that science, understanding of the ecosystem, and the availability of resources allow, both the DEP and the SFWMD should advance the dates established within the Everglades Forever Act (EFA) for establishment of the water quality standards specified in the EFA and design projects that have a primary focus on final goals and objectives, with interim goals and objectives that are consistent with and designed to lead to the final goals. Both agencies should continue to utilize the principles of adaptive management in their implementation of the EFA and ensure that the EFA and Restudy implementation are coordinated.

RECOMMENDATION 5: ADAPTIVE MANAGEMENT STRATEGIES SHOULD BE USED TO IMPLEMENT C&SF PROJECT MODIFICATIONS

The complexity of restoring the South Florida ecosystem requires that the traditional mode of problem solving be modified. Restoration of the Everglades cannot wait until some future time when total understanding of all of the processes occurring in this ecosystem is achieved. Planning, project design, and implementation, based on the extensive knowledge already available, must proceed expeditiously while restoration is still possible. There must also be a recognition of the ecological and societal uncertainties involved in undertaking any project or process identified for dealing with unexpected responses. Ecological responses will always be somewhat unpredictable, despite careful planning. As modifications to the C&SF Project are implemented, changes may have to be made over time so that the process can adjust to new technical information coming from many sources. Equally important is measuring the responses that come from each major structural and operational iteration, in order to learn cause and effect as a basis for better understanding the natural and manmade components of the South Florida ecosystem. The Commission recommends that projects be implemented using an adaptive strategy that allows modifications to the C&SF Project to take place in a structured, peer-reviewed way. The Commission further recommends that the Corps, with the assistance of the SFWMD, quickly develop the adaptive strategies. The entire program; planning, design, implementation, and operations; should be subjected to peer review and interagency scrutiny. The strategy should insure that the concerns of a broad group of people are seriously addressed in a reasonable, productive

setting. Maximum flexibility should be built into project designs so that reworking of major components will be avoided.

RECOMMENDATION 6: ADEQUATE AGENCY RESOURCES MUST BE PROVIDED FOR IMPLEMENTATION OF THE PLAN

It is critical that all agencies involved in the Restudy have adequate resources. Appropriate human resources are as important as providing the funding needed for Restudy activities. Too often, agency staffing levels are disconnected from the funds appropriated to carry out activities. If allowed to occur, the Restudy will be delayed. All agencies should ensure that they have adequate staff to accomplish the goals of the Restudy.

Congress should provide sufficient funds, as described in the annual cross-cut budget prepared for the South Florida Ecosystem Restoration Task Force, to complete the Restudy and implement the projects resulting from it as expeditiously as possible.

The State of Florida and the SFWMD should also provide funding needed to satisfy their objectives for Everglades restoration. This must include adequate resources for their share of Project-related costs. It is also of paramount importance that the State provide funding to advance all requirements of the Everglades Forever Act.

RECOMMENDATION 7: CONGRESS SHOULD REMOVE IMPEDIMENTS TO MORE EFFECTIVE PUBLIC/PRIVATE INVOLVEMENT IN ECOSYSTEM MANAGEMENT AND NATURAL SYSTEM RESTORATION

Successful coordination of the activities of the agencies involved in the restoration of the South Florida ecosystem requires that the decision-making process of each agency be designed to encourage the participation of other agencies and interested parties. The South Florida Ecosystem Restoration Task Force (Task Force) was established in 1993 to coordinate and facilitate the activities of the federal agencies involved in South Florida ecosystem management and natural systems restoration. In 1995, the Unfunded Mandates Act improved the access of other governmental organizations to the Federal process and resulted in the State of Florida, the Miccosukee Tribe, and the Seminole Tribe being included on the Task Force and the Working Group of the Task Force (Working Group). Local governments and non-governmental organizations, however, are still effectively excluded from participation on these groups. The Task Force and Working Group must assure that a process is found to expeditiously implement modifications to the C&SF Project, while maintaining a high level of public and nonfederal agency input. They will need some improved authority to do this

effectively. The Commission recommends that Congress enact legislation to permanently establish the South Florida Ecosystem Restoration Task Force as an advisory body to the federal process. Their input is intended to assist in expediting the federal policy review process and communicate the needs of the South Florida community to its federal partner. While the Commission recognizes that the Task Force is a federal coordinating body, the Commission recommends that adequate representation of state, local, regional and tribal interests be included in its membership and its deliberations.

The Federal Advisory Committee Act (FACA) was intended to enhance opportunities for involvement of organizations outside the federal government into the federal decision-making process. However, in South Florida, FACA has been difficult to implement and counter-productive in some applications. Instead of fostering openness, it has served to limit the access of nonfederal organizations into the planning process in certain respects. The involvement of the public in the decision-making process is crucial to the success of the Restudy. The Commission also recommends that the Restudy include extensive and meaningful opportunities for public involvement in the study process.

Although the existing Task Force and the Working Group, comprised of participating governmental agencies only, are not considered advisory committees under FACA, their meetings are open and have regular opportunities for public comment. The Commission recommends that they should be granted authority to seek additional nonfederal scientific, technical, or policy advice expeditiously. It must be possible to set up these groups to provide advice to the Task Force and Working Group quickly and simply, in a manner consistent with the spirit and intent of the FACA. Meetings of these advisory groups should be open to the public. The Task Force and Working Group should consider public input when appointing these groups and should ensure that they include appropriate representation from expert, affected, or interested parties such as agricultural and urban interests, local governments, and environmental groups. To ensure that local government agencies and the public are included in the decision-making processes of the Task Force and the Working Group, and to eliminate awkward and time consuming procedures, the Commission recommends that the efforts underway in South Florida be exempted from certain requirements of FACA including: (1) a waiver of Federal Register notice requirements, provided that a means other than publication in the Federal Register to provide the required notice of a meeting be used; (2) delegation to the Task Force and Working Group authority to establish advisory groups; (3) delegation to the Task Force and Working Group the discretion to appoint members to those groups after an opportunity for public comment; (4) delegation to the Task Force and Working Group the authority to approve and renew advisory group charters; and, (5) a waiver of charter filing requirements. Any such exemption should include a

requirement for agencies to develop a plan for public outreach and involvement that is consistent with the goals of FACA.

LIST OF ACRONYMS AND ABBREVIATIONS

ARS	Agricultural Research Service (USDA)
ASR	Aquifer Storage and Recovery
BCNP	Big Cypress National Preserve
BIA	Bureau of Indian Affairs
BMP	Best Management Practices
C&SF	Central and Southern Florida
cfs	cubic feet per second
Corps	United States Army Corps of Engineers
DERM	Department of Environmental Resource Management (Dade County)
EAA	Everglades Agricultural Area
ECP	Everglades Construction Project
EFA	Everglades Forever Act
ELM	Everglades Landscape Model
ENP	Everglades National Park
ENR	Everglades Nutrient Removal (Project)
EPA	Environmental Protection Agency
EPA	Everglades Protection Area
FACA	Federal Advisory Committee Act
FDCA	Florida Department of Community Affairs
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection

FDOT	Florida Department of Transportation
FGFWFC	Florida Game and Fresh Water Fish Commission
FKNMS	Florida Keys National Marine Sanctuary
GIS	Geographic Information Systems
IFAS	Institute of Food and Agricultural Services (University of Florida)
LECRWS	Lower East Coast Regional Water Supply
LNWR	Loxahatchee National Wildlife Refuge
OFW	Outstanding Florida Waters
MGD	Million Gallons per day
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum (of 1929)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service (USDA)
NSM	Natural System Model
PMC	Program Management Committee
PSP	Project Study Plan
RPC	Regional Planning Council
SOR	Save Our Rivers
SFERWG	South Florida Ecosystem Restoration Working Group

SFWMD	South Florida Water Management District
SRAC	Science Research Advisory Committee (to the Governor's Commission)
STA	Stormwater Treatment Area
SUS	State University System
SWIM	Surface Water Improvement and Management
TAC	Technical Advisory Committee (to the Governor's Commission)
UF	University of Florida (Gainesville)
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WCA	Water Conservation Area

GLOSSARY

Adaptive Management: A structured, iterative approach that recognizes that the information used in making decisions is imperfect and that, as decisions are made, a process is in place to gain better information and adjust the implemented action accordingly.

Aquifer: A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield useful quantities of groundwater to wells, springs or surface water.

Aquifer Storage and Recovery (ASR): The injection of freshwater into a confined saline aquifer during times when supply exceeds demand (wet season), and recovering it during times when there is a supply deficit (dry season).

Aquifer System: A series of geologic formations consisting of two or more aquifers divided by lower permeability units.

Backpumping: The practice of pumping water that is leaving an area back into a surface water reservoir.

Best Management Practices (BMPs): Agriculture and other industry management activities designed to achieve an important goal, such as reducing farm runoff or optimizing water use.

Brackish: Water with a chloride level greater than 250mg/l and less 19,000 mg/l.

Concurrency: The local government comprehensive plan requirement of § 163.3180, FS, to ensure that public facilities and services needed to support a development will be available at the time of the development's demand for such facilities and services.

Cone of Influence: The area around a producing well, affected by its operation.

Consumptive Use: Utilization of water reducing the supply from which it is withdrawn or diverted.

Control Structures: A manmade structure designed to regulate the level and/or flow of water in a canal (e.g., weirs, dams).

Cost Effective: The minimum cost within defined limits of performance and/or quality standards, for example, a cost effective public water supply would provide water meeting U.S. EPA drinking water standards and public preferences for

taste, color, and hardness and within a range of acceptable water pressure and some defined service reliability criterion.

Critical Water Supply Problem/Water Resource Caution Area: A geographic area where water resources are critical, or are anticipated to become critical over the next 20 years.

Demand Management: Reducing the demand for water through activities that alter water use practices, improve efficiency in water use, reduce losses of water, reduce waste of water, alter land management practices, and/or alter land uses.

Desalinization: A process of treating saline water, which removes chlorides and dissolved solids.

Development: Usually urban development, but can encompass any form of human-induced changes to the natural landscape.

Drawdown: When a well is pumped, water is removed from the aquifer surrounding the well, and the water table or piezometric surface is lowered. The drawdown at a given point is the distance the water level is dropped.

Ecosystem: A community of organisms, including humans, interacting with one another and the environment in which they live.

Ecosystem Management: An integrated, flexible approach to management of biological and physical environments--conducted through the use of tools such as planning, land acquisition, environmental education, regulation, and pollution prevention -- designed to maintain, protect, and improve the natural, managed, and human communities.

Effluent: Water that is not reused after flowing out of any wastewater treatment facility or other works used for treating, stabilizing, or holding wastes.

Equity: Equal opportunity or access to the use of a resource and benefits to be derived from the use of a resource. Often used mistakenly to refer to protecting the vested interest of groups with relative greater economic, social, and political influence. Sometimes confused with the concept of fairness, which refers to the proportional distribution of benefits and costs of resource use.

Evaluation and Appraisal Reports (EARs): A local government's self assessment of the success or failure of its local government comprehensive plan, pursuant to § 163.3191, FS.

Evaporation: The process by which water is changed from liquid to vapor.

Evapotranspiration: The loss of water to the atmosphere by evaporation from land and water surfaces and transpiration from plants.

Everglades: South Florida's huge, interior freshwater marsh variously dotted with "islands" of trees.

Everglades Agricultural Area: The area of histosols (muck) predominantly to the southeast of Lake Okeechobee used for agricultural production.

Everglades Ecosystem: A water dominated hydrologic unit beginning in the interconnected lakes and marshes of central Florida and extending downstream through the Kissimmee River system, Lake Okeechobee, the Everglades, Big Cypress Swamp, and into the estuaries of the Ten Thousand Islands, Biscayne Bay, Caloosahatchee Estuary, Indian River Lagoon, Florida Bay and through the Florida Keys.

Everglades System: A number of interrelated environments found in South Florida including freshwater marshes; wetland tree islands (broad-leaf types); cypress heads, domes, and dwarf cypress forests; tropical hardwood hammocks; pinelands; mangrove swamps and mangrove islands; coastal saline flats, prairies, and forests; tidal creeks and bays; shallow coastal marine waters; pond apple swamp (around the south and southeast shore of Lake Okeechobee); and cypress swamps (a narrow band along the eastern edge of Palm Beach and Broward counties). * the latter two categories no longer exist.

Exclusionary Zoning: Zoning practices that close housing and land markets to families with low and moderate incomes, including: zoning vacant residential land for large minimum lot size, thus reducing the supply of developable lots and increasing their cost; zoning for exclusively single-family residences, thus zoning out people who cannot afford their own homes; zoning for excessively large minimum house size; imposing unduly expensive subdivision regulations, which shift the burden of public improvements to the new homeowners.

Existing: Currently constructed, vested, or permitted development and/or its associated human or resource demands as of 1995.

Externalities: A secondary or unexpected consequence, often measured in an economic sense in terms of impacts.

Floodplain: Land area subject to inundation by flood waters from a river, water-course, lake, or coastal waters. Floodplains are delineated according to their estimated frequency of flooding.

Full Cost Accounting: An economic tool that takes into account the externalities involved in the production, use, and disposal of goods and services over time. Externalities are given prices to reflect their costs, including energy sources used, the environmental damage caused by the production, and the costs of disposal or recycling when the product is no longer usable. Natural or renewable resources, traditionally viewed as "free goods," are redefined as assets, having substantial value to an enterprise and being appropriately allocated in the calculation of profit and loss.

Groundwater: Water beneath the surface of the ground, whether or not flowing through known and definite channels.

Growth: Expansion or increase in scale, magnitude, or physical dimensions.

Human System: Any part of the natural system modified structurally for human economic or residential uses.

Hydraulics: The study of the physical behavior of water in terms of its flow paths, velocities, and stages. Surface water hydraulics are basically controlled by relatively few parameters, some of which have so far only been estimated by empirical methods. These are slope, surface roughness, depth of flow, channel shape and size, and sediment load. Each of these parameters is interrelated, so that the effect of slope is generally measured, while holding the other parameters constant, and so forth.

Hydrology: The study of the spatial and temporal changes in water volumes and discharge rates, and in its broadest interpretation includes the physical and dynamic properties of water, water quality, and many aspects of climatology and geology. Hydrologic parameters of importance to floodplain management are more limited, including: flood peak flows; flood volumes; time of concentration and travel; rate of rise; water velocities; sedimentation and degradation of flood channels and floodplains; flood elevation; the effect of geomorphology on floods; the hydraulics of flood channels, floodplains, and manmade structures; and water quality as it is impacted by floods.

Hydropattern: The full range of hydrologic parameters known as hydropattern, which includes the depth of water, duration of inundation, and the timing and distribution of fresh water flow. Hydropattern encompasses the more commonly used word "hydroperiod," which is the area's annual period of inundation.

Hydroperiod: The frequency and duration of inundation or saturation of an ecosystem. In the context of characterizing wetlands, the term hydroperiod describes that length of time during the year in which the substrate is either saturated or covered with water.

Industrial Revenue Bond: A source of financing that private lenders do not normally cover. In Florida, a \$75 million pool is available for financing certain manufacturing projects. Bonds are approved by a local government with the principal and interest paid solely by the beneficiary company. Bond proceeds can be used for site acquisition, architectural and engineering expenses, building construction costs, and equipment purchase.

Infiltration: The movement of water through the soil surface into the soil under the forces of gravity and capillarity action, or the volume of water that passes into the soil profile over a unit area.

Irrigation: The application of water by artificial means. The goals of irrigation include, but are not limited to, supplying evapotranspiration needs, field preparation, freeze protection, crop cooling, and leaching of salts.

Land Assembly: The consolidation of fragmented land holdings.

Land Readjustment: The replatting of an area of land with multiple owners.

Long Hydroperiod: A long hydroperiod (relative to the Everglades) is a hydroperiod in excess of 10 months (often with continuous flooding for a few years).

Levee: An embankment to prevent flooding, or a continuous dike or ridge for confining the irrigation areas of land to be flooded.

Marginal Cost: The cost associated solely with each additional unit of production or consumption.

Minimum Flows and Levels: The limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area (§ 373.042(1), FS).

Mitigation: Usually consists of restoration, enhancement, creation, preservation, or a combination thereof.

Mitigation Bank: A project undertaken to provide for the withdrawal of mitigation credits to offset adverse impacts.

Mitigation Credit: A unit of measure that represents the increase in ecological value resulting from restoration, enhancement, preservation, or creation activities.

Natural System: A self-sustaining living system that supports an interdependent network of aquatic, wetland-dependent, and upland living resources.

Overlay Zones: A planning technique employed to describe uses that may be allowable within a given district, provided that approval is received to "overlay" a special category on top of the underlying zoning category. A local government can then impose a new set of regulations on a special area within an existing district. This allows local government to provide additional protection, above and beyond the provisions of the underlying zoning district, to such areas as historic districts, wetlands, or special land features.

Permeability: The ability of a rock or sediment to transmit fluid.

Potable Water: Water that is suitable for drinking, culinary, or domestic purposes. The maximum chloride concentration is 250 mg/l.

Potentiometric Head: The level to which water will rise in a well, piercing a confined aquifer.

Potentiometric Surface: An imaginary surface in a confined aquifer that coincides with the hydrostatic pressure level of the water in the aquifer.

Process Water: Water used for nonpotable industrial uses, e.g., mixing cement.

Project Study Plan: The plan of study which is used to define and manage the development and conduct of a feasibility study conducted by the Corps. The PSP documents the assumptions, work tasks, products, and the level of detail that will be necessary during the feasibility study to determine the existing and the future "without project" conditions; formulate a range of alternatives; assess their effects; and present a clear rationale for the selection of water resource development plan(s). The PSP includes the baseline cost, schedule, and assignment of responsibilities for the study.

Reasonable-Beneficial Use: The use of water in such quantity as is necessary for economic and efficient utilization for a purpose and in a manner both reasonable and consistent with the public interest.

Raw Water: Water that has not received any manmade treatment.

Reclaimed Water: Water that has received at least secondary treatment and is reused after flowing out of a wastewater treatment facility.

Recreational Water Use: Water used in association with landscaping of public parks, golf course facilities, public ball fields or football fields.

Reservation of Water: That water, which may be reserved from use (by the FDEP or the SFWMD) in such locations and quantities, and for such seasons of

the year, as may be required for the protection of fish and wildlife or the public health and safety (§ 373.223(3), FS).

Reservoir: A manmade or natural lake where water is stored.

Resilience: The ability of a natural system to recover from or adapt to the stresses being placed upon it.

Restoration: To recover the natural system's vitality and biological and hydrologic integrity in such a way that the stated levels of health and ecological function are maintained over time.

Reuse: The deliberate application of reclaimed water, in compliance with FDEP and Water Management District rules, for a beneficial purpose.

Reverse Osmosis (RO): The process of pressurizing a saline solution to force it through a semipermeable membrane and separate water from solutes.

Saline Water: Water with a chloride concentration greater than 250 mg/l. The term saline water includes brackish water and seawater.

Seawater: Water which has a chloride concentration equal to or greater than 19,000 mg/l.

Short Hydroperiod: Relative to the Everglades, a hydroperiod of about 7 or fewer months. Large annual variations are typical of individual locations because of year-to-year differences in rainfall.

Slough: A channel in which water moves sluggishly, or a place of deep muck, mud, or mire. Sloughs are wetland habitats that serve as channels for water draining off surrounding uplands and/or wetlands. Sloughs can vary widely in size, but are normally long and narrow and positioned lower in the landscape. Depending upon the adjacent habitats, sloughs can exhibit temporary to almost permanent water regimes. Due to this large range of hydroperiods, plant species can vary widely from spike rushes and various aquatic species in the wetter areas to beak rushes, low panicums, and yellow-eyed grass in the less frequently flooded communities.

Stage: The elevation of the surface of a surface water body.

Stormwater: Surface water resulting from rainfall that does not percolate into the ground or evaporate.

Subsidence: Lowering of the soil level caused by the shrinkage of organic layers. This shrinkage is due to desiccation, consolidation, and biological oxidation.

Surface Water: Water upon the surface of the earth, whether contained naturally or artificially. Water from natural springs is classified as surface water when it exits from the spring onto the earth's surface.

Surface Water Management: The development and implementation of a combination of structural and nonstructural measures intended to reconcile the water conveyance and storage function of depressions, lakes, swales, channels, floodplains, and coastal waters with the space and related needs of a designated area.

Surficial Aquifer: A heterogeneous unit comprised of all hydraulically connected saturated sediments from the water table down to the relatively impermeable sediments of the underlying confining unit. It is an unconfined aquifer system, recharged by rainfall and by leakage from surface water bodies.

Sustainability: The state of having met the needs of the present without endangering the ability of future generations to be able to meet their own needs.

Sustainable Agriculture: An integrated system of plant and animal production practices, having site specific application that will, over the long term, satisfy human food and fiber needs, enhance environmental quality and the natural resource base upon which the agricultural economy depends, making the most efficient use of nonrenewable resources and on-farm resources, and integrate where appropriate natural biological cycles and controls, sustain the economic viability of farm operations and enhance the quality of life for farmers and society as a whole.

Sustainable Community: A community which uses its resources to meet current needs while ensuring that adequate resources are available for future generations. Such a community seeks improved public health and better quality of life for all its residents by limiting waste, preventing pollution, maximizing conservation and promoting efficiency, and developing local resources to enhance the local economy.

Transmissivity: The rate at which water is transmitted through an aquifer under a particular hydraulic gradient. It is a function of the permeability and thickness of an aquifer and is used to judge an aquifer's production potential.

Urban Development: The human landscape characterized by cities, towns, suburbs, and outlying areas typically commercial, residential, and industrial in nature. They are typically nonagricultural or nonrural in nature.

Urban Development Boundary: A planning technique used to delineate the physical extent that urban development will be allowed in a particular jurisdiction.

Urban Forestry: The coordinated management of planting and maintaining trees in public spaces in urban centers that maximizes social, economic, and ecological benefits.

Urban Service Area: The geographic extent or area to which urban utilities or services are provided or planned to be provided over a specific time frame.

Value-added: The monetary worth contributed by labor to raw materials through the production process. Any process that adds value to products and final goods.

Water Budget: A description and quantification of the quality and movement of water in the hydrologic cycle within a specified geographic area. The product is often portrayed as a "balance sheet" of water in and water out in a dynamic system.

Water Conservation Areas (WCAs): That part of the original Everglades ecosystem that is now diked and hydrologically controlled by people for flood control and water supply purposes. These are located in the western portions of Dade, Broward, and Palm Beach Counties, and comprise a total of 1,337 square miles.

Water Control Structure: A barrier that acts to hold water at a planned level.

Water Table: That surface of a body of unconfined ground water at which the pressure is equal to the atmosphere; defined by the level at which water within an unconfined aquifer stands in a well that penetrates the aquifer far enough to hold standing water.

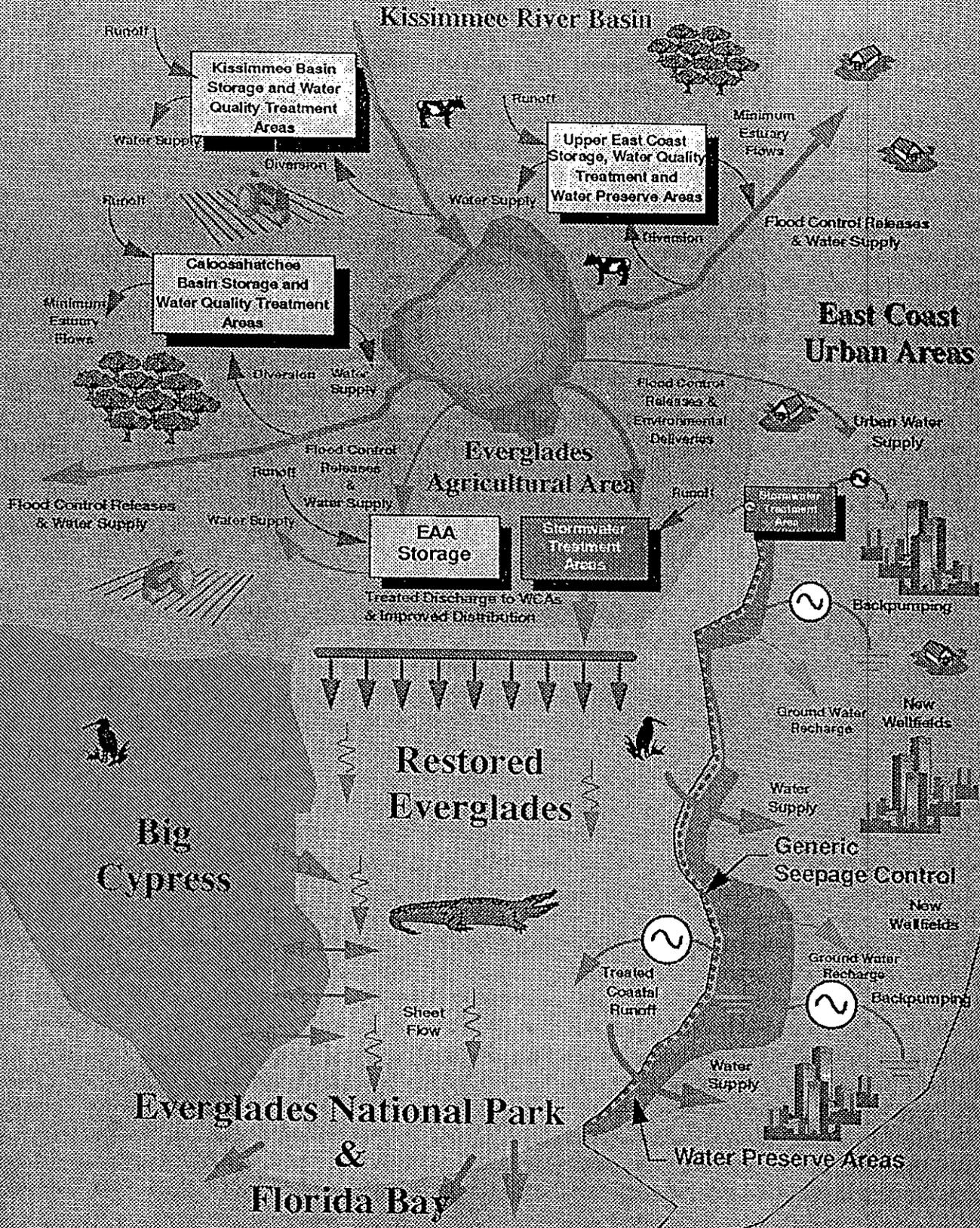
Water Use: Any utilization of water that reduces the supply from which it is withdrawn or diverted.

Wastewater: The combination of liquid and water-carried pollutants from residences, commercial buildings, industrial plants, and institutions together with any ground water, surface runoff or leachate that may be present.

Wetlands: Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and under normal circumstances do or would support a prevalence of vegetative or aquatic life that require saturated or seasonally saturated soil conditions for growth and reproduction. These include swamps, marshes, bayheads, cypress ponds, sloughs, wet prairies, wet meadows, river overflows, mudflats, and natural ponds.

Xeriscape: The use of landscaping techniques to conserve water and reduce maintenance. Techniques include the use of drought tolerant plants, landscape layout, irrigation system design, and irrigation system management.

GCSSF's Conceptual Plan Schematic



Concepts Not Shown

- Lake Okeechobee Operational Plan
- Aquifer Storage and Recovery
- Invasive Plant Control
- Conservation of Soil
- Protect and Restore Coastal, Estuarine & Marine Ecosystems
- Increase Spatial Extent and Quality of Wetlands
- Operate, Manage and Implement C&SF Project Modifications